Atomic Energy Central School No. 4 Rawatbhata

Class 12 - English Core

Time : 3 Hours **Half Yearly Examination (2019-20)** **M.M. :80**

General Instructions:

a. This paper is divided into three sections : A, B, C. All the sections are compulsory.

b. Separate instructions are given in each section and question, wherever necessary. Read these instructions very carefully and follow them faithfully.

c. Do not exceed the prescribed word limit while answering the questions.

Section A

1. **Read the passage and on the basis of your understanding of the passage answer the questions given below:** 12

    1. As religious people believing in God, we are all aware of the influence of prayer in our individual lives. It is true our temples, gurudwaras, churches and mosques reverberate with the prayers of the devout on festive occasions and even in the course of daily life. When individuals face dire situations, often they are led into prayer; their faith thus opens for them a source of comfort and encouragement in their hour of need.
    2. But how does India as collective entity, exercise its faith in prayer? It may be recalled that during the freedom struggle and subsequently after Independence, the Father of the Nation used to lead the people in prayer on matters affecting its destiny. The men of different faiths used to take part in such meetings, which gave them a sense of purpose and also a sense of solidarity as people sharing one destiny.
    3. Since the Mahatma fell to the bullets of an assassin, no one else probably came forward to provide leadership to an exercise of prayer at the national level. No doubt, people of all faiths had organized prayers at their places of worship in the aftermath of national tragedies like the Gujarat Earthquake of the Orissa cyclone. The hijacking of an Indian plane with its passengers of Kandahar in the recent past had moved this nation to pray. The whole nation again had taken to prayers in mass on two other occasions when Amitabh Bachchan fell seriously on the sick bed.
    4. Man's need for prayer is as great as his need for bread. As food is necessary for the body, prayer is necessary for the soul. I have not a shadow of doubt that the strife and quarrels with which our atmosphere is so full today are due to the absence of the spirit of true prayer. True prayer never goes unanswered," wrote Gandhiji. According to Vasudevan, Secretary of the Rajghat Samadhi Samiti, all-religion prayer meetings are held every Friday at Rajghat from 4 p.m. to 5.15 p.m.
    5. It is said that the act of prayer changes people and situations. There is a general impression that prayer is an act of seeking favours from God for selfish ends. It is as if all praying people are only interested in taking their shopping lists to their Maker! For from it, the very act of praying teaches one to sympathize with those who suffer. It broadens one's vision and outlook. It builds up one's character by imparting a sense of responsibility towards other people and situations.
    6. The latest example of a praying nation comes from the United States which is often labelled as too materialistic. Speaking at the national Prayer Breakfast at Washington in the second week of February, President George Bush praised Americans of all faiths for turning to prayer in the wake of the September 11 terrorist attacks. He said he had spent much time 'one bended knee' since terrorists attacked the World Trade Centre and the Pentagon, killing more than 3000 people.
    7. Regardless of the religious affiliations, people in the affected areas showed an exemplary sense of togetherness in the hour of tragedy. All differences of religion, ethnicity, race and language were forgotten as volunteers got busy assuaging the pain and sorrow felt by the victims. The American example has several lessons for India which is also a pluralistic society. It has demonstrated that

differences of religion and ethnicity need not stand in the way of the nation unitedly facing all its challenges. If it is true that all religious faiths teach tolerance, humility and the value of helping neighbours, then the religious leaders of this nation could also engender unity and oneness of purpose by coming together periodically to pray for the nation. And when they focus on the fact that all people, regardless of their differences share one common destiny, there could be greater communal harmony. Such a consciousness ought to pave the way for peace in society.

QUESTIONS

1.1 Answer each of the questions given below by choosing the most appropriate option: (1×5=5)

i. People often pray when they _____
   a. Are sick
   b. Face dreadful situations
   c. Want their desires to be fulfilled
   d. Are depressed

ii. What is the general impression about the prayer?
   a. It provides food to the soul.
   b. It is an act of seeking favour from God.
   c. It teaches us to sympathise with those Who suffer.
   d. It imparts in us a sense of responsibility towards other people and situations.

iii. The whole nation prayed for _____
   a. Amitabh Bacchan when he fell seriously ill.
   b. Sanjay Dutt
   c. Aamir Khan
   d. Salman Khan

iv. All-religion prayer meeting are held at Rajghat on every _____
   a. Saturday
   b. Sunday
   c. Friday
   d. Tuesday

v. "True prayers never goes unanswered", wrote _____
   a. Pt. Nehru
   b. Smt. Indira Gandhi
   c. Sh. Rajeev Gandhi
   d. Mahatma Gandhi

1.2 Answer the following questions briefly: (1×4=4)

i. What has the absence of the true prayer resulted in?
ii. What does the act of praying teach us?
iii. What lesson does the America example give to India?
iv. What do all religious faiths teach?

1.3 Pick out the words/phrases from the passage which are similar in meaning to the following: (1×3=3)

i. Killer (para 3)
ii. Shown/displayed (para 7)
iii. Unity (para 2)

2. **Read the passage given below and answer the questions that follow:** **8**

I. I remember my childhood as being generally happy and can recall experiencing some of the most carefree times of my life. But I can also remember, even more vividly, moments of being deeply frightened. As a child, I was truly terrified of the dark and getting lost. These fears were very real and caused me some extremely uncomfortable moments.

II. Maybe it was the strange way things looked and sounded in my familiar room at night that scared me so much. There was never total darkness, but a street light or passing car lights made clothes hung over a chair take on the shape of an unknown beast. Out of the corner of my eye, I saw curtains move when there was no breeze. A tiny creak in the floor would sound a hundred times louder than in the daylight

and my imagination would take over, creating burglars and monsters. Darkness always made me feel helpless. My heart would pound and I would lie very still so that 'the enemy' wouldn't discover me.

III. Another childhood fear of mine was that I would get lost, especially on the way home from school. Every morning, I got on the school bus right near my home—that was no problem. After school, though, when all the buses were lined up along the curve, I was terrified that I would get on the wrong one and be taken to some unfamiliar neighbourhood. I would scan the bus for the faces of my friends, make sure that the bus driver was the same one that had been there in the morning, and even then ask the others over and over again to be sure I was in the right bus. On a school or family trips to an amusement park or a museum, I wouldn't let the leaders out of my sight. And of course, I was never very adventurous when it came to taking walks or hikes because I would go only where I was assured I would never get lost.

IV. Perhaps, one of the worst fears I had as a child was that of not being liked or accepted by others. First of all, I was quite shy. Secondly, I worried constantly about my looks, thinking people wouldn't like me because I was too fat or wore braces. I tried to wear 'the right clothes' and had intense arguments with my mother over the importance of wearing flats instead of saddled shoes to school. Being popular was very important to me then and the fear of not being liked was a powerful one.

V. One of the processes of evolving from a child to an adult is being able to recognise and overcome our fears. I have learnt that darkness does not have to take on a life of its own, that others can help me when I am lost and that friendliness and sincerity will encourage people to like me. Understanding the things that scared us as children help to cope with our lives as adults.

1. On the basis of your reading of the above passage, make notes on it using headings and sub-headings. Use recognisable abbreviations, wherever necessary.
2. Write a summary of the above passage in about 80 words using the notes made and also suggest a suitable title.

Section B

3. Your school has planned an excursion to Lonavala near Mumbai during the autumn holidays. Write a notice in not more than 50 words for your school notice board, giving detailed information and inviting the names of those who are desirous to join. Sign as Naresh / Namita, Head Boy / Head Girl, DV English School, Thane, Mumbai. **4**

OR

Design a poster in about 50 words to create awareness among the people of your city on the importance of following traffic rules.

4. Despite all the incentives the government is providing to encourage education of the girl child, the number of girls in the rural schools is not rising to the desired level. Write a letter to the Editor of a national daily giving your views on the problem. List a few suggestions on how the situation can be improved. You are Rani/Raj, 121 Main street, Kanpur. **6**

OR

Pramod Suri, a resident of 245, Tilak Nagar, Delhi, reads an advertisement for young school boys and girls to market the products of a renowned company in Delhi. He decides to apply for the same. Write Pramod's application to the Personnel Manager, Harison and Simpson Ltd., 237, Nehru Place, New Delhi.

5. Write an article in 150-200 words on the topic, 'Poverty is the cause of all evils', to he published in the Young World of the 'The Hindu', Chennai. **10**
6. 'The Internet cannot replace a classroom teacher'. Write a debate in 150-200 words either for or against the motion. **10**

Section C

7. Read the extract and answer the following questions: (Keeping Quiet) **4**

It would be an exotic moment
without rush without engines
we would all be together
in a sudden strangeness

a. Why does the poet say that "it will be an exotic moment"?
b. How would we feel at that moment?
c. Why will it be strange for everybody?
d. How will keeping quiet bring us together?

9. Read the extract and answer the questions given below: (1x4)

The experience had a deep meaning for me, as only those who have known stark terror and conquered it can appreciate. In death there is peace. There is terror only in the fear of death, as Roosevelt knew when he said, "All we have to fear is fear itself." Because I had experienced both the sensation of dying and the terror that fear of it can produce, the will to live somehow grew in intensity. At last I felt released — free to walk the trails and climb the peaks and to brush aside fear.

Questions:

1. According to the author, who can understand the meaning of his experience?
2. What does the author express about his fear at the end?
3. What does the author say about the sensation of dying?
4. Which desire should be stronger in the narrator's opinion?

10. Do any 5 questions : (2X5=10)

a)Did the stranger agree to go to the ironmaster's house? Why or why not?

b) Why does M Hamel reproach himself for his student's unsatisfactory progress in studies?

c) How do the ragpickers help their families?

d)How can we say that ordinary people too contributed in the freedom movement?

e) How is the study of Antarctica region useful to us?

f) Do you think that the third level was a medium of escape for Charley? Why?

g)What is the author's indirect comment on subjecting innocent animals to the willfulness of human beings?

11. Author said that he was still not out of wits while drowning. What plan(s) did he make to save himself?**6**

OR

Why was the sharecropping arrangement in Champaran irksome?

12. Why is Antarctica the place to go to, to understand the earth's present, past and future? **6**

OR

'The modern world is full of insecurity, fear, war, worry and stress.' What are the ways in which we attempt to overcome them?

Atomic Energy Central School No. 4 Rawatbhata

Class 12 - Physics

Half Yearly (2019-20)

Maximum Marks: 70 **Time Allowed: 3 hours**

General Instructions:

1.All questions are compulsory.

2.There are 39 questions in total. Questions 1 to 20 carry one mark each, quessstions 21 to 27 carry two marks each, questions 28 to 34carry three marks each & questions 35 to 37 carry five marks each.

3.There is no overall choice. However, an internal choice has been provided in three questions of one marks, two questions of two marks, two questions of three marks & all three questions of five marks each.

4.Use of calculator is not permitted.

Section A

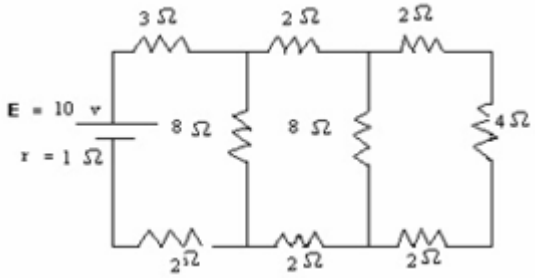
1. A tennis ball which has been covered with charges is suspended by a thread so that it hangs between two metal plates. One plate is earthed, while other is attracted to a high voltage generator. The ball **1**

   a) swings backward & forward hitting each plate in turn
   b) is repelled by earthed plate and stays there
   c) is attracted to the high voltage plate and stays there
   d) hangs without moving

2. Two charges -10C and +10C are placed 10 cm apart. Potential at the centre of the line joining the two charges is: **1**

   a) 4 V
   b) zero
   c) -2V
   d) 2 V

3. For the given circuit , with cell e m f = 10 V and internal resistance = 1Ω, which of the following is correct? **1**



   a) The current through the $3-\Omega$resistor is 0.5 A.
   b) The current through the 3 Ω resistor is 1 A.
   c) The current through the $4-\Omega$resistor is 0.5 A.
   d) The current through the $4-\Omega$resistor is 0.25 A.

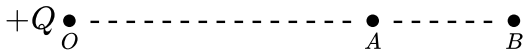
4. The resistance of a galvanometer is 50Ω and the current required to give full scale deflection is $100\mu A$. In order to convert it into an ammeter for reading up to 10 A, it is necessary to put a resistance of: **1**

   a) $5\times10^{-2}\Omega$
   b) $5\times10^{-5}\Omega$
   c) $5\times10^{-4}\ \Omega$
   d) $5\times10^{-3}\Omega$

5. A short bar magnet has a magnetic moment of 0.48 J/T. Magnetic field produced by the magnet at a distance of 10 cm from the centre of the magnet on the equatorial lines (normal bisector) of the magnet has a direction and magnitude of **1**

a) 0.43 G along N-S direction
b) 0.38 G along N-S direction
c) 0.55 G along N-S direction
d) 0.48 G along N-S direction

6. A charge q is placed at the centre of a cube of side I.What is the electric flux passing through each face of the cube? **1**
7. Which orientation of an electric dipole in a uniform electric field would correspond to stable equilibrium? **1**
8. In Coulomb's law, on what factors the value, of electrostatic force constant 'K' depends? **1**
9. A point charge + Q is placed at point O as shown in the figure. Is the potential difference (V_A - V_B) positive, negative or zero? **1**



10. Why electrostatic potential is constant throughout the volume of the conductor and has the same value as on its surface? **1**
11. Does the charge given to a metallic sphere depend on whether it is hollow or solid? Give reason for your answer. **1**
12. What is the significance of the direction of electric current? **1**
13. Would the galvanometer show any current if the galvanometer and cell are interchanged at the balance point of the bridge? **1**
14. Plot a graph showing a variation of current versus voltage for the material GaAs. **1**
15. An electron moving with a velocity of 107 m/s enters a uniform magnetic field of 1 T along a direction parallel to the field. What would be its trajectory? **1**
16. A narrow beam of protons and deuterons, each having the same momentum enters a region of the uniform magnetic field directed perpendicular to their direction of momentum. What would be the ratio of the radii of the circular path described by them? **1**

OR

Using the concept of force between two infinitely long parallel current carrying conductors define one ampere of current.

17. The susceptibility of a magnetic material is 1.9×10^{-5}. Name the type of magnetic material, it represents. **1**
18. The magnetic susceptibility, χ of a given material is -0.5. Identify the magnetic material. **1**

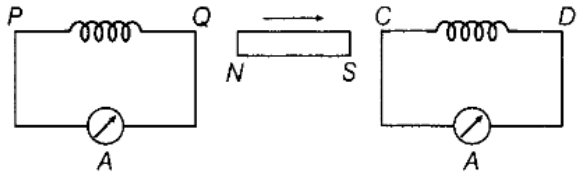
OR

What kind of ferromagnetic material is used for coating magnetic tapes in a cassette player, or for building 'memory stores' in a modern computer?

19. On what factors, does the magnitude of the emf induced in the circuit due to magnetic flux depend? **1**
20. How does the mutual inductance of a pair of coils change when the number of turns in each coil is decreased? **1**

OR

A bar magnet is moved in the direction indicated by the arrow between two coils PQ and CD. Predict the directions of induced current in each coil.



Section B

21. Why must electrostatic field at the surface of a charged conductor be perpendicular to every point on it? **2**
22. Dielectric constant of a medium is unity. What will be its permittivity? **2**
23. Given a battery how would you connect two capacitors, in series or in parallel for them to store the greater (a) total charge (b) total energy? **2**

OR

The space between the plates of a parallel plate capacitor is filled consecutively with two dielectric layers of thickness d_1 and d_2 having relative permittivity $\in_1$ and $\in_2$ respectively. If A is area of each plate, what is the capacity of the capacitor?

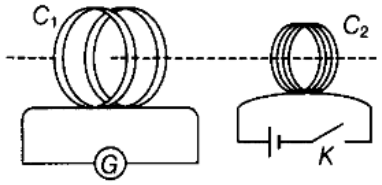
24. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, find **2**
    i. the resistance of the resistor.

ii. the terminal voltage of the battery.

OR

A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quatitites is constant along the conductor : current, current density, electric field, drift speed? Explain

25. A deuteron and a proton moving with the same speed enter the same magnetic field region at right angles to the direction of the field. Show the trajectories followed by the two particles in the magnetic field. Find the ratio of the radii of the circular paths which the two particles may describe. **2**
26. Deduce the relation between relative permeability (μ_r) and susceptibility (χ_m). **2**
27. A current is induced in coil C_1 due to the motion of current carrying coil C_2. **2**



i. Write any two ways by which a large deflection can be obtained in the galvanometer G.

ii. Suggest an alternative device to demonstrate the induced current in place of a galvanometer.

Section C

28. A thin conducting spherical shell of radius R has charge +q spread uniformly over its surface. Using Gauss's law, derive an expression for an electric field at a point outside the shell. Draw a graph of electric field E(r) with distance r from the centre of the shell for $0 \leqslant r \leqslant \infty$. **3**
29. Use Gauss' law to derive the expression for the electric field between two uniformly charge parallel sheets with surface charge densities σ and $-\sigma$, respectively. **3**
30. What is the area of the plates of a 2 F parallel plate capacitor, given that the separation between the plate is 0.5 cm? **3**
31. Find the relation between drift velocity and relaxation time of charge carriers in a conductor. A conductor of length L is connected to a DC source of emf E'. If the length of the conductor is tripled by stretching it, keeping E' constant, explain how its drift velocity would be affected. **3**
32. A dielectric slab of thickness 't' is kept in between the plates, each of area 'A', of a parallel plate capacitor, separated by a distance 'd'. Derive an expression for the capacitance of this capacitor for t < < d. **3**
33. A magnet is suspended so that it may oscillate in the horizontal plane. If performs 20 oscillations per minute at a place where the angle of dip is 30° and 15 oscillations per minute, where the angle of dip is 60°. Compare the earth's total magnetic field at these two places. **3**

OR

Three identical specimens of a magnetic materials nickel, antimony and aluminium are kept in a non-uniform magnetic field. Draw the modification in the field lines in each case. Justify your answer.

34. A small flat search coil of area 2 cm^2 with 25 closely wound turns, is positioned normal to the field direction, and then quickly rotated by 90°. The total charge flown in the coil is 7.5 mC. The resistance of the rod is 0.50Ω . Estimate the field strength of magnetic field. **3**

OR

Current in a circuit falls from 5.0 A to 0.0 A in 0.1 s. If an average emf of 200 V induced, give an estimate of the self inductance of the circuit?

Section D

35. i. Define electric flux. Write its SI unit. Gauss' law in electrostatics is true for any closed surface, no matter what its shape or size is. Justify this statement with the help of a suitable example. **5**

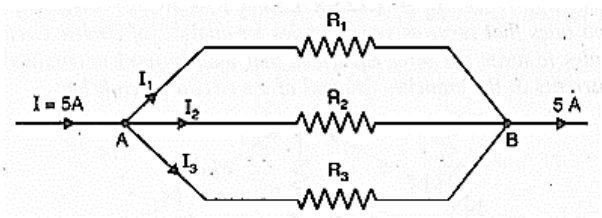
ii. Use Gauss' law to prove that the electric field inside a uniformly charged spherical shell is zero.

OR

i. Derive the expression for the energy stored in parallel plate capacitor. Hence, obtain the expression for the energy density of the electric field.

ii. A fully charged parallel plate capacitor is connected across an uncharged identical capacitor. Show that the energy stored in the combination is less than the energy stored initially in the single capacitor.

36. Three piece of copper wires of lengths in the ratio 2:3:4 and with diameters in the ratio 4:5:6 are connected in parallel. Find the current in each branch if the main current is 5A. **5**



OR

For a circular coil of radius R and N turns carrying current I, the magnitude of the magnetic field at a point on its axis at a distance x from its centre is given by, $B = \frac{\mu_0 I R^2 N}{2\left(x^2+R^2\right)^{3/2}}$

i. Show that this reduces to the familiar result for field at the centre of the coil.

ii. Consider two parallel co-axial circular coils of equal radius R, and number of turns N, carrying equal currents in the same direction, and separated by a distance R. Show that the field on the axis around the mid point between the coils is uniform over a distance that is small as compared to R, and is given by $B = 0.72\frac{\mu_0 NI}{R}$ approximately

37. A bar magnet of magnetic moment $1.5\mathrm{JT}^{-1}$ lies aligned with the direction of a uniform magnetic field of 0.22 T. **5**

a. What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment: (i) normal to the field direction, (ii) opposite to the field direction?

b. What is the torque on the magnet in cases (i) and (ii)?

OR

Two long parallel horizontal rails, distance d apart and each having a resistance λ per unit length, are joined at one end by a resistance R. A perfectly conducting rod MN of mass m is free to slide along the rails without friction. There is a uniform magnetic field of induction B normal to the plane of the paper and directed into the paper. A variable force F is applied to the rod MN such that as the rod moves, constant current flows through R.

i. Find the velocity of the rod and the applied force F as function of the distance x of the rod from R.

ii. What fraction of the work done per second by F is converted into heat?

Atomic Energy Central School No. 4 Rawatbhata

Class 12 - Chemistry

Half Yearly(2019-20)

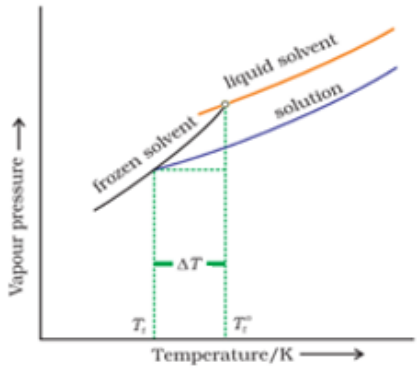
Maximum Marks: 70 **Time Allowed: 3 hours**

General Instructions:

There is no overall choice in the paper. However, there will be at least 33% internal choice.

Section A

1. The following graph shows **1**



a) Depression in freezing point of the solvent
b) Relative lowering of vapour pressure
c) Elevation in boiling point of the solvent
d) Osmotic pressure

2. Saturated solution of KNO_3 is used to make 'salt bridge' because **1**

a) KNO_3 is highly soluble in water
b) velocity of K^+ is greater than that of NO_3^-
c) velocity of NO_3^- is greater than that of K^+
d) velocity of both K^+ and NO_3^- are nearly the same.

3. The unit of rate constant for a first order reaction is **1**

a) Mol/L
b) Mol/L/s
c) $Mol^2/L^2/s^2$
d) s^{-1}

4. Which of the following is most effective electrolyte in causing the flocculation of a negatively charged arsenious sulphide solution? **1**

a) $MgCl_2$
b) KCl
c) $AlCl_3$
d) $K_3Fe(CN)_6$

5. In the froth floatation process for the concentration of ore, the particles float because **1**

a) They reacts with oil
b) Their surface is wetted with oil
c) They are insoluble
d) They are light

6. Give an example of a solution containing a liquid solute in a solid solvent. **1**

7. The vapour pressure of solvent gets lowered, when a non- volatile solute is added to it. Why? **1**

OR

Explain boiling point elevation constant for a solvent.

8. The resistance of 0.01 M NaCl solution at 25^oC is 200 ohm. The cell constant of the conductivity cell is unity. Calculate the molar conductance. **1**

9. The rate of reaction $X \rightarrow Y$ becomes 8 times when the concentration of the reactant X is doubled. Write the rate law of the reaction.
10. What is difference between an emulsion and a gel? **1**
11. Give two examples of substances which form: **1**
    a. Lyphobic sol.
    b. Lyophilic sol.
12. Why ΔH for chemisorption is high? **1**

OR

List four applications of adsorption.

13. What is meant by the term pyrometallurgy? **1**

14. Which is the strongest oxidizing agent among ClO_4^-, BrO_4^- and IO_4^-? Given Reduction potentials E° for ClO_4^-, BrO_4^- and IO_4^- are 1.19 , 1.74 and 1.65 V respectively. **1**
15. HF is least volatile, whereas HCl is the most volatile. Why? **1**
16. Sulphur has more tendency to show catenation than oxygen. Why? **1**
17. Size of trivalent lanthanoid cations decreases with increase in the atomic number. (give reason) **1**
18. Why transition elements act as good catalyst? **1**
19. Which is the most stable oxidation state among Lanthanoids? **1**
20. What is the coordination number of central metal ion in $[Fe(C_2O_4)_3]^{3-}$. **1**

OR

Write the formula of copper hexacyanoferrate (II).

Section B

21. Why is an increase in temperature observed on mixing chloroforms with acetone? **2**

OR

Write the structures of the following compounds:
    i. XeOF4
    ii. H_2SO_5

22. At 298 K, the molar conductivities at infinite dilution of NH_4Cl, NaOH and NaCl are 129.8, 217.4 and 108.9 S cm^2mol^{-1} respectively. The molar conductivity of 0.01 M NH_4OH solution is 9.33 Scm^2mol^{-1}, calculate the degree of dissociation of NH_4OH at this dilution? **2**
23. A first order reaction takes 40 min for 30% decomposition. Calculate $t_{1/2}$. **2**
24. What do you understand by activation of adsorbent? How is it achieved? **2**
25. Why is leaching of gold by metal cyanides carried out in the presence of oxygen? Give the chemical equation. Name the metal used as reducing agent. **2**
26. Describe a method for refining nickel. **2**
27. How would you account for the irregular variation of ionization enthalpies (first and second) in the first series of the transition elements? **2**

OR

Explain as to how the two complexes of nickel $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$ have different structures but do not have their different magnetic behaviour. (Ni = 28).

Section C

28. Write the chemical equation for all the steps involved in the rusting of iron. Give any one method to prevent rusting of iron. **3**
29. Calculate the equilibrium constant for the reaction. **3**
    $Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^2(aq) + Cu(s)$
    Given: $E^0_{Zn^{2+}/Zn} = -0.763V$
    and $E^0_{cu^{2+}/cu} = +0.34V$
30. Draw a graph for: **3**

a. Concentration of reactant against time for a zero order reaction.
b. Log[Ro]/[R] against time for a first order reaction.

31. In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below: **3**

$A/mol\,L^{-1}$	**0.20**	**0.20**	**0.40**
$B/mol\,L^{-1}$	0.30	0.10	0.05
$r_0/mol\,L^{-1}s^{-1}$	5.07×10^{-5}	5.07×10^{-5}	1.43×10^{-4}

What is the order of the reaction with respect to A and B?

32. Explain what is observed: **3**
i. When a beam of light is passed through a colloidal sol
ii. An electrolyte, NaCl is added to hydrated ferric oxide sol
iii. Electric current is passed through a colloidal sol

OR

The value of $\Delta_t G^\theta$ for formation of Cr_2O_3 is - 540 $kJ\,mol^{-1}$ and that of Al_2O_3 - 827kJmol^{-1}. Is the reduction of Cr_2O_3 possible with Al?

33. Discuss the general characteristics of the 3d series of the transition elements with special reference to their **3**
i. atomic sizes
ii. formation of colored compound
iii. tendency for complex formation.

OR

Compare the chemistry of actinoids with that of lanthanoids with reference to:
i. Electronic configuration
ii. Oxidation states
iii. Chemical reactivity

34. Draw all the isomers (geometrical and optical) of : **3**
i. $[CoCl_2(en)_2]^+$
ii. $[Co(NH_3)Cl(en)_2]^{2+}$
iii. $[Co(NH_3)_2Cl_2(en)]^+$

Section D

35. 1. Define the term osmotic pressure. **5**
Describe how the molecular mass of a substance can be determined by a method based on measurement of osmotic pressure?
2. 0.1 mole of acetic acid was dissolved in 1 kg of benzene. Depression in freezing point of benzene was determined to be 0.256 K. What conclusion can you draw about the state of the solute in solution? [Given: K_f for benzene = 5.1 Km^{-1}]

OR

(i) What do you mean by relative lowering of vapors pressure? Give its mathematical relation.
(ii) Osmotic pressure of a solution containing 7g of a protein per 100 cubic centimeter of solution is 3.3 × 10-2 bar at 37oC. Calculate the molar mass of protein.

36. **5**
(i) Give reasons:
(a) SF_4 is not a tetrahedral molecule.
(b) Bleaching action of chlorine is permanent.
(ii) Explain the manufacturing of sulphuric acid by contact process.

OR

(a) (i) Write the favorable conditions for the manufacture of sulphuric acid by contact process.
(ii) Draw the structure of XeF_4.
(b)Account for the following:
(i) Although Fluorine has less negative electron gain enthalpy yet F_2 is strong oxidizing agent.
(ii)Inter halogen compounds are more reactive than their parent halogens.
(c) Write a chemical reaction to test sulphur dioxide gas. Write chemical equation involved.

37. a. Complete the following chemical reaction equations: **5**
a. $Fe^{2+}(aq) + MnO_4^-(aq) + H^+(aq) \rightarrow$
b. $Cr_2O_7^{2-}(aq) + I^-(aq) + H^+(aq) \rightarrow$
b. Explain the following observations:

i. Transition elements are known to form many interstitial compounds.

ii. With the same d^4 d-orbital configuration Cr^{2+} ion is reducing while Mn^{3+} ion is oxidizing.

iii. The enthalpies of atomization of transition elements are quite high.

OR

(i)Describe the manufacturing of potassium permanganate ($KMnO_4$) from pyrolusite ore.

(ii)Give reasons:

a. Zn, Cd & Hg are not regarded as transition metals.

b. Sulphuric acid is highly viscous.

c. $HClO_4$ is one of the strongest acid.

Atomic Energy Central School No. 4 Rawatbhata

Class 12 - Mathematics

Half Yearly Mathematics

Maximum Marks: 80 **Time Allowed: 3 hours**

General Instructions:

a) All the questions are compulsory.

b) There are 37 questions in total.

c) Section A contains 20 objective answer type questions and carry one mark each. These answers

d) Section B contains 7 questions of two marks each.

e) Section C contains 7 questions of four marks each.

f) Section D contains 3 questions of six marks each..

g) There is no overall choice. However, an internal choice has been provided in some of the questions. You have to attempt only one of the choices in such questions.

h) Use of calculators is not permitted. However, you may use log tables if necessary.

Section A

1. A relation R on the set N of natural numbers is defined as R={(a,b): a+b is even,$\forall$ a,b $\in$ N} ,then R is **1**

   a) a reflexive relation but not symmetric
   b) an equivalence relation
   c) Symmetric but not transitive
   d) Not an equivalence relation

2. Let $f : A \to B$ and $g : B \to C$ be two functions. Then the composition of f and g, denoted by gof, is defined as **1**

   a) f(g(x)), $\forall$ x $\in$ A
   b) g(f(x + 2)), $\forall$ x $\in$ A
   c) g(f(x)), $\forall$ x $\in$ A
   d) g(f(x^2)), $\forall$ x $\in$ A

3. Let $f : A \to B$ and $g : B \to C$ be the two bijective functions. Then (g o f)$^{-1}$ is **1**

   a) g o f
   b) $f^{-1} o\ g^{-1}$
   c) g^{-1}of^{-1}
   d) f o g

4. Fill in the blanks: **1**

   The principle value branch of $\cos^{-1}$x is _____.

5. Fill in the blanks: **1**

   The value of sin ($2\tan^{-1}$)(0.75)) is equal to _____.

6. $\tan^{-1}\left(\frac{a-b}{1+ab}\right)+\tan^{-1}\left(\frac{b-c}{1+bc}\right)+\tan^{-1}\left(\frac{c-a}{1+ca}\right)$, a, b, c > 0; is equal to **1**

   a) 0
   b) $\frac{\pi}{2}$
   c) π
   d) None of these

   OR

   $\tan^{-1}\frac{1}{4}+\tan^{-1}\frac{2}{9}=$

   a) $\frac{1}{2}\cos^{-1}\frac{3}{5}$
   b) $\frac{1}{2}\tan^{-1}\frac{1}{2}$
   c) $\frac{1}{2}\tan^{-1}\frac{3}{5}$
   d) $\frac{1}{2}\sin^{-1}\frac{3}{5}$

7. If A is any square matrix then which of the following is not symmetric ? **1**

   a) A+A^t
   b) A - A^t
   c) A^tA
   d) AA^t

8. Let A = $\begin{bmatrix} 1 & 0 & 0 \\ 5 & 2 & 0 \\ -1 & 6 & 1 \end{bmatrix}$, then adj (A) is **1**

a) $\begin{bmatrix} 2 & -5 & 32 \\ 0 & 1 & 6 \\ 0 & 0 & 2 \end{bmatrix}$ b) $\begin{bmatrix} 2 & -25 & -32 \\ 0 & 2 & -36 \\ 0 & 0 & 1 \end{bmatrix}$

c) $\begin{bmatrix} 2 & 0 & 0 \\ -25 & 2 & 0 \\ -32 & 36 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 2 & 0 & 0 \\ -5 & 1 & 0 \\ 32 & -6 & 2 \end{bmatrix}$

9. The equations 2x + 3y = 7, 14x + 21y = 49 has **1**

a) infinitely many solutions b) finitely many solutions

c) a unique solution d) no solution

10. If $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$, then $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} =$ **1**

a) –abc b) None of these

c) 0 d) abc

11. If A+B+C=π, then the value of $\begin{vmatrix} \sin(A+B+C) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(A+B) & -\tan A & 0 \end{vmatrix}$ **1**

a) none of these b) 2

c) 1 d) 0

12. If A and B are square matrices of same order and A' denotes the transpose of A, then **1**

a) AB = O $\Rightarrow$ |A| = 0 and |B| = 0 b) (AB)' = A'B'

c) (AB)' = B'A' d) AB = O $\Rightarrow$ A = 0 or B = 0

13. Fill in the blanks: **1**

If $y = \sqrt{\sin\ x + y}$, then $\frac{dy}{dx}$ is equal to _____.

OR

If $y = x\sqrt{1-x^2} + \sin^{-1}x$,then $\frac{dy}{dx}$ is equal to

a) $\frac{1}{\sqrt{1-x^2}}$ b) $\sqrt{1-x^2}$

c) $2\sqrt{1-x^2}$ d) None of these

14. If x = acos^{3}t, y = asin^{3}t, then $\frac{dy}{dx}$ is equal to **1**

a) – tan t b) cosec t

c) cos t d) cot t

15. If y = a sin mx + b cos m x, then $\frac{d^2y}{dx^2}$ is equal to **1**

a) my$_1$ b) None of these

c) -m^{2}y d) m^{2}y

16. The minimum value of f(x) =sin x cos x is **1**

a) none of these b) $\frac{1}{2}$

c) $-\frac{1}{2}$ d) 0

17. The slope of the tangent to the curve x = a (cos θ + θ sin θ),y = a (sin θ – θ cos θ) at any point 'θ' is **1**

a) tan θ b) – cot θ

c) – tan θ d) cot θ

18. The normal to the curve 2 y = 3 – x^2 at (1, 1) is **1**

a) x – y = 0 b) – y = 0

c) x + y + 1 = 0 d) x – y + 1 + 0

19. $\int \tan^{-1}x$ dx is equal to **1**

a) $x\ \tan^{-1}x + \frac{1}{2}\log(1+x^2) + C$ b) $x\ \tan^{-1}x + \log\ (1+x^2) + C$

c) $2x\ \tan^{-1}x + \log\ (1-x^2) + C$ d) $x\ \tan^{-1}x - \frac{1}{2}\log(1+x^2) + C$

20. $\int \sqrt{x^2+a^2}\ dx$ is equal to **1**

a) $\frac{x}{2}\sqrt{x^2+a^2} - \frac{a^2}{2}\log(x+\sqrt{(x^2+a^2)}$ b) $\tan^{-1}(x^2+x+2) + C$

c) $\frac{x}{2}\sqrt{x^2+a^2} + \frac{a^2}{2}\log(x+\sqrt{(x^2+a^2)}$ d) $\frac{x}{2}\sqrt{x^2+a^2} + \frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right)$

OR

$\int (\sin(\log x) + \cos(\log x))$ dx is equal to

a) log (sin x - cos x) + c b) x sin (log x) +C

c) sin (log x) – cos (log x) + C d) x cos (log x) + C

Section B

21. Given a non empty set X, consider P (X) which is the set of all subsets of X. **2**
Define the relation R in P (X) as follows:
For subsets A, B in P (X), ARB if and only if A $\subset$ B. Is R an equivalence relation on P (X)? Justify your answer.

22. If $2\tan^{-1}(\cos\theta) = \tan^{-1}(2\,\mathrm{cosec}\theta)$ then show that $\theta = \frac{\pi}{4}$, where n is any integer. **2**

OR

If $\tan^{-1}\left(\frac{x-2}{x-4}\right) + \tan^{-1}\left(\frac{x+2}{x+4}\right) = \frac{\pi}{4}$, then find the value of x.

23. If $x\begin{bmatrix}2\\3\end{bmatrix} + y\begin{bmatrix}-1\\1\end{bmatrix} = \begin{bmatrix}10\\5\end{bmatrix}$, find the values of x and y. **2**

OR

If A = $\begin{bmatrix}\frac{2}{3} & 1 & \frac{5}{3}\\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3}\\ \frac{7}{3} & 2 & \frac{2}{3}\end{bmatrix}$ and B = $\begin{bmatrix}\frac{2}{5} & \frac{3}{5} & 1\\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5}\\ \frac{7}{5} & \frac{6}{5} & \frac{2}{5}\end{bmatrix}$, then compute 3A – 5B.

24. Prove that the determinant $\begin{vmatrix} x & \sin\theta & \cos\theta\\ -\sin\theta & -x & 1\\ \cos\theta & 1 & x\end{vmatrix}$ is independent of θ. **2**

25. Find $\frac{dy}{dx}$, if $\sin^2 x + \cos^2 y = 1$ **2**

OR

Find all points of discontinuity of f, where f is defined by: $f(x) = \begin{cases} 2x+3, & x \leqslant 2\\ 2x-3, & x > 2\end{cases}$

26. Find the approximate value of f (3.02) where $f(x) = 3x^2 + 15x + 3$. **2**

27. Integrate the function $\frac{x^3\sin(\tan^{-1}x^4)}{1+x^8}$ **2**

Section C

28. If f : X $\to$ Y is a function. Define a relation R on X given by R = {(a, b): f(a)= f(b)}. Show that R is an equivalence relation on X. **4**

OR

Show that the relation S in the set R of real numbers defined as S = {(a, b): a, b $\in$ Rand a $\leq$ b^3} is neither reflexive nor symmetric nor transitive.

29. Show that $\sin^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} + \tan^{-1}\frac{63}{16} = \pi$ **4**

30. If $A = \begin{bmatrix}8 & 0\\ 4 & -2\\ 3 & 6\end{bmatrix}$ $B = \begin{bmatrix}2 & -2\\ 4 & 2\\ -5 & 1\end{bmatrix}$ then find the matrix X such that 2A + 3X = 5B. **4**

31. Using matrices, solve the following system of equations **4**
$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4$
$\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1$
$\frac{6}{x} + \frac{9}{y} + \frac{-20}{z} = 2$

OR

Using elementary transformations, find the inverse of the matrix A = $\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and use it to solve the following system of linear equations:

8x+ 4y + 3z = 19,

2x+y+z=5,

x + 2y + 2z = 7

32. If $x^y = e^{x-y}$, then prove that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$. **4**

33. Find the intervals in which the function f(x) = (x - 1)(x - 2)^2 is increasing or decreasing. **4**

34. Find $\int \frac{(2x-5)e^{2x}}{(2x-3)^3}$ dx. **4**

OR

Evaluate $\int \sin x \cdot \sin 2x \cdot \sin 3x dx$.

Section D

35. Let A = R – {3} and B = R – {1}. Consider the function f: A $\rightarrow$ B defined by $f(x) = \left(\frac{x-2}{x-3}\right)$. Is f one-one and onto? Justify your answer. **6**

36. Show that: $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix}$ = a^3 **6**

37. A square piece of tin of side 18cm is to be made into a box without top by cutting a square from each corner and folding of the flaps to form the box. What should be the side of the square to be cut off so that the volume of the box is the maximum possible? **6**

OR

Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.

Atomic Energy Central School No. 4 Rawatbhata

Class 12 - Biology

Half Yearly (2019-20)

Maximum Marks: 70 **Time Allowed: 3 hours**

Section A (1 Mark each)

1. Continued self-pollination results in inbreeding depression as they

   a) Help in evolution b) Produce pure line

   c) New genes are accumulated d) Mutation is established

2. Write the possible genotypes Mendel got when he crossed F_1 tall pea plants with a dwarf pea plants.

   OR

   Fill in the blanks:

   In Binary fission ..... is followed by cytokinesis.

3. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

   OR

   Name the surgical methods of birth control in male and female.

4. Give the scientific name of the pathogen causing malignant malaria in humans.
5. Why is distillation required for producing certain alcoholic drinks?

Section B (2 Mark each)

6. What is point mutation? Give one example.
7. Define homologous organs. Give one example of an organ homologous to the hand of man.
8. Mention the key concepts about the mechanism of biological evolution / speciation according to
   (i) de Vries and
   (ii) Darwin.
9. State the significance of the study of fossils in evolution.

   OR

   What is bagging technique? How is it useful in a plant breeding programme?

10. In which parts of the body of the hosts do the following events in the life cycle of Plasmodium take place? Name both, the body part and the host:
    (a) Fertilization
    (b) Development of gametocytes
    (c) Release of sporozoites
    (d) Asexual reproduction.
11. Explain what is meant by biofortification.
12. Give two examples of natural predators of insect-pests.

    OR

    What are the measures one has to take to prevent from contracting STDs?

Section C (3 Mark each)

13. Distinguish between asexual and sexual reproduction. Why is vegetative reproduction also considered as a type of asexual reproduction?

    OR

    (a) Give the haploid chromosomal number of the following organisms House fly, Rat, Rice, Onion, Fruitfly, Maize
    (b) Select the hermaphrodites in the following animals Earthworm, Taenia, Cockroach, Leech, Prawn

14. With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.
15. Name the functions of the following:
    (a) Corpus luteum
    (b) Endometrium
    (c) Acrosome

(d) Sperm tail
(e) Fimbriae

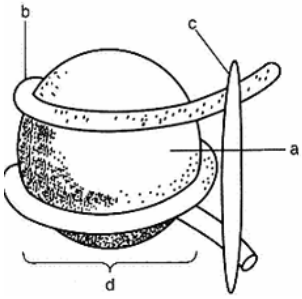
OR

Explain the law of dominance using a monohybrid cross.

16. Describe sexually transmitted diseases. Name some important STDs and their causative agents.
17. What are test tube babies?
18. (i) Give two reasons why Mendel chose garden pea for his experiments. Give the biological name of this plant.
(ii) State Mendels principal of segregation.

OR

How did Griffith explain the transformation of R-strain (non-virulent) bacteria into S-strain (virulent)?

19. 

i. What is this diagram representing?
ii. Name the parts a, b and c.
iii. In the eukaryotes, the DNA molecules are organized within the nucleus. How is the DNA molecule organized in a bacterial cell in the absence of a nucleus?

20. A Couple quarrelled with the hospital authority on suspicion that their child had been exchanged after birth. The couple based their argument on the fact that their child is O blood group whereas they are A and B blood groups respectively. The doctor smiled and explained.
i. What values of the doctor is reflected here?
ii. How can the child be O blood group as explained by the doctor?
iii. Which test method can be considered authentic to identify the biological parents of the child?
iv. Name the other blood group(s) which the child could have inherited.
21. Explain convergent and divergent evolution with the help of one example of each.

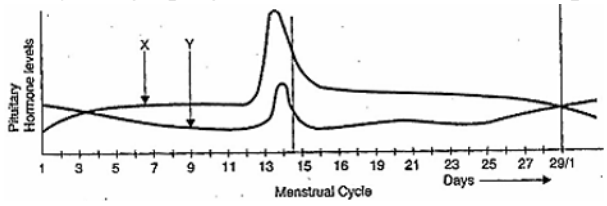
OR

What are biofertilizers? Name the two elements which are made available by them.

22. List the harmful effects caused by alcohol / drug abuse.
23. Which part of the plant is best suited for making virus free plants and why?
24. Three water samples namely river water, untreated sewage water and secondary effluent discharged from a sewage treatment plant were subjected to BOD test. The samples were labeled A, B and C but the laboratory attendant did not note which was which. The BOD values of the three samples A, B and C were recorded as 20 mg/L, 8 mg/L and 400 mg/L respectively. Which sample of the water is most polluted? Can you assign the correct label to each assuming the river water is relatively clean?

Section D (5 Mark each)

25. Study the graph given below and answer the question that follow:



i. Name the hormones X and Y.
ii. Identify the ovarian phases during a menstrual cycle
a. 5^{th} day to 12^{th} day of the cycle.
b. 14^{th} day of the cycle.
c. 16^{th} day to 25^{th} day of the cycle.
iii. Explain the ovarian events (a), (b) and (c) under the influence of hormones X and Y

OR

What is geitonogamy? Give an example. How does geitonogamy differ from xenogamy in plants?

26. a. You are given tall pea plants with yellow seeds whose genotypes are unknown. How would you find the genotype of these plants? Explain with the help of cross.

    b. Identify a, b and c in the table given below:

	Pattern of Inheritance	**Monohybrid F_1 Phenotypic expression**
1	Co-dominance	a
2	b	The progeny resembled only one of the parents
3	Incomplete dominance	c

OR

"A population has been exhibiting genetic equilibrium" Answer the following with regard to the above statement.

i. Explain the above statement
ii. Name the underlying principle
iii. List any two factors which would upset the genetic equilibrium of the population.
iv. Take up any one such factor and explain how the gene pool will change due to that factor.

27. Briefly describe various steps involved in plant breeding.

OR

Explain the different steps involved in sewage treatment before it can be released into natural water bodies.

Atomic Energy Central School No-4, Rawatbhata
Half Yearly Examination, 2019-20
Class: XII **Subject : COMPUTER SCIENCE**
Time allowed: 3 hours ***Maximum Marks: 70***

1. (a) Define a class **State** in C++ with the following descriptions: [5]

Private Members:

- Name of the state (type string)
- Population (type long int)
- Number of girls under 16 yrs of age attending school (type long int)
- Total number of girls under 16 yrs of age (type long int)
- A member function CAL_PER() to calculate and return the percentage of girls attending school by using the formula: (No. of girls attending school/ Total girls) * 100)

Public Members:

- A constructor to assign initial values of name of the state as "Not Allotted", others by 0.
- A function Give_Details() to allow user to enter data for all data members.
- A function Show_Details() to display the data members at output along with the percentage of girls attending the school.

(b) Explain the features of inline function used in class? Also give the restrictions for Inline functions. [3]

(c) Define the static data members of class and their usage with a suitable example. [2]

(d) Answer the questions (i) to (iii) after going through the following class: [3]

```
class WORK
{  int WorkID;
   char WorkType;
public:
~WORK ( )                    // Function 1
{  cout<<"Un-Allocated"<<endl;      }
void status( )               // Function 2
{  cout<<WorkID<<";"<<WorkType<<endl;     }
WORK ( )                     // Function 3
{  WorkID=10;
   WorkType='T';
}
WORK (WORK &W)               // Function 4
{  WorkID = W.WorkID;
   WorkType = W.WorkType;
}
};
```

(i) Which member function out of Function1, Function2, Function3 and Function4 shown in the above example of class WORK is called automatically, when the scope of an object gets over? What kind of this function is in C++?

(ii) Write statements to call/invoke the Function 4.

(iii) As per OOPS, which concept is illustrated by Function 3 and 4 together? [2]

(e) Compare the Parameterized and Copy Constructors with examples? [4]

(f) Define a class Student with following members:

Private:

int rollno
char name[25]
float Submarks[5] (5 subject marks)
char Class[12]

float per;

Protected:

void Calcper():- function to calculate and assign the percentage marks in per.

Public:

void Getvalues():- function to store all data members values except per and call the function Calcper()

void Disp():- function to print all data members at output

Write a main program function to create an object of class Student and display at output.

2. a) Read the following class declarations and answer the questions from (i) to (v): [5]

```
class Kitchen_Products
{ char Modelno[10];
  char comp_Name[20];
  int Year;
protected:
  void Get_it();
  void Show_it();
};
class Fridge : public Kitchen_Products
{ protected:
  int capacity;
  long price;
  char Color[12];
public:
  void Read_it();
  void Print_it();
};
class Stock : protected Fridge
{  intStock_inHand;
public:
  intSold_No;
  void Get_Data();
  void Disp_Data();
};
```

i) What is the size of the object of the class Stock?

ii) Name the member function inherited into the class Stock.

iii) Name the data members accessible by the object of the class Stock;

iv) Name the members, which are accessible by the object of class Fridge.

v) If the class Stock is inherits publically from class Fridge then, write the name of inherited public members in the class Stock.

b) Read the following class declarations and answer the questions from (i)to (iv): [4]

```
 class FacetoFace
{ char CenterCode[10];
public:
  void Input( );
  void Output( );
};
class Online
{ char Website[50];
public:
  void Sitein( );
  void Siteout( );
};
class Training : public FacetoFace, private Online
{ long Tcode;
  float Charge;
int Period;
```

```
public:
  void Register( );
  void Show ( );
};
```

(i) a) Which type of inheritance shown in the above example?

b) What will be the size of the object belongs to the class Training?

(ii)Write names of all members accessible from Show ( ) function of class Training.

(iii) Write name of all data members accessible through an object of class Training.

(iv) Is the function Output( ) accessible inside the function SiteOut( )? Justify your answer.

c) What do you mean by Inheritance? Explain the various forms of Inheritance?

d) Give a suitable example in C++, to show and explain how the constructors will be used and called, in case of nested classes(containership)? [2] [2]

e) Draw the parameterized constructor definition for the class derived? [2]

```
class base1
{  protected:
       int a;
   public:
       base1 (int x)
       {    a=x;
            cout<<"Constructing Base 1 \n";
       }
};

class base2
{  protected:
                int b;
   public:
       base2 (int y)
       {   b=y;
           cout<<"Constructing Base 2\n";
       }
};
class derived : public base2, public base1
{     int c;
  public:       ……
};
```

f) What do you mean by Shadowing affect in inheritance explain with a suitable example? [2]

3. a) An array A[-1..15][-2..10] is stored in the memory with each element occupying 4 bytes of space. Assuming the address of A[9][9] is 10000 then compute the base address of array A and also the address of A[5][-2], when the array is stored as : [6]

i) Row wise ii) Column Wise

b) Write a function in C++ which accepts an integer array, its size and an integer element as arguments and search that element in the array by using binary search algorithm. [3]

OR

Write a function in C++, which accepts an integer array and its size as parameters and rearranges the array in the descending order by using bubble sort or selection sort method. *(Write the method used in comments in the beginning of function)*

c) Write a function in C++ which accepts a 2-D array of integers as argument and displays the sum of upper half elements only. [2]

Example, if the array content is

```
3 5 4 2                    3 5 4 2 [upper half]
7 6 9 1                      6 9 1
2 1 8 3                        8 3
3 4 3 2                          2
```

Output through the function should be : - Sum of upper half elements : 43

d) Find the output for the following program: [2]

```
#include<iostream.h>
#include<ctype.h>
void Encript ( char T[])
{for( inti=0 ; T[i] != ' \0' ; i+= 2)
{     if(islapha(T[i]))
        {  if (islower (T[i] ))
           T[i] += 1;
          else
              T[i] = T[i+1];
         }
   else if(isspace(T[i])
            T[i] = '@'';
           else
             T[i] ='#';
}              }//end of function
void main()
{ char text [] = "Half Yearly Exam: 2019";
encrypt(text);
cout<<text<<endl;
}//end of main
```

e) Write a function ModAr(int a[], int size) in C++, to modify the elements of the array by adding them with 0, 2, 4, 6….onwards staring from position 0 in array: for example: if the array is : 2, 5, 7, 8, 12, 16
then after modify the array contents are: 2, 7, 11, 14, 20, 26 [3]

f) Differentiate between ios::ate and ios:: app file modes? [1]

g) Compare the binary files and text files? [1]

4. a) Convert the following Infix Expression into Postfix Expression, show the contents of stack at each step: A * (B + D)/ E – F – (G + H/K) [3]

b) Evaluate the following Postfix Expression and find the answer: [2]
5, 6, 2, +, *, 12, 4, /, -

c) Convert the following Infix Expression into Postfix Expression, show the contents of stack at each step: TRUE and not FALSE OR TRUE and FALSE and false [3]

d) Write a function INSERT(), which perform insertion operation in a Queue using linked list implementation. Let the Queue is already exist and the function create new dynamic nodes and insert them into Queue as per asked by user. The function also displays the total number of nodes in the Queue. The structure of each node should be as follows: [4]

```
struct Node
{ int m,p;
  Node *next;
};
```

e) Write a function in C++, to delete a node containing names of student, from a dynamically allocated stack of student. Assume the stack has already a set of nodes of following structure. The function receives the value of top by reference and display the stack after deletion. [3]

```
struct student
 {     char name[20];
       student *next;
 };
```

f) State the condition of a circular queue is empty? [1]

Atomic Energy Central School No. 4 Rawatbhata

Class 12 - Physical Education

Half Yearly (2019-20)

Maximum Marks: 70 **Time Allowed: 3 hours**

General Instructions :
*(i) The question paper contains **26** questions.*
*(ii) **All** questions are compulsory.*
*(iii) Questions no. **1** -**11** carry **1** mark each. Answers to these questions should be in approximately **20 – 30** words each.*
*(iv) Questions no. **12** to **19** carry **3** marks each. Answers to these questions should be in approximately **80 – 100** words each.*
*(v) Questions no. **20** to **26** carry **5** marks each. Answers to these questions should be in approximately **150 – 200** words each.*

Section A

1. What is seeding? **1**
2. Explain Consolation tournament with example? **1**
3. What is Dieting? **1**
4. Name any two water soluble vitamins,. **1**

OR

Write two chemicals which can cause food intolerance.

5. What is Hypertension? How asanas are helpful in controlling it. **1**
6. Define Disability. **1**
7. Write the full form of ASD and OCD **1**

OR

Write the symptoms of ADHD.

8. Explain the types of Motor development. **1**
9. Differentiate between Primary and Secondary Amenorrhea. **1**

OR

What do you understand by the term triad?

10. Which test would you suggest your grandmother for measuring upper body flexibility? **1**
11. Who introduced the Barrow three item general motor ability test? **1**

OR

Enlist three senior citizen test.

Section B

12. What is Planning? Explain its objectives. **3**

OR

Explain the various committees and their responsibilities in conducting sports events.

13. Differentiate between food allergy and Food intolerance. **3**
14. Define Asanas. Write the classification of asanas. **3**
15. How should one behave with the people with disabilities? **3**
16. What are the strategies to make physical activities accessible for children with special needs. **3**

OR

Discuss the advantages of physical activities for children with Special needs.

17. What are the facters affecting Motor development in children? **3**
18. Explain Female Athlete Triad? **3**
19. How can you measure recovery phase of an Individual or measurement of cardiovascular fitness? **3**

OR

Explain Barrow three items General motor ability test.

Section C

20. Draw a knock out fixture of 21 teams mentioning all the steps involved. **5**
21. What is Nutritive and Non-Nutritive components of Diet? Explain in detail about Nutritive components. **5**
22. Asanas act as preventive measures.Describe. **5**
23. Write the types of Disorder.Explain any two. **5**
24. What do you mean by Postural deformities?Write the causes and corrective measures of Knock Knees and Lordosis. **5**

OR

Describe the causes and types of Disability.

25. Describe any five test suggested by Rikli and Jones for Senior citizens. **5**
26. What is Round Robin Tournament? Draw a fixture of 7 teams using league tournemnt. **5**

OR

What is Harvard Step test?Explain its procedure and equipment required.

परमाणु ऊर्जा केंद्रीय विद्यालय - 4 , रावतभाटा

अर्द्धवार्षिक परीक्षा –2019-20

समय 3 घंटे कक्षा -12 विषय –हिन्दी पूर्णाङ्क –80

खण्ड क

1 निम्नलिखित गदयांश को पढ़कर पूछे गए प्रश्नों के उत्तर लिखिए ।

स्वतंत्र भारत का सम्पूर्ण दायित्व आज विद्यार्थी के ही ऊपर है –क्योंकि आज जो विद्यार्थी हैं ,वे ही कल स्वतंत्र भारत के नागरिक होंगे । भारत की उन्नति और उत्थान उन्हीं के उन्नति और उत्थान पर निर्भर करता है । अत: विद्यार्थियों को चाहिए कि वे अपने भावी जीवन का निर्माण बड़ी सतर्कता के साथ करें । उन्हें प्रत्येक क्षण अपने राष्ट्र ,अपने समाज अपने धर्म ,अपनी संस्कृति को अपनी आंखों के सामने रखना चाहिए कि उनके जीवन से राष्ट्र को कुछ बल प्राप्त हो सके । जो विद्यार्थी राष्ट्रीय दृष्टकोण से अपने जीवन का निर्माण नहीं करते ,वे राष्ट्र और समाज के लिए भार-स्वरूप होते हैं ।

विद्यार्थी का लक्ष्य विद्योपार्जन है । भली भांति विद्योपार्जन करके वह राष्ट्र के प्रति अपने कर्तव्य का निर्वाह सुचारु रूप से कर सकता है । राजनीति इस लक्ष्य की पूर्ति नहीं कर सकती । राजनीति वास्तव मे धूर्तों का खेल है जो अनेक दांव-पेंच खेल कर जीवन मे सफलता प्राप्त कर लेते हैं

यह सरल एवं शुद्ध –हृदय विद्यार्थी के वश का खेल नहीं है । राजनीति छात्रों के अध्ययन मे बाधा ही नहीं डालती वरन उन्हें गुमराह भी कर देती । अत: छात्रों को चाहिए कि सर्वप्रथम अपने आप को योग्य बनाने के बाद ही वे राजनीति क्षेत्र मे कदम रखें ।

(क) उचित शीर्षक लिखिए । 1

(ख) विद्यार्थियों को राजनीति में कब कदम रखना चाहिए ? 1

(ग)भारत की उन्नति किस पर और क्यों निर्भर करती है ? 2

(घ)विद्यार्थियों को अपने भावी जीवन का निर्माण किस प्रकार करना चाहिए ? 2

(ड) किस प्रकार के विद्यार्थी अपने राष्ट्र और समाज के लिए भार-स्वरूप होते हैं ? 2

(च)विद्यार्थी राष्ट्र के प्रति अपने कर्तव्य का निर्वाह किस प्रकार कर सकता है ? 2

(च) छात्रों को राजनीति में भाग क्यों नहीं लेना चाहिए ? 2

2 निम्नलिखित कव्यांश को पढ़कर पूछे गए प्रश्नों के उत्तर लिखिए : 1+1+1+1= 4

यदि फूल नहीं बो सकते तो कांटे कम से कम मत बोओ !

है अगम चेतना की घाटी ,कमजोर बड़ा मानव का मन

ममता की शीतल छाया में होता कटुता का स्वयं शमन ।

ज्वालाएं जब घुल जाती हैं ,खुल –खुल जाते हैं मूदें नयन

होकर निर्मलता में प्रशांत बहता प्राणों का क्षुब्ध पवन ।

संकट में यदि मुसका न सको, भय से कातर हो मत रोओ

यदि फूल नहीं बो सकते तो कांटे कम से कम मत बोओ !

(क) फूल बोने और कांटे बोने का प्रतीकार्थ क्या है ?

(ख) मन किन स्थितियों में अशांत होता है और कैसी स्थितियां उसे शान्त कर देती है ?

(ग) संकट आ पड़ने पर मनुष्य का व्यवहार कैसा होना चाहिए ?

(घ)मन में कटुता कैसे आती है ?

अथवा

पाकर तुझसे सभी सुखों को हमने भोगा ,

तेरा प्रत्युपकार कभी क्या हमसे होगा ?

तेरी यह देह तुझी से बनी हुई है ,

बस तेरे ही सुरस –सार से सनी हुई है ,

फिर अंत समय तुही इसे अचल देख अपनाएगी।

हे मातृभूमि ! यह अंत मे तुझसे ही मिल जाएगी।

(क) यह काव्यांश किसे संबोधित है? उससे हम क्या पाते हैं ?

(ख) प्रत्युपकार किसे कहते हैं ? देश का प्रत्युपकार क्यों नहीं हो सकता ?

(ग) शरीर योगदान में मातृभूमि का क्या योगदान है ?

(घ) अचल विशेषण किसके लिए प्रयुक्त हुआ है ?

खण्ड –ख

3 निम्नलिखित में से किसी एक विषय पर अनुच्छेद लिखिए : 5

(क) तनाव : आधुनिक जीवन –शैली की देन (ग) मन के हारे हार है ,मन के जीते जीत

(ख) मेरे जीवन का लक्ष्य

4 भारतीय युवाओं में क्रिकेट खेल के प्रति अत्यधिक लगाव की चर्चा करते हुए अन्य खेलों के प्रति उदासीनता के बारे में किसी समाचार पत्र के संपादक को पत्र लिखए। 5

अथवा

किसी पर्यटन स्थल के होटल के प्रबंधक को निर्धारित तिथियों पर होटल के दो कमरे आरक्षित करने का अनुरोध करते हुए पत्र लिखिए। पत्र में उन्हें कारण भी बताइए कि आपने वही होटल क्यों चुना ?

5 निम्नलिखित में से किन्हीं चार प्रश्नों के संक्षिप्त उत्तर लिखिए : 1+1+1+1=4

(क) भारत में पहला छापाखाना कब और कहां खुला ?

(ख) किन्हीं दो राष्ट्रीय समाचार पत्रों का नाम लिखिए।

(ग) पेज थ्री पत्रकारिता क्या है ?

(घ) एनकोडिग से आप क्या समझते हैं ?

(ङ) फीचर किसे कहा जाता है ?

6 ' जंकफूड ' और ' स्वास्थ्य ' विषय पर एक आलेख लिखिए। 3

अथवा

हाल ही में पढ़ी गई किसी ' खेल पुस्तक ' की समीक्षा लिखिए।

7 मतदान केंद्र पर लगा ' लोकतंत्र का मेला ' विषय पर एक फीचर तैयार कीजिए। 3

अथवा

विद्यालय में सम्पन्न स्वच्छता अभियान को विषय बनाकर एक फीचर तैयार कीजिए।

8 निम्नलिखित काव्यांश को पढ़कर पूछे गए प्रश्नों के उत्तर लिखिए : 2+2+2=6

मुझसे मिलने को कौन विकल ?

मैं होऊं किसके हित चंचल ?

यह प्रश्न शिथिल करता पद को ,

भरता उर में विह्वलता है !

दिन जल्दी –जल्दी ढलता है !

(क) कवि के मन में कौन –कौन से प्रश्न उठते हैं ?

(ख) कवि की व्याकुलता का क्या कारण है ?

(ग) कवि के कदम शिथिल क्यों हो जाते हैं ?

अथवा

कविता एक उड़ान है चिड़िया के बहाने

कविता की उड़ान भला चिड़िया क्या जाने ?

बाहर भीतर , इस घर, उस घर

कविता का पंख लगा उड़ने के माने

चिड़िया क्या जाने ?

(क) कविता कहां –कहां उड़ सकती है ?

(ख) कविता की उड़ान और चिड़िया की उड़ान में क्या अंतर है ?

(ग) कविता के पंख लगा कर कौन उड़ता है ?

9 निम्नलिखित काव्यांश को पढकर पूछे गए प्रश्नों के उत्तर लिखिए : 2+2=4

जाने क्या रिश्ता है, जाने क्या नाता है

जितना भी उड़ेलता हूं ,भर भर फिर आता है

दिल में क्या झरना है ?

मीठे पानी का सोता है

भीतर वह ऊपर तुम

मुसकाता चांद ज्यों धरती पर रात- भर

मुझ पर त्यों तुम्हारा ही खिलता वह चेहरा है !

(क)काव्यांश के भाव सौंदर्य को स्पष्ट कीजिए ।

(ख) काव्यांश के शिल्प सौंदर्य पर प्रकाश डालिए ।

अथवा

मैं जला हृदय मे अग्नि ,दहा करता हूं ,

सुख दोनों में मग्न रहा करता हूं ,

जग भाव -सागर तरने को नाव बनाए ,

मैं भव - मौजों पर मस्त बहा करता हूं !

(क) काव्यांश का भाव सौंदर्य स्पष्ट कीजिए ।

(ख) काव्यांश की अलंकार योजना बताइए ।

10 निम्नलिखित में से किन्हीं दो प्रश्नो के उत्तर दीजिए : 3+3=6

(क) 'आत्म परिचय' में कवि के कथन –शीतल वाणी में आग लिए फिरता हूं –का विरोधाभास स्पष्ट कीजिए ।

(ख) पतंगों के साथ –साथ वे भी उड़ रहे हैं –बच्चों के साथ उड़ान का कैसा संबंध बनाता है ?

(ग)' भाषा को सहूलियत ' से बरतने का क्या अभिप्राय है ?

(घ) 'कैमरा में बंद अपाहिज' करुणा के मुखौटे में छिपी क्रूरता की कविता है –विचार कीजिए ।

11 निम्नलिखित गदयांश को पढ़कर पूछे गए प्रश्नों के उत्तर लिखिए : 2+2+2=6

भक्तिन और मेरे बीच में सेवक -स्वामी का संबंध है ,यह कहना कठिन है ; क्योकि ऐसा कोई स्वामी नहीं हो सकता ,जो इच्छा होने पर भी सेवक को अपनी सेवा से हटा न सके और ऐसा कोई सेवक भी नहीं सुना गया जो स्वामी के चले जाने का आदेश पाकर अवज्ञा से हंस दे। भक्तिन को नौकर कहना उतना ही असंगत है ,जितना अपनी घर में बारी –बारी से आने –जाने वाले अंधेरे –उजाले और आंगन में फूलने वाले गुलाब और आम को सेवक मानना।

(क) लेखिका द्वारा नौकरी छोड़कर चले जाने का आदेश पाकर भक्तिन की क्या प्रतिक्रिया होती थी ?

(ख) भक्तिन को सेविका कहना कितना असंगत है ?

(ग) गदयांश से भक्तिन के व्यक्तित्व के किस विशेषता का पता चलता है ?

अथवा

बाजार में एक जादू है। वह जादू आंख की राह काम करता है। वह रूप का जादू है पर जैसे चुंबक का जादू लोहे पर ही चलता है ,वैसे ही इस जादू की भी मर्यादा है। जेब भरी हो और मन खाली हो ,ऐसी हालत में जादू का असर खूब होता है। जेब खाली पर मन भरा न हो, तो भी जादू चल जाएगा। मन खाली है तो बाजार की अनेकानेक चीजों का निमंत्रण उस तक पहुंच जाएगा। कहीं हुई उस वक्त जेब भारी तब तो फिर वह मन किसकी मानने वाला है। मालूम होता है यह भी लूं ,वह भी लूं। सभी सामान जरूरी और आराम को बढ़ाने वाला मालूम होता है। पर यह सब जादू का असर है। जादू की सवारी उतरी कि पता चलता है कि फैनसी चीजों की बहुतायत आराम मे मदद नहीं देती ,बल्कि खलल ही डालती है।

(क) बाजार के जादू को रूप का जादू क्यों कहा गया है ?

(ख) बाजार का जादू किस तरह के लोगों पर अधिक असर करता है ?

(ग) बाजार के जादू के बंधन से बचाने का क्या उपाय हो सकता है ?

12 निम्नलिखित प्रश्नों के उत्तर लिखिए :

(क) इंदर सेना सबसे पहले गंगा मैया की जय क्यों बोलती है ? नदियों का भारतीय सामाजिक ,सांस्कृतिक परिवेश मे क्या महत्व है?3

(ख) लुट्टन पहलवान ने ऐसा क्यों कहा होगा कि मेरा गुरु कोई पहलवान नहीं ,यही ढ़ोल है ? 3

(ग) गांव में महामारी फैलाने और अपने बेटे के देहांत के बावजूद लुट्टन पहलवान ढ़ोल क्यों बजाता है ? 3

(घ) चार्ली सबसे ज्यादा स्वयं पर कब हंसता है ? 1

13 वर्तमान समय में परिवार की संरचना ,स्वरूप से जुड़े आपके अनुभव सिल्वर वैडिग कहानी से कहां तक सामंजस्य बैठा पाते हैं ?4

अथवा

जूझ के लेखक ने अपने मराठी शिक्षक सौंदलगेकर से किन गुणों और जीवन- मूल्यों को ग्रहण किया ? क्या आज भी उनकी प्रासंगिकता है?

14 निम्नलिखित मे से किन्हीं दो प्रश्नों के उत्तर लिखिए : 2+2+2+2=8

(क)सिल्वर वैडिंग पाठ के आधार पर ' जो हुआ होगा' की दो अर्थ छवियां लिखिए।

(ख) यशोधर बाबू की कहानी को दिशा देने में किशन दा की महत्वपूर्ण भूमिका रही है। आपके जीवन को दिशा देने में किसका महत्वपूर्ण योगदान रहा है ?

(ग) जूझ पाठ के लेखक के पिता अपने बेटे की पढ़ाई के विरुद्ध क्यों थे ? शिक्षा के प्रति अपनाया गया रवैया वर्तमान संदर्भ में त्याज्य क्यों है ?

(घ)सौंदलकर कौन थे ? उनके क्या विशेषता थी ?

Solution

Class 12 - English Core

Half Yearly English

Section A

1. **1.1 Answer each of the questions given below by choosing the most appropriate option: (1×5=5)**
   i. (b) Face dreadful situations.
   ii. (a) It provides food for the soul.
   iii. (a) Amitabh Bachhan when he fell seriously ill.
   iv. (c) Friday
   v. (d) Mahatma Gandhi

   1.2 Answer the following questions briefly: (1×4=4)
   i. Strife and quarrels with which our atmosphere is so full today are due to the absence of the spirit of true prayer.
   ii. The act of praying teaches us to sympathize with those who suffer. It teaches us to be compassionate, more humane and also to empathize with those who suffer.
   iii. The America example gives a lesson to India that the differences in religion and ethnicity need not stand in way when the nation is unitedly facing all its challenges.
   iv. All religious faiths teach us tolerance, humility and the value of helping neighbours.

   1.3 Pick out the words/phrases from the passage which are similar in meaning to the following: (1×3=3)
   i. Assassin
   ii. Demonstrated
   iii. Solidarity
2. **Title: Childhood Fears**

   Notes

   I. **Memories of childhood**
      i. happy & carefree
      ii. but always frightd
      iii. fear of darkness and getting lost
      iv. real fears
      v. most uncomfortable moments

   II. **Fear of darkness**
      i. Reasons
         a. clothes hanging & moving curtains looked like beast
         b. heard loud noises
         c. strange things happened
         d. fear of burglars and monsters
      ii. Feelings
         a. helpless & scared
         b. heart pounded
         c. fear of being caught by the intruder

   III. **Fear of getting lost**
      i. while walking home
      ii. taking wrong bus in school
      iii. dropped at some unfamiliar neighborhood
      iv. being left alone
      v. get lost in amusement park
      vi. never taken adventurous trips

   IV. **Worst fear**
      i. of not being acptd by friends
      ii. of not looking good

iii. of not wearing rt clothes
iv. was fat

V. **Evolving as an adult**

i. to rcgns & overcome fear
ii. darkness does no harm
iii. realise that others will help
iv. being friendly & sincere will pay
v. undrstng childhd fears

- **Key to Abbreviations**

frightd	frightened
acptd	accepted
rt	right
rcgns	recognise
undrstng	understanding
childhd	childhood
&	and

Summary:-

The writer's childhood was happy and carefree. But he was very frightened of darkness and of getting lost. His own room aggravated the fear of darkness though he had enough light in the room because of the street lights. The curtains in his room would give a run for life when there was breeze outside and his bus journey would give the fear of getting lost. The worst fear was of not being accepted, for which he did everything to look right. As he grew into an adult, he recognised and overcame his fears. He also preached that understanding childhood fears helps to cope with life as an adult.

Section B

3.

DV ENGLISH SCHOOL, THANE, MUMBAI
NOTICE
Excursion to Lonavala

20th September 20XX
The school has planned an excursion to Lonavala near Mumbai on 15th October 20XX. The journey from our school will begin at 8:00 am and we will return to school at 5:00 pm. Dispersal will be from gate number 3 of the school. The charges for the excursion are Rs. 200 inclusive of bus fare, snacks and lunch. Those students who are interested can enrol their names with the undersigned.

Naresh
(Head Boy)

OR

BE A GOOD CITIZEN - OBEY TRAFFIC RULES
KEEP SAFETY - YOUR PRIMARY GOAL

Do's and Dont's

- Do not jump red lights
- Do not cross speed limits
- Do not drink and drive
- Do not use mobile phones while driving
- Always wear helmet and seat belts
- Drive sensibly
- Respect traffic rules
- Drive slow at pedestrian crossings
- Follow all the sign boards for you personal safety

Issued in Public Interest by National Road Federation

4. 121, Main street
Kanpur
16th February, 20XX
The Editor
The Hindustan Times
Kanpur
Subject: Need to encourage the education of girl child
Sir,
Through the columns of your esteemed daily, I would like to draw the attention to the lack of girl education which is still prevailing in the remote areas of our modernising and westernising country. The fact that the number of girls in rural schools is not rising to the desired level disturbs me from within. For many past years, the government of India has been planning, launching and implementing various schemes to attract more and more girls to get basic education but it is rather unfortunate that despite all the incentives the government is providing to encourage the education of the girl child, their number has not risen to the desired level in rural areas. Although there are many obstacles to overcome, issues like gender disparity need to be addressed over and over again. There should be schemes like awarding the villages which show the largest proportional enrolment and an average attendance of girls in school. Such families who send their daughters to school can also be rewarded. Moreover, a strong public opinion on girls' education needs to be created in rural India. I am sure that by taking up these few simple steps, the situation of education of girls in rural India will come up to the desired level.
Yours sincerely
Ram

OR

245, Tilak Nagar
Delhi

3rd April 2019

The Personnel Manager
Harrison and Simpson Ltd
237 Nehru Place
New Delhi
Sir
Sub: Outdoor Marketing Assistants
In response to your advertisement published in 'The Hindustan Times' dated 30 March 2019, which stated the requirement of young boys and girls for marketing your products in Delhi, I offer my candidature for the same.

I fulfil the conditions laid down in your advertisement. I know how to ride and have my own scooter. I enjoy sound health, good personality and pleasing manners. I have good PR skills which are, I feel, utmost required in this field of work. I have heard a lot about your prestigious company and your products. I have reasonably good command over Hindi and English. Although I am just 18 and have finished my schooling from the Summer Fields Public School this year only, I believe I possess all the requirements for the job.

It will be an honour for me to get associated with your esteemed organisation and work, learn and explore myself under the guidance of your expert team. I do assure you of my dedicated service and wholehearted cooperation.
If you find me eligible for the post, you can call me for an interview at any time suitable to you. Hoping for a positive response.
Yours faithfully
Pramod Suri

5. **Poverty Is The Cause Of All Evils**
by GK Saxena

Poverty has the power and the ability to make people compromise their moral and cultural values as well as religious beliefs. Thus, it has become the root cause of almost all evils in today's global scenario. It has created a new race of people possessing the qualities of frustration and loss of hope and value for life.
It has no borders. If one is hungry and has no means of stuffing the aching stomach with food, stealing will be a solution which one may adopt. So, poverty has pushed societies to lose compassion for others. Life has become about the survival of the fittest. Thus, people engage in the crime of all sorts including fraud, robbery, snatching, drug trafficking and corruption in order to survive.
The riches of the world entice the poor to resort to crimes as they are ignorant.
Education is touted as the means to escape poverty and it often is. The poor get little or no education. Thus, they often don't even know certain things that may help them improve their situation. So it is the responsibility of the government as well as the duty of the prosperous class to help those who struggle to make a living.

6. **For the Motion**

Good morning everyone! Respected judges, worthy opponents and the esteemed audience,
Today, I Karuna of class XII, stand before you all to speak in favour of the motion, "The Internet cannot replace a classroom teacher".
The classrooms today differ from the classrooms a decade ago in multitudinous ways. The influx of technology has opened doors, expanded minds and changed the world. However, no matter how advanced and beneficial the technology has got, it can never replace a classroom teacher. There is no denying to the fact that the internet can solve a bulk of problems and provide students all the necessary answers along with illustrations. However, it cannot replace a classroom teacher as it is devoid of any kind of emotion, which is very much required during teaching. A teacher simply does not impart knowledge or information. A teacher leads, guides, facilitates and mentors a student. He understands the emotions and sentiments of the students. He realises the positive as well as the negative feelings of the students.
A teacher faces all types of students with different mental abilities while teaching. He, thus, adjusts his teaching methodology according to them. He helps the weaker students to bloom and motivates his students accordingly. The internet cannot solve all the queries but a teacher can and that too in person. Teachers help the students to remain alert and active in the classroom during teaching, whereas a machine can never do so. Internet would never care about how much concentration, focus and attention the student is learning with. Besides, it can never beat the knowledge of human beings. In addition, it's not necessary that all the information provided by internet is genuine. Have you ever wondered where all the information or knowledge on the internet has come from? It is only we humans who have fed it into the computers.
In conclusion, I would like to say that a machine can never replace a living and breathing knowledgeable person.
Thank you!

Against the Motion

Good morning everyone! Respected judges, worthy opponents and the esteemed audience,
Today, I Karuna of class XII, stand before you all to speak against the motion, "The Internet cannot replace a classroom teacher".
The classrooms today differ from the classrooms a decade ago in multitudinous ways. These days, a modern classroom is defined by technology. Teachers, administrators, parents and students have been told time and again that it is technology alone through which we can sharpen our education system. True personalised tech-infused learning is the future of education. In today's age, the old school method of books and notes is no longer beneficial. Teachers have to keep themselves updated with today's trends and have to equip themselves with the latest technology.
There is constant pressure on teachers and administrators today to implement technology in classroom. In order to fully engage the students and make them learn, a teacher will have to come out of his comfort zone and explore new ways of teaching through the internet. The internet has immense potential to upgrade today's educational system. There may come a time soon when the role of a teacher in the classroom will considerably be diminished by the internet-based learning environment .
In near future, the teacher will not be able to function without internet and technology. The teacher will have to become a facilitator of imparting trustworthy information from electronic sources. The teachers today need to strike a balance and empower themselves through technology so as to prevent themselves from getting replaced altogether by the internet.

Thank you!

Section C

7. a. 'It will be an exotic moment' as it has never happened when everyone is silent and tries to understand and analyze the result of his actions.
   b. We will be united and walk like brothers with no hatred or malice.
   c. Initially it will be strange for everybody because noone has ever cared to think about his actions. It will be for the first time when everyone will come together without any ill will or intention of war.
   d. Keeping quiet will help us understand ourselves and we will be united and bound together.
8. (a)
   With water wings

   Explanation:
   At the age of ten or eleven, Douglas decided to learn swimming with water wings at the YMCA pool because it was only two or three feet deep at the shallow end.
9. (a)
   Douglas' mother

   Explanation:
   Douglas' mother used to warn him continuously against swimming in Yakima river because that river was very dangerous.
10. (b)
    Because he wanted to tease him.

    Explanation:
    Douglas was sitting on the side of the pool. A big bruiser of a boy came and asked him jokingly if he would like to be ducked. He then picked him up and threw him into the swimming pool because he wanted to tease him.
11. (c)
    California

    Explanation:
    At the age of three or four, Douglas' father took him to a beach in California. He was knocked down and buried by waves there. He developed his aversion to the water from there.
12. The stranger didn't agree to go to the ironmaster's house because he was carrying the money he had stolen from the crofter. He knew that if the ironmaster found out his true identity, he would hand him over to the police. Thus, he didn't want to take any risk and declined the invitation.
13. M Hamel had been irregular with his students as he gave tasks like watering his flowers to the children and even gave a holiday to them whenever he wanted to go fishing. He had that realisation that he could have utilised that time in teaching. We learn that many of the times the parents of the children wanted them to work in fields so they made them miss school too. Mr. Hamel does not forget to take the partial blame on himself for the ignorance of children in the French class. So, he reproached himself for his students' unsatisfactory progress in studies.
14. The young ragpickers helped their families by picking up garbage. These children worked hard to support their families at such a tender age by selling garbage which was their daily bread. They become partners of their parents in survival. Survival in Seemapuri means rag picking.

    OR

    Freedom movement is the story of the contributions and sacrifices of countless unsung heroes like Raj Kumar Shukla and numerous sharecroppers of Champaran. They supported Gandhiji actively to initiate the first victory of Civil Disobedience in India. Indian freedom struggle wouldn't have been possible without mass support.
15. The prisoner was made to row to a nearby island where no one lived. All the necessary things were given to him. He was dressed in Japanese clothes and his hair was covered with a black cloth. He was told to signal

two flashes if he ran out of food. When Dr Sadao received no signal, he was convinced the prisoner had escaped safely. Dr. Sadao had also advised him to wait for Korean boats to take help.

16. Mr. Lamb's attitude towards life changed the mindset of Derry in a short meeting. Derry found wings, a new perception about himself which opened a whole new world for him and gave him a new lease of life. He had promised Mr. Lamb that he would come and did not want to let him down. He knew that if he didn't go back, he 'd never go anywhere in this world again. So even though, his mother tried to stop him to revisit Mr. Lamb, but Derry never listened to her.
17. Despite all vigilance, Evans' friend disguised as McLeery, the invigilator, managed to smuggle the disguised material into the cell which later on proved very beneficial for Evans to pose as injured McLeery. He came wearing two parson's dresses with black fronts and collars. Apart from it he also brought an extra pair of spectacles. The rubber ring that he brought contained pig's blood treated for coagulation. All this was passed on to Evans when Stephens' vigilant eyes were away from the peep-hole.
18. After Douglas was thrown into the deep end of the pool, he found himself in great trouble, as he did not know how to swim. Though he remained in the pool only for a few seconds, it was enough to drown him. Douglas got frightened after being tossed into the deep water. But he was still not out of his wits. On his way down, he planned to make a big jump when his feet hit the bottom, rise up like a cork to the surface, lie flat on it and paddle to the edge of the pool. Though he summoned all his strength and courageously tried to make several attempts to jump up, he could not get out of the water. Instead, he got panicked, suffocated, dizzy, terrorized and paralysed during his attempts and experienced the terror that fear of death can produce as well as the sensation of dying. Therefore, the plan he made was not successful and at the end, he was saved by the same boy who had tossed him into the pool.

OR

The Indian peasants of Champaran worked for the British landlords who owned most of the arable land of the village which was divided into large estates. The peasants had to pay rent for working on the land. Indigo was the chief commercial crop. The English planters forced the peasants to grow Indigo on 15 percent of their land holdings. The entire harvest was to be paid as rent to the landlords. When Germany started producing synthetic Indigo the price of the crop started dwindling. The landlord didn't need the crop so they tried to enter into another agreement from the sharecroppers to pay them the compensation in order not to grow any indigo crop. This arrangement was irksome for the peasants. Some paid compensation willingly, some were forced to do it. But some who were against this move hired lawyers and decided to fight. The peasants appointed lawyers and the landlords hired Thugs. At this point, Gandhiji reached Champaran and started his civil disobedience movement.

19. Evans had already escaped from the jail thrice, there was always a fear that he might make another attempt to escape. Therefore all possible precautions were taken by the governor to restrain him from escaping again and he personally monitored all the security arrangements. Recreation Block was heavily guarded, from where he expected the prisoner could make another break. Evans cell was checked by Jackson to wave off the possibility of anything in Evans possession which might hamper the smooth conduct of the examination.

    His nail scissors, nail file, and razor were taken away, his cell was bugged so that the governor could hear all the conversations going on there and to keep a strict watch on the activities of the cell during the examination, A police officer Stephens was posted there. The invigilator, Mc Lerry was also frisked to make sure that he carried no objectionable material with him. The governor ordered that all the messages or phone call should go via him only.

OR

The Governor of the HM Prison, Oxford, appears to be a kind-hearted and generous human being. He arranges for an O-level exam for a prisoner, who is renowned for his ability to escape. He was, though, quite skeptical of Evans and took every necessary precaution to make sure that Evans had no means to escape. He was just and a fair person. He complied with Evans' requests despite his misgivings.

He was also very proud and self-conscious. He did not want Evans to disgrace him by escaping from his prison. He had a sharp presence of mind, which was clear from the fact that he cross-checked every call that was made to the prison that day. However, he got over-confident of his arrangements and somehow underestimated Evans. He was quite intelligent. he could trace Evans back again at Golden Lion hotel but he believed in others easily which gave Evans a chance to escape to escape in front of him.

Also, he was a person who does not mind showering praise on a prisoner. When Evans revealed his secret

plan to him, he admired him. He was a simple man and didn't realize the extent of deception, However, at last, he proved to be just another gullible Governor when Evans tricked him again and successfully escaped. His overconfidence and self-praise let him down.

Solution

Class 12 - Physics

Half Yearly (2019-20)

Section A

1. (a)
swings backward & forward hitting each plate in turn

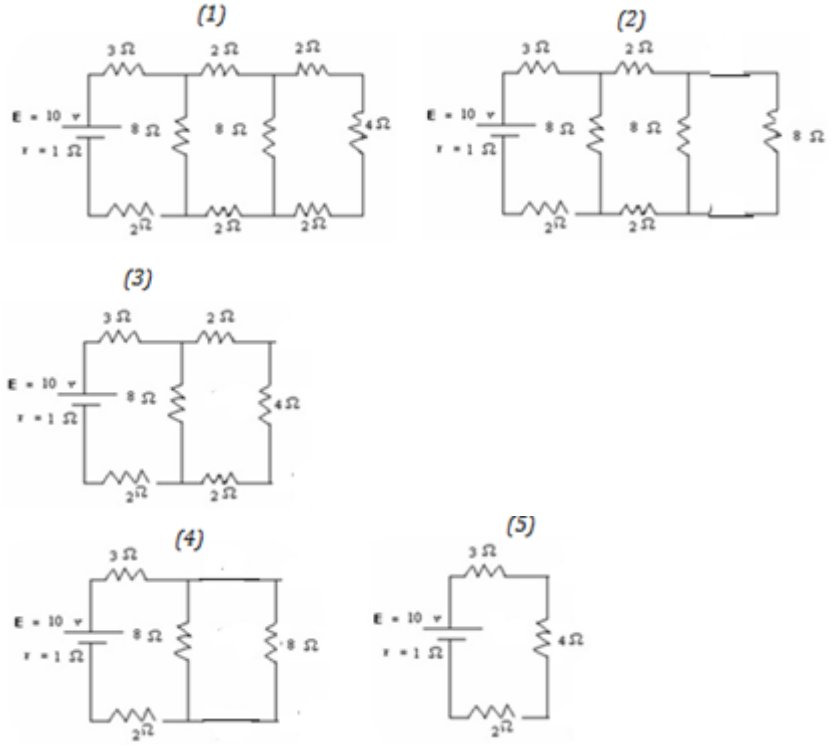
Explanation:
The plate which connected to high voltage generator induces negative charge on ball which causes attraction. When the ball strikes the positive plate, charge distribution again takes place that is the bass becomes positive and repulsion takes place. When it strikes the plate which connected to earth than its charge goes to earth and again it will be attracted towards positive plate. Hence the ball swings backward and forward hitting each plate in turn.

2. (b)
zero

Explanation:
Potential at any point due to a point charge is given by
$v = \frac{1}{4\pi\in_0}, \frac{q}{r}$
The potential due to both the charges will be equal but of opposite sign. Potential due to -10 C will be negative (let -v). potential due to +10C will be positive(let +v) thus net potential at mid point will be
v_{NET} = -v + v = zero

3. (b)
The current through the 3 Ω resistor is 1 A.

Explanation:
The circuit is reduced to find equivalent resistance as follows;



In (1), 2Ω, 4 Ω, and 2 Ω are in series. Their equivalent resistance is 8 Ω. In (2), the two 8 Ω resistors are in parallel and their equivalent resistance is 4 Ω. In (3) 2 Ω, 4 Ω, and 2 Ω are in series. Their equivalent resistance is 8 Ω which is in parallel with the 8 Ω resistance as shown in (4). The total resistance in the circuit

R= 3+4+2+1(internal resistance)=10 Ω. The current through the 3 Ω resistor

$I = \frac{E}{R} = \frac{10}{10}$

I = 1 A

4. (c)

$5 \times 10^{-4}\ \Omega$

Explanation:

Ig = 10^{-4}A

I = 10 A; G = 50Ω

$S = \frac{I_g \times G}{(I - I_g)}$

$= 5 \times 10^{-4}\ \Omega$

5. (d)

0.48 G along N-S direction

Explanation:

$\overrightarrow{B}_{equatorial} = \frac{\mu_o}{4\pi}\frac{\overrightarrow{m}}{r^3}$, where m is magnetic moment

$= 10^{-7} \times \frac{0.48}{(10^{-1})^3}$

$= 0.48 \times 10^{-4} T = 0.48 G$

Direction of magnetic field at equatorial position is opposite to that of magnetic moment, i.e. from N to S

6. Applying Gauss' theorem which states that total electric flux linked with a closed surface is given by $\phi = \frac{q}{\varepsilon_0}$ where, q is the total charge enclosed by the closed surface and ε_0 is permittivity of free space.

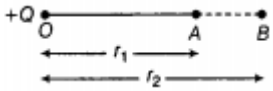
∴ Total electric flux linked with cube, $\phi = \frac{q}{\varepsilon_0}$

As charge is at centre, therefore, electric flux will be symmetrically distributed through all 6 faces of the cube so each face will receive 1/6 of the total electric flux.

Flux linked with each face of the cube = Total Flux/6 $= \frac{1}{6}\phi = \frac{1}{6} \times \frac{q}{\varepsilon_0} = \frac{q}{6\varepsilon_0}$

Unit of Electric flux is Weber and it is a scalar quantity.

7. The dipole is in stable equilibrium when direction of electric dipole moment of electric dipole is in the direction of electric field.
8. It depends on the nature of medium between the two charges and also on the system of units.
9. According to question,



$r_2 > r_1$ (say the distances of the points A and B respectively from point O)

Now potential at point A due to charge + Q, (V_A) = $\frac{kQ}{r_1}$

Potential at point B due to charge + Q, (V_B) = $\frac{kQ}{r_2}$

As , $V_A \propto (1/r_1)$

and $V_B \propto (1/r_2)$

and $r_2 > r_1$ so, $V_A > V_B$

,Which means the potential difference (V_A - V_B) is always positive.

10. Since, electric field intensity inside the conductor is zero. So, electrostatic potential is a constant.

Mathematically, E = - $\frac{dV}{dr}$ = 0

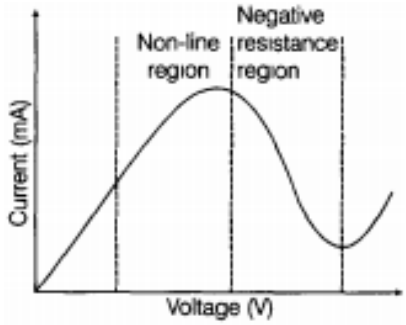
⇒dV= 0....(i)

Integrating the equation (i) we get V = constant.

Thus, the potentials at every point inside the conductor as well as on the surface of the conductor are same.

11. In case of metallic sphere, charge given to it is mostly resides on its surface. Therefore, there is no difference whether the sphere is hollow or solid. As in both the cases, the charge that will reside will be same.

12. The direction of conventional electric current is opposite to the direction of flow of electron or ions or in the direction of (+) ions.
13. No. The galvanometer will not show any current.
14. Variation of current versus voltage for the material Ga-As semiconductor material can be shown as -



It shows at first current increases with applied voltage and then decreases in non linear fashion.

15. Straight line as $F = qvB \sin\theta$ here $\theta = 0$
16. The radius of circular path depends on the charge and magnetic field as,
r = $\frac{mv}{qB}$ [$\because$ qvB = $\frac{mv_2}{r}$]
For constant momentum, $r \propto \left(\frac{1}{q}\right)$
Also, charge on proton = charge on deuteron
$\therefore \ \frac{r_p}{r_d} = \frac{q_d}{q_p} = \frac{q_p}{q_p} = 1$
Hence, $r_p : r_d = 1 : 1$

OR

One ampere current is the current which flows through each of two parallel uniform linear conductors of length 1m each, which are placed in free space at a distance of 1m from each other and for which they attract or repel each other with a force of $2 \times 10^{-7}\text{N}$ in that space.
The nature of the force is attractive or repulsive when the direction of currents in the two conductors are in the same or opposite directions respectively.

17. **Paramagnetic substance.**
The susceptibility of paramagnetic substance is small and positive (1.9×10^{-5}).
Ex. Aluminium, Sodium etc.
18. Given: $\chi = -0.5$
Therefore, it is diamagnetic material as magnetic susceptibility is negative.

OR

Ceramics.

19. The magnitude of the emf induced in the circuit due to magnetic flux depends on the time rate of change of magnetic flux through the circuit
$|\varepsilon| = d\phi_B/dt$ again magnetic flux, $\phi_B = \vec{B}.\vec{A}$ i.e. it also depens on the magnetic field, area of the circuit and angle between them.
20. It will decrease $[\because M \propto N_1 N_2]$.

OR

From the figure, it is clear that North pole of the magnet is moving away from coil PQ, so current will be induced in such a way that it acts as South pole. Hence, the direction of current will be anti-clockwise. Again, the South pole is approaching towards coil CD, so end C of the coil will act as South pole. Hence, the direction of current will be clockwise.

Section B

21. As the electric field inside a conductor is always zero. The electric lines of forces exert lateral pressure on each other which leads to repulsion between like charges. Thus, in order to stabilize spacing, the electric field lines are normal to the surface. Other reason can also be defined as if the electric field lines are not perpendicular to the surface there will be a tangential component of electric field along the surface which forces charge to move along the circumference due to which potential will not remain same on the surface.
22. We know that dielectric constant of a medium is
$K = \in_r = \frac{\in}{\in_0}$

$\therefore \in = k\in_0 = 1 \times 8.854 \times 10^{-12}$
$= 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$

23. Total charge q = CV, and total energy $U = \frac{1}{2}CV^2$. Now V is constant and $C_p > C_s$, therefore, parallel combination is required for storing greater charge and greater energy.

OR

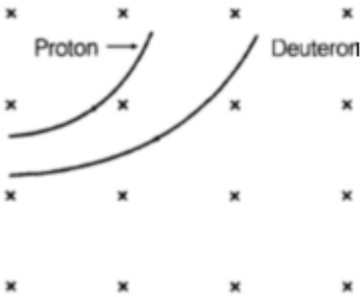
As effective thickness of dielectric is $\frac{1}{\in}$ times the actual thickness, therefore, we may write the capacity of condenser as $C = \frac{\in_0 A}{\frac{d_1}{\in_1} + \frac{d_2}{\in_1}}$

24. Internal Resistance is the resistance which is present within the battery that resists the current flow when connected to a circuit. Thus, it causes a voltage drop when current flows through it. It is the resistance provided by the electrolyte and electrodes which is present in a cell.
Given, E = 10V, $r = 3\Omega$, I = 0.5A
Total resistance of circuit
$R + r = \frac{E}{I} = \frac{10}{0.5} = 20\Omega$
    i. External resistance, R = 20 - r = 20 - 3 = 17Ω
    ii. Terminal voltage, V = IR = 0.5 $\times$ 17 = 8.5 V

OR

Only current because it is given to be steady. The rest depends on the area of cross section inversely.

25. The trajectories of the two particles, Proton and Deuteron in the magnetic field are shown in the Figure.

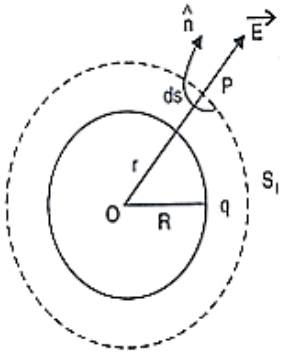


Now, as $r = \frac{mv}{qB} \rightarrow r \propto m$
So, ratio of radii of deuteron path and proton path is
$\frac{r_d}{r_p} = \frac{m_d}{m_p}$
$\because \quad m_d = 2m_p$
$\Rightarrow \quad r_d = 2r_p$
or $r_d : r_p = 2 : 1$
Also note that smaller the radius, greater the curvature and vice-versa. This is why, proton's path has got greater curvature.

26. $\mu_r = 1 + \chi_m$
27. **Large deflection means a high current for short time. So, to produce large deflection, induced current should be high and to produce high induced current, rate of change of flux should be high, i.e. more change in magnetic flux in less time.**
    i. Large deflection in the galvanometer connected with the coil C_1 in given question, can be obtained when change in magnetic flux with the coil is made fast. So, according to the diagram given in question,
        a. fast change in magnetic flux in the coil C_1 can be done by moving the coil C_2 quickly, towards C_1 or by moving the coil C_2 quickly away from C_1
        b. by switching off and on the key, more change of magnetic flux linked with the coil C_1 can be done in less time.
    ii. Alternating device ID in the place of galvanometer can be LED or bulb.

Section C

28. Electric field intensity at any point outside a uniformly charged spherical shell:
Assume a thin spherical shell of radius R with centre O. Let charge +q is uniformly distributed over the surface of the shell.



Let P be any point on the Gaussian surface sphere S_1 with centre O and radius r (r > R). According to Gauss's law.

$\oint_S \vec{E} \cdot \vec{d}\, s = \frac{q}{\varepsilon_0} \Rightarrow \oint_E \vec{E} \cdot \hat{n}\, ds = \frac{q}{\varepsilon_0}$

$\therefore E \oint ds = \frac{q}{\varepsilon_0} \Rightarrow E \cdot 4\pi r^2 = \frac{q}{\varepsilon_0}$

$\therefore E_r = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r^2}$

At any point on the surface of the shell,

r = R

$\therefore E_R = \frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{r^2}$

If σ is charge density

$\therefore q = 4\pi R^2 \sigma$

$\therefore E_R = \frac{1}{4\pi\varepsilon_0} \cdot \frac{4\pi R^2 \sigma}{R^2}$

Therefore, $E_R = \frac{\sigma}{\varepsilon_0}$

Graph : As charge on shell reside on outer surface so there is no charge inside shell so electric field by Gauss's law will be zero.

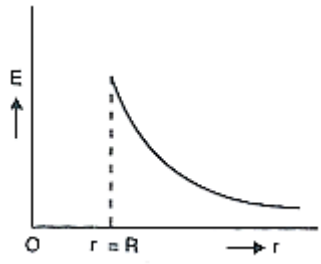
So inside shell r < R

q = 0 or $\sigma = 0$

$E = \frac{\sigma}{\varepsilon_0}$

E = 0

The variation of the electric field intensity E(r) with distance r from the centre for shell $0 \leqslant r \leqslant \infty$ is shown below.

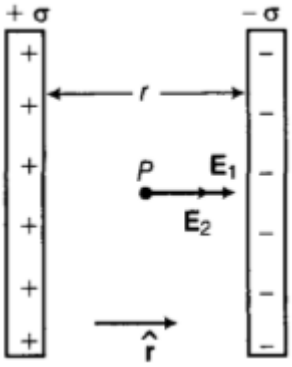


29. Let us consider two uniformly charge, large parallel sheets carrying charge densities $+\sigma$ and $-\sigma$ respectively, are separated by a small distance 'l' from each other. one plate contains positive charge and other plate contains negative charge. Electric field lines travels from positive charged plate to negative charged plate.

    By Gauss' law, it can be proved that electric field intensity due to a uniformly charged infinite plane sheet is given by

    $E = \frac{\sigma}{2\varepsilon_0}$ ..... (i)

    The electric field is directed normally outward from the plane sheet if nature of charge on sheet is positive and normally inward if charge is negative in nature.



Let $\hat{\mathbf{r}}$ represents unit vector directed from positive plate to negative plate.
Now, Electric Field Intensity (EFI) at any point P between the two plates is given by

i. $\mathbf{E}_1 = +\frac{\sigma}{2\varepsilon_0}\hat{\mathbf{r}}$ [due to positive plate]

ii. $\mathbf{E}_2 = +\frac{\sigma}{2\varepsilon_0}\hat{\mathbf{r}}$ [due to negative plate]

$\therefore$ Electric field intensity at point P is given by

$\mathbf{E} = \mathbf{E}_1 + \mathbf{E}_2 = \frac{\sigma}{2\varepsilon_0}\hat{\mathbf{r}} + \frac{\sigma}{2\varepsilon_0}\hat{\mathbf{r}} \Rightarrow \mathbf{E} = \frac{\sigma}{\varepsilon_0}\hat{\mathbf{r}}$

Thus, a uniform electric field is produced between the two infinite parallel plane sheet of charge which is directed from positive plate to negative plate. Now if the plates are of finite size, the electric fields will not be uniform and exactly perpendicular to the plates. It is a more complicated problem because of the fringing (or bending) fields. Usually, we just ignore the fringing fields and assume the field is perfectly uniform between the plates. This is a very good approximation most of the time. If sheet size is large or small , Formula will be applied same as mentioned above. Electric field intensity depends on charge , if more charge is present on sheets , more the electric field intensity will be developed.

30. Given, the separation between plates (d) = 0.5 cm $= 5 \times 10^{-3} m$ the capacitance (c) = 2F
Now
$C = \varepsilon_0 \frac{A}{d}$
$A = \frac{Cd}{\varepsilon_0} \left(\varepsilon_0 = 8.85 \times 10^{-12} Fm^{-1}\right)$
$= \frac{2 \times 5 \times 10^{-3}}{8.85 \times 10^{-12}}$
$A = 1.13 \times 10^9 m^2$
$= 1.13 \times 10^3 km^2 = 1130 km^2$
The area of plates should be in kilometers in order to get the capacitance in Farads. Therefore, the ordinary capacitors are in the range of μF.
31. **Drift Velocity** (V_d) : It is defined as the average velocity with which free electrons get drifted towards the positive end of a conductor (opposite to the electric field) under the influence of an external electric field.
Relaxation time (τ) : It is time interval between two successive collisions of electron in a conductor when current flows in a conductor.
We know that
$V_d = \frac{a\tau}{2} \frac{qE}{2m_e} \times \tau$
E = electric field
a = average acceleration
q = charge of the carrier
m = effective mass of charge
The conductor connected to DC source of emf E' .
Suppose, initial length of the conductor, $l_i = l$
New length, $l_f = 3l$
We know that,
Drift velocity, $v_d \propto E$
Thus,
$\frac{(v_d)_f}{(v_d)_i} = \frac{E_f}{E_i}$
we know that,

$E = \frac{E'}{L}$

E= electric field

E' = emf of the battery

L = length of the conductor

A conductor of length L is connected to a D.C source of emf ' E '. $E_i = \frac{E'}{L}$

length of the conductor is tripled by stretching it, keeping ' E ' constant,$E_f = \frac{E'}{3L}$

$\frac{(v_d)_f}{(v_d)_i} = \frac{E_f}{E_i} = \frac{\frac{E'}{3L}}{\frac{E'}{L}}$

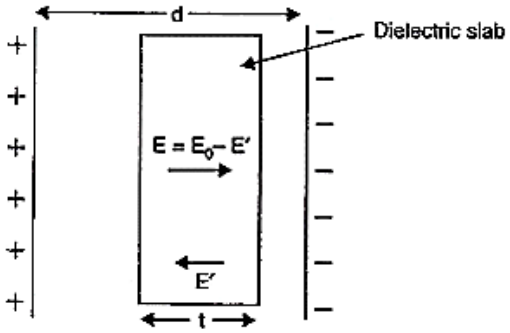
$\frac{(v_d)_f}{(v_d)_i} = \frac{1}{3}$

Thus, $(v_d)_f = \frac{(v_d)_i}{3}$

Thus, drift velocity decreases by three times.

32. Let A is the area of the two plates of the parallel plate capacitor and d is the separation between them. A dielectric slab of thickness t < d and area A is kept between the two plates. The total electric field inside the dielectric slab will be:

$E = \frac{E_0}{K} = E_0 - E'$ where E' is the opposite field developed inside the slab due to polarization of slab. Total potential difference between the plates,



$V = E_0(d-t) + Et$

$= \frac{\sigma}{\varepsilon_0}(d-t) + \frac{\sigma}{k\varepsilon_0}t$

$= \frac{\sigma}{\varepsilon_0}\left[(d-t) + \frac{t}{k}\right]$

$V = \frac{q}{A\varepsilon_0}\left[(d-t) + \frac{t}{k}\right]$

where q is the charge on each plate.

Since, $C = \frac{q}{V}$

or $C = \frac{q}{\frac{q}{A\varepsilon_0}\left[(d-t)+\frac{t}{k}\right]}$

or $C = \frac{A\varepsilon_0}{\left[(d-t)+\frac{t}{k}\right]}$

33. $v = \frac{1}{2\pi}\sqrt{\frac{MB_H}{I}}$ or $v \propto \sqrt{B_H}$ $w^2 = \frac{MB}{I}$

$4\pi^2 v^2 = \frac{MB}{I}$

$v = \frac{1}{2}\pi\sqrt{\frac{MB}{I}}$

or $v\alpha\sqrt{B\cos\delta}$

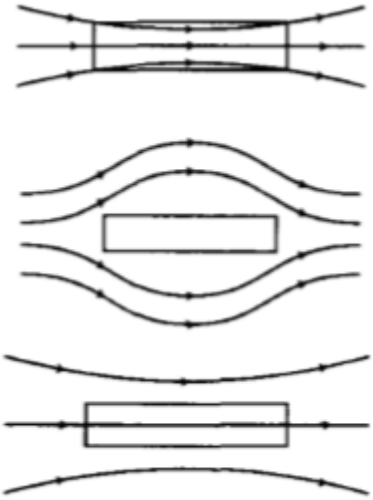
or, $B\ \cos\delta\ \propto\ v^2$ or $B\ \propto \frac{v^2}{\cos\delta}$

$\frac{B_1}{B_2} = \frac{v_1^2}{\cos\delta_1} \times \frac{\cos\delta_2}{v_2^2} = \frac{20\times20\times\cos60^\circ}{\cos30^\circ\times15\times15}$

$= \frac{200\times2}{\sqrt{3}\times225} = \frac{400}{225\sqrt{3}} = \frac{16}{9\sqrt{3}}$

OR

The modifications are shown in the figure.



It happens because

i. nickel is a ferromagnetic substance. (as ferromagmefer substance strongly attracts magnetic field lines always)

ii. antimony is a diamagnetic substance.(as diamagnetic substance always feebly repels magnetic field lines)

iii. aluminium is a paramagnetic substance.(as a paramagnetic substance feebly attracts magnetic field lines)

34. The total charge flowing through the coil,

$q = \int_{t_1}^{t_2} I dt$

$= \frac{1}{R}\int_{t_1}^{t_2} E\, dt$

Where, induced EMF, $|E| = N\frac{d\phi}{dt} \Leftrightarrow Edt = Nd\phi$

Hence, $q = \frac{N}{R}\int_{\phi_1}^{\phi_2} d\phi = \frac{N}{R}(\phi_1 - \phi_2)$ ....(i)

Given, N = 25, $q = 7.5 \times 10^{-3} C, \phi_2 = 0,\ R = 0.50\Omega$

Putting these values in equations (i), we get

$\phi_1 = 1.5 \times 10^{-4} Wb, A = 2.0 \times 10^{-4} m^2$

$Q = \frac{qR}{N}$(From I)

$\therefore B = \frac{\phi_1 - \phi_2}{A}$ = 0.75 T

OR

Here, $\frac{dI}{dt} = \frac{(I_2 - I_1)}{t} = \frac{0.0 - 5.0}{0.1} = -50\ As^{-1}$

e = 200 V, L = ?

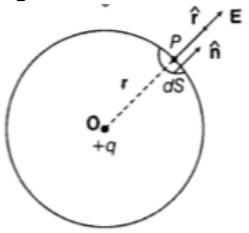
As $|e| = L\left|\frac{dI}{dt}\right| \quad \therefore \quad L = \frac{|e|}{\left|\frac{dI}{dt}\right|} = \frac{200}{50}$ = 4 H

Section D

35. i. Gauss's law states that the net flux of an electric field in a closed surface is directly proportional to the enclosed electric charge. It is one of the four equations of Maxwell's laws of electromagnetism. It was initially formulated by Carl Friedrich Gauss in the year 1835 and relates the electric fields at the points on a closed surface and the net charge enclosed by that surface. The electric flux is defined as the electric field passing through a given area multiplied by the area of the surface in a plane perpendicular to the field. Yet another statement of Gauss's law states that the net flux of a given electric field through a given surface, divided by the enclosed charge should be equal to a constant. The total electric flux linked with a surface is equal to the total number of electric lines of force passing through the surface when surface is held normal to the direction of electric field. The SI unit of electric flux is Nm^2C^{-1}.

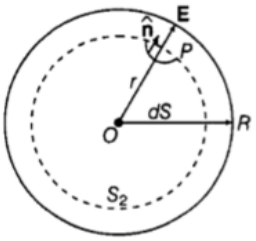
According to Gauss' law in electrostatics, the surface integral of electrostatic field E produced by any sources over any closed surface S enclosing a volume V in vacuum, i.e. total electric flux over the closed surface Sin vacuum, isl $\frac{1}{\varepsilon_0}$ times the total charge (q) contained inside S, i.e. $\phi_E = \oint_S \mathbf{E} \cdot d\mathbf{S} = \frac{q}{\varepsilon_0}$

Maxwell's equations let us calculate the forces charged particles exert on each other. While Newton's laws only hold for particles moving with speeds much less than the speed of light, Maxwell's equations hold for particles moving with any speed. We say that Maxwell's equations are relativistically correct. Maxwell's equations are a set of four equations. The first of these equations is Gauss law -



where, $\hat{r}$ is unit vector directed from 0 to P. Consider a small area element dS of the sphere around P. Let it be represented by the vector $dS + \hat{n} \cdot dS$.
where, $\hat{n}$ is unit vector along out drawn normal to the area element.
∴ Electric flux over the area element,
$d\phi_E = \mathbf{E} \cdot dS = \left(q/4\pi\varepsilon_0 \cdot \hat{\mathbf{r}}/r^2\right) \cdot (\hat{n} dS)$
$\mathbf{E} \cdot d\mathbf{S} = q/4\pi\varepsilon_0 \quad dS/r^2 \cdot \hat{\mathbf{r}}\hat{\mathbf{n}}$
As normal to a surface of every point is along the radius vector at that point, therefore, $\hat{r} \cdot \hat{n} = 1$
$E \cdot dS = q/4\pi\varepsilon_0 \cdot dS/r^2$
Integrating over the closed surface area of the sphere, we get total normal electric flux over the entire sphere,
$\phi_E = \oint\limits_S E \cdot d\mathbf{S} = \frac{q}{4\pi\varepsilon_0 r^2} \oint\limits_S dS = \frac{q}{4\pi\varepsilon_0 r^2} \times$ total area of surface of sphere.
$= \frac{q}{4\pi\varepsilon_0 r^2}\left(4\pi r^2\right) = \frac{q}{\varepsilon_0}$
Hence, $\oint_S \mathbf{E} d\mathbf{S} = q/\varepsilon_0$, which proves Gauss' theorem.

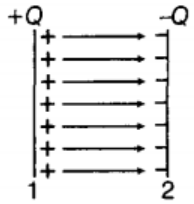
ii. Electric field inside a uniformly charged spherical shell.
According to Gauss' theorem
$\oint_S \mathbf{E} \cdot d\mathbf{S} = \oint_S E\hat{\mathbf{n}} \cdot dS = \frac{q}{\varepsilon_0}$ or $E \oint_S ds = \frac{q}{\varepsilon_0}$
$\therefore E \cdot 2\pi r^2 = q/\varepsilon_0 \Rightarrow E = q/4\pi\varepsilon_0 r^2$ ..... (i)
In the given figure, the point P where we have to find the electric field intensity is inside the shell. The Gaussian surface is the surface of a sphere S_2 passing through P and with the centre at 0. The radius of the sphere S_2 is r < R. The electric flux through the Gaussian surface, as calculated in Eq. (I),i.e. E x4w2. As charge inside a spherical shell is zero, the Gaussian surface encloses no charge. The Gauss' theorem gives



$E \times 4\pi r^2 = \frac{q}{\varepsilon_0} = 0 \quad \therefore \quad E = 0$ for $r < R$
Hence, the electric field due to a uniformly charged spherical shell is zero at all points inside the shell as no charge resides inside it and potential will be uniform everywhere but on the surface it will be constant and non zero.

OR

i. Let the total charge on the plates of the below capacitor is +Q and -Q respectively.



∴The potential difference between the plates of the above capacitor of capacitance C for an infinitesimal charge q is q/C.

∴ Potential of condenser= q/C.

Small amount of work done in giving an additional charge dq to the condenser,

$dW = \frac{q}{C} \times dq$

∴Total work done in giving a charge Q to the condenser,

$W = \int_{q=0}^{q=Q} \frac{q}{C} dq = \frac{1}{C}\left[\frac{q^2}{2}\right]_{q=0}^{q=Q} \Rightarrow W = \frac{1}{C}\frac{Q^2}{2}$

As, an electrostatic force is conservative, this work is stored in the form of potential energy (U) of the condenser.

$U = W = \frac{1}{2}\frac{Q^2}{C}$

$\because \quad Q = CV \Rightarrow U = \frac{1}{2}\frac{(CV)^2}{C} = \frac{1}{2}CV^2$

$\because \quad CV = Q \Rightarrow U = \frac{1}{2}QV$

Hence, $U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}CV^2 = \frac{1}{2}QV$

Energy density (U) is defined as the total energy per unit volume of the condenser.

i.e., $u = \frac{\text{Total energy } (U)}{\text{Volume } (V)} = \frac{\frac{1}{2}CV^2}{Ad}$

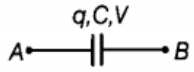
Using, $C = \frac{\varepsilon_0 A}{d}$ and V = Ed (Where V is the potential difference and E is the Electric field existing between the plates)

We get, $U = \frac{1}{2}\left(\frac{\varepsilon_0 A}{d}\right)\left(\frac{E^2 d^2}{Ad}\right) = \frac{1}{2}\varepsilon_0 E^2$

Here, Energy density between plates of capacitors is directly proportional to Electric field that exist between the plates of capacitor.

ii. Initial condition :

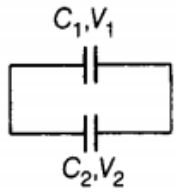
If we consider a charged capacitor of capacitance C with potential difference V, then its charge would be given, q = CV



and energy stored in it is given by

$U_1 = \frac{1}{2}CV^2$.....(i)

When this charged capacitor is connected to uncharged capacitor,



Let the common potential be V_1, the charge flow from first capacitor to the other capacitor unless both the capacitor attains the common potential.

$\Rightarrow Q_1 = CV_1$ and $Q_2 = CV_2$

Applying conservation of charge,

$Q = Q_1 + Q_2 \Rightarrow CV = CV_1 + CV_2$

$\Rightarrow V = V_1 + V_2 \Rightarrow V_1 = \frac{V}{2}$ [hence voltage will be equally divided between the capacitors]

Total energy stored on both the capacitor

$U_2 = \frac{1}{2}CV_1^2 + \frac{1}{2}CV_1^2 \Rightarrow U_2 = \frac{1}{2}C\left(\frac{V}{2}\right)^2 + \frac{1}{2}C\left(\frac{V}{2}\right)^2$

$U_2 = \frac{2CV^2}{8} = \frac{1}{4}CV^2$

From Eqs. (i) and (ii), we get, $U_2 < U_1$

It means that energy stored in the combination is less than that stored initially in the single capacitor. It is due to the fact that when the charge is transferred from one capacitor to another capacitor energy is wasted in transferring the charge.

36. Let l_1, l_2, l_3 be lengths of three copper wires and D_1, D_2, D_3 be their diameters and A_1, A_2, A_3 be there area of cross section.

Given, $l_1 : l_2 : l_3 = 2 : 3 : 4$

$\therefore l_1 = 2l$, $l_2 = 3l$ and $l_3 = 4l$

Also given, $D_1 : D_2 : D_3 = 4 : 5 : 6$

$\therefore A_1 : A_2 : A_3 = (4)^2 : (5)^2 : (6)^2 = 16 : 25 : 36$

$A_1 = 16A$, $A_2 = 25A$ and $A_3 = 36A$

If ρ is the resistivity of copper, then

$R_1 = \frac{\rho l_1}{A_1} = \frac{\rho \times 2l}{16A} = \frac{1}{8}\frac{\rho l}{A}$

$R_2 = \frac{\rho l_2}{A_2} = \frac{\rho \times 3l}{25A} = \frac{3}{25}\frac{\rho l}{A}$

and $R_3 = \frac{\rho l_3}{A_3} = \frac{\rho 4l}{36A} = \frac{1}{9}\frac{\rho l}{A}$

$\therefore R_1 : R_2 : R_3 = \frac{1}{8} : \frac{3}{25} : \frac{1}{9}$

$= 25 \times 9 : 3 \times 8 \times 9 : 8 \times 25$

Or $R_1 : R_2 : R_3 = 225 : 216 : 200$

$R_1 = 225$ R, $R_2 = 216$ R and $R_3 = 200$ R

Let I_1, I_2 and I_3 be the currents through the wires of resistances R_1, $R_2$and R_3 respectively. Then, $I_1 + I_2 + I_3 = 5$ ...(i)

and $I_1 \times 225R = I_2 \times 216R = I_3 \times 200R$

or $I_1 \times 225 = I_2 \times 216 = I_3 \times 200$

$\therefore I_2 = \frac{225I_1}{216} = 1.04I_1$

and $I_3 = \frac{225I_1}{200} = 1.125I_1$

Putting values in equation (i) we get

$I_1 + 1.04I_1 + 1.125\ I_1 = 5$

On solving $I_1 = 1.58$A

$\therefore I_2 = 1.04 \times 1.58 = 1.64A$

and $I_3 = 1.125 \times 1.58 = 1.78$ A

OR

a. Given, that $B = \frac{\mu_0 I R^2 N}{2(x^2+R^2)^{3/2}}$ (Axial line)

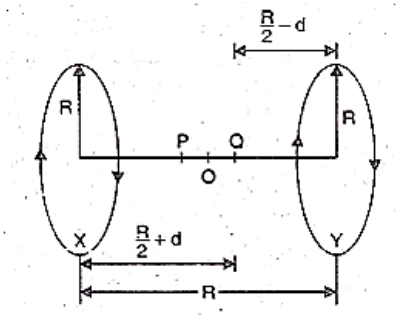
Putting x = 0 (centre of coil)

$B = \frac{\mu_0 I R^2 N}{2R^3}$

or $B = \frac{\mu_0 I N}{2R}$

which is same as the standard result

b. In figure O is a point which is midway between the two coils X and Y.



Let B_X be the magnetic field at Q due to coil X

Then $B_x = \frac{\mu_0 N I R^2}{2\left[\left(\frac{R}{2}+d\right)^2+R^2\right]^{3/2}}$

If B_y is the magnetic field at Q due to coil Y, then

$By = \frac{\mu_0 NIR^2}{2\left[\left(\frac{R}{2}-d\right)^2+R^2\right]^{3/2}}$

The currents in both the coils X and Y are flowing in the same direction. So, the resultant field is given by

B = B_x + B_y

$B = \frac{\mu_0 NIR^2}{2\left[\left(\frac{R}{2}+d\right)^2+R^2\right]} + \frac{\mu_0 NIR^2}{2\left[\left(\frac{R}{2}-d\right)^2+R^2\right]^{3/2}}$

$B = \frac{\mu_0 NIR^2}{2}\left[\frac{1}{\left[\left(\frac{R}{2}+d\right)^2+R^2\right]^{3/2}} + \frac{1}{\left[\left(\frac{R}{2}-d\right)^2+R^2\right]^{3/2}}\right]$

$B = \frac{\mu_0 NIR^2}{2}\left[\frac{1}{\left[\frac{R^2}{4}+d^2+Rd+R^2\right]^{3/2}} + \frac{1}{\left[\frac{R^2}{4}+d^2-Rd+R^2\right]^{3/2}}\right]$

$B = \frac{\mu_0 NIR^2}{2}\left[\frac{1}{\left[\frac{5R^2}{4}+Rd\right]^{3/2}} + \frac{1}{\left[\frac{5R^2}{4}-Rd\right]^{3/2}}\right] \because d^2 << R^2$

$B = \frac{\mu_0 NIR^2}{2\left(\frac{5}{2}R^2\right)^{3/2}}\left[\frac{1}{\left[1+\frac{4}{5}\frac{d}{R}\right]^{3/2}} + \frac{1}{\left[1-\frac{4}{5}\frac{d}{R}\right]^{3/2}}\right]$

$= \frac{\mu_0 NIR^2}{2\left(\frac{5}{4}\right)^{3/2}R^3}\left[\left[1-\frac{3}{2}\times\frac{4}{5}\times\frac{d}{R}\right]+\left[1+\frac{3}{2}\cdot\frac{4}{5}\cdot\frac{d}{R}\right]\right]$

$= \frac{\mu_0 NI\cdot 2}{2\left(\frac{5}{4}\right)^{3/2}R}$

$= \frac{\mu_0 NI}{R}\left(\frac{5}{4}\right)^{3/2}$

$= 0.72\frac{\mu_0 NI}{R}$(approx)

37. a. Magnetic moment, *M* = $1.5JT^{-1}$

Magnetic field strength, *B*= 0.22 T

i. The work required to allign the magnetic moment normal to the direction of magnetic field is given as:

$W = -MB(\cos\theta_2 - \cos\theta_1)$

$= -1.5\times 0.22(\cos 90^\circ - \cos 0^\circ)$

$= -0.33(0-1)$

$= 0.33J$

ii. The work required to make the magnetic moment opposite to the direction of magnetic field (θ_1 = 0° and θ_2 = 180°) is given as:

$W = -MB(\cos\theta_2 - \cos\theta_1)$

$= -1.5\times 0.22(\cos 180^\circ - \cos 0^\circ)$

$= -0.33(-1-1)$

$= 0.66J$

b. For case (i): $\theta = \theta_2 = 90^\circ$

$\therefore$Torque, $\tau = MB\sin\theta$

$= 1.5\times 0.22\sin 90^\circ$

$= 0.33J$

For case (ii): $\theta = \theta_2 = 180^\circ$

$\therefore$Torque, $\tau = MB\sin\theta = MB\sin 180^\circ = 0J$

OR

Let the distance from R to MN be x. Then the area of the loop between MN and R is xd and the magnetic flux linked with the loop is B x d. As the rod moves, the emf induced in the loop is given by

$|\varepsilon| = \frac{d}{dt}(Bxd) = Bd\frac{dx}{dt} = Bvd$

Where v is the velocity of MN. The total resistance of the loop between R and MN is $R + 2\lambda r$. The current in

the loop is given by

$i = \frac{|e|}{R+2\lambda x} = \frac{Bvd}{R+2\lambda x}$

i. Force acting on the rod,

$F = iB\,d = \frac{B^2d^2}{R+2\lambda x}v$

$\therefore m\frac{dv}{dt} = \frac{B^2d^2}{R+2\lambda x} \cdot \frac{dx}{dt}$

or $dv = \frac{B^2d^2}{m} \cdot \frac{dx}{R+2\lambda x}$

On integrating both sides, we get

$v = \frac{B^2d^2}{2\lambda m} In\left(\frac{R+2\lambda x}{R}\right)$

and Force $= \frac{B^2d^2}{R+2\lambda x} \cdot \frac{B^2d^2}{2\lambda m} In\left(\frac{R+2\lambda x}{R}\right)$

ii. Work done per second = Fv

Heat produced per second $= i^2(R + 2\lambda x)$

$= \left(\frac{Bvd}{R+2\lambda x}\right)^2 (R + 2\lambda x)$

$= \left(\frac{B^2d^2v}{R+2\lambda x}\right) \cdot v$

= F . v

Thus, the ratio of heat produced to work done is I. The entire work done by F per second is converted into heat.

Solution

Class 12 - Chemistry

Half Yearly(2019-20)

Section A

1. (a)
   Depression in freezing point of the solvent

   Explanation:
   This graph is for depression in freezing point. Freezing point is the temperature at which vapour pressure of pure solid solvent becomes equal to vapour pressure of solution.
2. (d)
   velocity of both K^+ and NO_3^- are nearly the same.

   Explanation:
   Saturated solution of KNO_3 is used in salt bridge because of same mobility of K^+ and NO_3^-. if the velocities would not have been the same then the ions would not have been able to neutralise the charge equally in both half cells. consequently, an opposing force would be developed that restricts the flow of current.
3. (d)
   s^{-1}

   Explanation:
   unit of rate constant for nth order reaction (k) = $\left(mol\ L^{-1}\ \right)^{1-n}\ s^{-1}$
   put, n=1 ;
   unit of rate constant for 1st order reaction(k) = s^{-1}
4. (c)
   $AlCl_3$

   Explanation:
   The arsenic sulphide sol has negative charge. The maximum coagulation power for precipitating it is of 0.1 N $AlCl_3$.
5. (b)
   Their surface is wetted with oil

   Explanation:
   In froth floatation gangue particles get wetted by water and particles of metal get wetted by oil. So ore particles come/float to the top.
6. Amalgam of mercury with sodium. They are called solid solutions.
7. When a non-volatile solute is added to a solvent, the surface area for escape of solvent molecules decreases and vapour pressure gets lowered.

   OR

   Boiling point elevation constant (K_b) of a solvent is elevation in boiling point when concentration of solution is taken as 1 molal solution. that is a solution containing 1 gram mole of solute dissolved in 1000g of the solvent. The SI unit of K_b is $K\ kg\ mol^{-1}$.
8. $\Lambda_m = \frac{1}{R} \times \frac{l}{A} \times \frac{1000}{M} = \frac{1}{200} \times 1 \times \frac{1000}{0.01} = 500 \mathrm{Scm^2 mol^{-1}}$

   OR

   Zn and Mg. because these are more reactive than iron and form oxide layer on the surface of iron and protected
   Zn and Mg are more electropositive than iron, hence it is more reactive than iron, so it oxidizes in preference to the iron object.

9. For a first order reaction, the equation is : $k = \frac{2.303}{t} \log \frac{[R]_o}{[R]}$

   A constant value of k justify's the first order of the reaction.

   OR

   $\frac{dx}{dt} = K[X]^3$
10. **Emulsion:** It is a colloidal mixture in which the dispersed phase and the dispersion medium are liquids. Example: Butter.

    Gel: It is a colloidal mixture in which the dispersed phase is liquid and the dispersion medium is solid. Example: Cheese.
11. a. Lyophobic sol : Gold, platinum.

    b. Lyophilic sol : gum, gelatin, starch, proteins with suitable dispersion medium.
12. In chemisorption, new chemical bonds are formed with evolution of large amount of energy. Therefore ΔH for chemisorption is high.

    OR

    Applications of adsorption.

    i. Activated charcoal is used in gas masks to remove poisonous gases such as CH_4, CO etc.

    ii. Animal charcoal is used as decoloring agent in the manufacture of sugar.

    iii. Silica is used for removing moisture.

    iv. The ion exchange resins are used for removing hardness of water.
13. Pyrometallurgy is the process of extracting the metal by heating the metal oxide with a suitable reducing agent.

    OR

    Copper is extracted by hydrometallurgy from low grade ores. It is leached out using acid or bacteria. The solution containing Cu^{2+} ions is treated with scrap iron or H_2.

    $Cu^{2+}(aq) + H_2(g) \rightarrow Cu(s) + 2H^+(aq)$
14. Higher the value of reduction potentials, stronger is the oxidising behaviour. Therefore, BrO_4^- is the strongest oxidizing agent.
15. HF is least volatile because of extensive intermolecular hydrogen bonding. Whereas HCl has least van der Waals forces of attraction, therefore it is most volatile.
16. Due to stronger S-S bond and due to small size and greater interelectronic repulsion O-O bond, is weaken so it can't show catenation.
17. It is due to poor shielding effect of 4f-electrons, effective nuclear charge increases, ionic size decreases.
18. The transition metals and their compounds are known for their catalytic activity. This activity is due to their ability to adopt multiple oxidation states and to form complexes.
19. Lanthanoids shows +3 oxidation state as stable oxidation state. But apart from +3, some elements shows+2 and +4 oxidation state as well.
20. Six

    OR

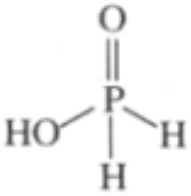
    $Cu_2[Fe(CN)_6]$

Section B

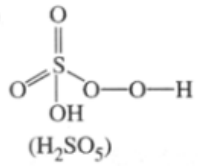
21. When acetone and chloroform are mixed, there are new attractive forces due to intermolecular hydrogen bonding. Thus, the attractive forces become stronger and the escaping tendency of each liquid from the solution decreases. So due to H-bonding between acetone and $CHCl_3$, the force of attraction increases and therefore energy is released.

    OR

    The structures of H_3PO_2 and H_2SO_5 are given below:

i. 

(H_3PO_2)

ii. 

(H_2SO_5)

22. $\lambda_m{}^0(NH_4OH) = \lambda_m{}^o(Na_4Cl) + \lambda_m{}^o(NaOH) - \lambda_m{}^o(NaCl)$

    = 129.8 +217.4 - 108.9 = 237.3 5cm^2/mol

    Degree of dissociation, $\alpha = \frac{\lambda m}{\lambda m^0} = \frac{9.335 \text{cm}^2/\text{mol}}{237.35 \text{cm}^2/\text{mol}}$

    = 0.039 or 3.9%.

23. For a first order reaction,

    $t_1 = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$

    $k = \frac{2.303}{40 \text{ min}} \log \frac{100}{100-30} = \frac{2.303}{40 \text{ min}} \log \frac{10}{7} = 8.918 \times 10^{-3} \text{min}^{-1}$

    Therefore, $t_{1/2}$of the decomposition reaction is

    $t_{1/2} = \frac{0.693}{k} = \frac{0.693}{8.918 \times 10^{-3}} \text{ min}$

    = 77.7 min (approximately)

24. By activating an adsorbent, we tend to increase the adsorbing power (adsorbing sites) of an adsorbent. Some ways to activate an adsorbent are:

    i. By increasing the surface area of the adsorbent. This can be done by breaking it into smaller pieces or powdering it.

    ii. Some specific treatments can also lead to the activation of the adsorbent. For example, wood charcoal is activated by heating it between 650 K and 1330 K in vacuum or air. It expels all the gases absorbed or adsorbed and thus, creates a space for adsorption of gases.

25. The presence of oxygen is necessary to convert gold into oxidized state.

    $4Au + 8KCN + 2H_2O + O_2 \rightarrow 4K[Au(CN)_2] + 4KOH$

    $2K[Au(CN)_2] + Zn \rightarrow K_2[Zn(CN)_4] + 2Au$

    Metal used as reducing agent is zinc

26. Nickel is refined by Mond's process. In this process, nickel is heated in the presence of carbon monoxide to form nickel tetracarbonyl, which is a volatile complex.

    $Ni + 4CO \xrightarrow{330-350\ K} \underset{Nickel\ tetracarbonyl}{Ni(CO)_4}$

    Then, the obtained nickel tetracarbonyl is decomposed by subjecting it to a higher temperature (450 - 470 K) to obtain pure nickel metal.

    $\underset{Nickel\ tetracarbonyl}{Ni(CO)_4} \xrightarrow{330-350\ K} \underset{Nickel}{Ni} + 4CO$

27. Due to an increase in nuclear charge which accompanies the filling of the inner d orbitals, there is a increase in ionisation enthalpy along each series of the transition elements from left to right. However, many small variations occur. The irregular trend in the first ionisation enthalpy of the 3d metals, can be accounted for by considering that the removal of one electron alters the relative energies of 4s and 3d orbitals

    OR

    $[Ni(CN)_4]^{2-}$ is a square planar complex. Which is diamagnetic as no unpaired electron is present.

    $[Ni(CO)_4]$ is a tetrahedral complex which is diamagnetic due to the absence of unpaired electrons.

Section C

28. **At anode:** $2Fe(s) \rightarrow 2Fe^{2+} + 4e^-$

    $E^0_{(Fe^{2+}/\ Fe)}$ = -0.44 V

    Cathode: $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$; E^0cell (H^+O_2/H_2O) = 1.23V

    The overall reaction being:

    $2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$; E^0cell = 1.67V

    The ferrous ions are further oxidized by atmosphere oxygen to ferric ions which came out as rust in the form of hydrated ferric oxide ($Fe_2O_3.nH_2O$)

    The method to prevent rusting of iron is by Barrier protection.

29. $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$

    $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

    $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$

    $E_{cell} = E^0_{Cu^{+2}/Cu} - E^0_{Zn^{+2}/Zn}$

    = + 0.34V - (-0.763V)

    = 1.103 V

    $\log K = \frac{nE^0}{0.0591}$

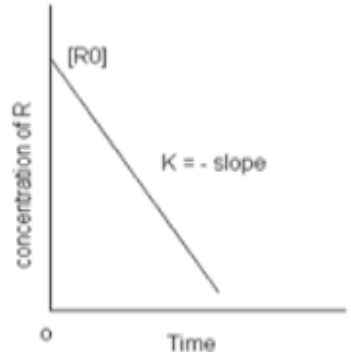
    $= \frac{2 \times 1.103}{0.0591}$

    $\log K = \frac{2.206}{0.0591}$ = 37.326

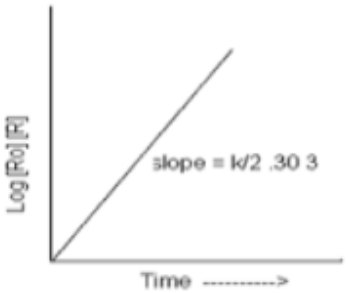
    k = Antilog 37.326

    $= 2.118 \times 10^{37}$

30. a.



    b.



31. Consider the order of the reaction with respect to A is x and with respect to B is y.

    Therefore, $r_0 = k[A]^x[B]^y$

    $5.07 \times 10^{-5} = k[0.20]^x[0.30]^y$ ..... (i)

    $5.07 \times 10^{-5} = k[0.20]^x[0.10]^y$ ..... (ii)

    $1.43 \times 10^{-4} = k[0.40]^x[0.05]^y$ ..... (iii)

    Dividing equation (i) by (ii), we obtain

    $\frac{5.07 \times 10^{-5}}{5.07 \times 10^{-5}} = \frac{k[0.20]^x[0.30]^y}{k[0.20]^x[0.10]^y}$

    $1 = \frac{[0.30]^y}{[0.10]^y}\left(\frac{0.30}{0.10}\right)^0 = \left(\frac{0.30}{0.10}\right)^y$

    y = 0

    Dividing equation (iii) by (ii), we obtain

    $\frac{1.43 \times 10^{-4}}{5.07 \times 10^{-5}} = \frac{k[0.40]^x[0.05]^y}{k[0.20]^x[0.30]^y}$

    $\frac{1.43 \times 10^{-4}}{5.07 \times 10^{-5}} = \frac{[0.40]^y}{[0.20]^y}$ $[Since\ y = 0,\ [0.05]^y = [0.30]^y = 1]$

$2.821 = 2^x$

$\log 2.821 = x \log 2\ (Taking\ \log\ on\ both\ sides) x = \frac{\log 2.821}{\log 2}$

= 1.496

= 1.5 (approximately)

Hence, the order of the reaction with respect to A is 1.5 and with respect to B is 0.

32. i. When a beam of light is passed through a colloidal solution, then scattering of light is observed. This is known as the Tyndall effect. This scattering of light illuminates the path of the beam in the colloidal solution.

ii. When NaCl is added to ferric oxide sol, it dissociates to give Na^+ and Cl^- ions. Particles of ferric oxide sol are positively charged. Thus, they get coagulated in the presence of negatively charged Cl^- ions.

iii. The colloidal particles are charged and carry either a positive or negative charge. The dispersion medium carries an equal and opposite charge. This makes the whole system neutral. Under the influence of an electric current, the colloidal particles move towards the oppositely charged electrode. When they come in contact with the electrode, they lose their charge and coagulate.

OR

The value of $\Delta_t G^\theta$ for the formation of Cr_2O_3 from Cr ($-540\ kJ\ mol^{-1}$) is higher than that of Al_2O_3 from ($-827 kJ\ mol^{-1}$). Therefore, Al can reduce Cr_2O_3 to Cr. Hence, the reduction of Cr_2O_3 with Al is possible.

Alternatively,

$2Al + \frac{3}{2}O_2 \rightarrow Al_2O_3\ \Delta_r G^\theta = -827\ kJ\ mol^{-1}$

$2Cr + \frac{3}{2}O_2 \rightarrow Cr_2O_3\ \Delta_r G^\theta = -540\ kJ\ mol^{-1}$

Subtracting equation (ii) from (i), we have

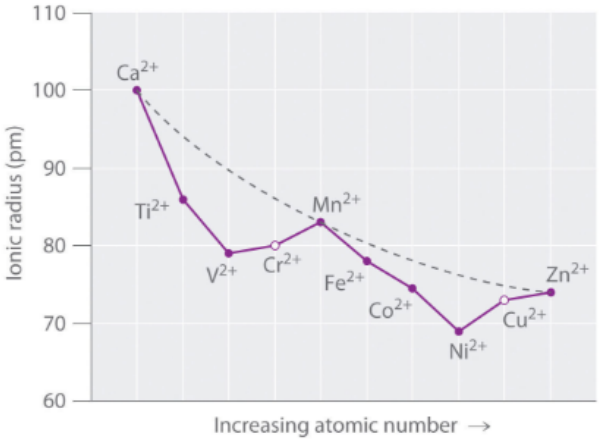
$2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$

$\Delta_r G^\Theta = -827 - (-540)$

$= 287\ kJ\ mol^{-1}$

As $\Delta_t G^\Theta$ for the reduction reaction of Cr_2O_3 by Al is negative, this reaction is possible.

33. i. **Atomic size:** The atomic size in 3d transition series decreases from Sc to Mn then Fe, CO, Ni has almost the same atomic size copper has a bigger size. It is because of the number of unpaired electrons in d-orbitals increases in the beginning till Mn. Therefore effective nuclear charge increases hence atomic size decreases. Then pairing of electrons in d-orbitals take place, atomic size remains the same and finally, it increases due to repulsion between paired electrons in d-orbitals which leads to a decrease in effective nuclear charge.



ii. They have a high enthalpy of atomization due to strong metallic bonding and additional covalent bonding due to the presence of unpaired electrons in d-orbitals.

iii. The transition elements have a strong tendency to form complex compounds because the following reasons:a) Small size b) high nuclear charge c) availability of vacant d- orbitals.

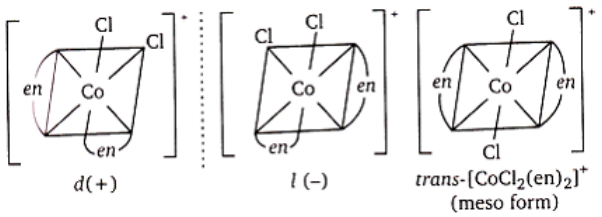
OR

i. **Electronic configuration :** In lanthanoids 4f - orbitals are progressively filled so their electronic configuration is $4f^{1-14}\ 5d^{0-1}\ 6s^2$ whereas in actinoids 5f-orbitals are progressively filled so their electronic configuration is $5f^{1-14}6d^{0-1}\ 7s^2$

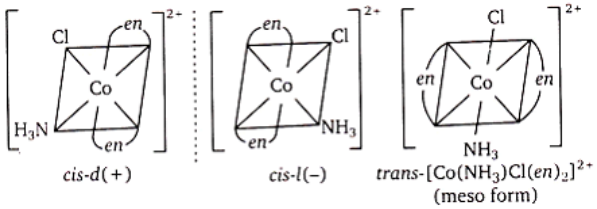
ii. **Oxidation states:** Lanthanoid show +3 oxidation state. Some elements show +2 and +4 oxidation states also. Actinoids show +2 ,+4, +5, +6, + 7 oxidation states. Although +3 and +4 are most common.

iii. **Chemical reactivity:** Actinoids are more reactive than lanthanoids due to bigger atomic size and lower ionization energy.

34. i.

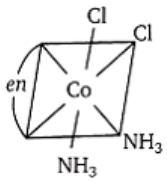


ii. Optical isomers of cis $[CoCl_2 (en)_2]^+$

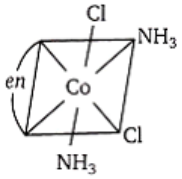


iii. Optical isomers of cis - $[Co(NH_3) Cl(en)_2]^{2+}$

a.



b.



Section D

35. a. Osmotic pressure : Osmotic pressure is the extra pressure which is applied over the solution side to stop the flow of solvent molecules into solution when both are separated by semipermeable membrane.
Determination of molar mass of solute;
As we know
$\pi = CRT$
$\pi = \frac{n_B RT}{V}$
$\pi = \frac{w_B}{M_B}\frac{RT}{V}$
$\therefore$ Molar mass of solute $(M_B) = \frac{w_B RT}{\pi V}$
Here, w_B is mass of solute, n is osmotic pressure, T is temperature (in K) and R is universal solution constant.

b. Given,$w_A = 1kg = 1000g(benzene)$
$\Delta \mathrm{T}_f = 0.256\,K$, $K_f = 5.12Km^{-1}$
0.1 mole of acetic acid $= 0.1\text{mole} \times 60\text{gmol}^{-1}$
$= 0.6\text{g}$
$\therefore \ \mathrm{w}_B = 6.0g$
$M_B = ?$
As we know
$M_B = \frac{K_f \times w_B \times 1000}{\Delta T_f \times w_A}$
$M_B = \frac{5.12\ Km^{-1} \times 6.0g \times 1000g\ Kg^{-1}}{0.256K \times 1000g}$

$M_B = 120\, g\, mol^{-1}$

$vant's\ Hoff\ factor(i) = \frac{M_B(Calculated)}{M_B(Observed)}$

$= \frac{60}{120} = \frac{1}{2} = 0.5$

Conclusion: The value of 'i' is less than 1. Hence, the solute (CH_3COOH) dimerises in solution.

OR

Activity of a catalyst: The ability of a catalyst to increase the rate of a chemical reaction is called its activity. For example: Hydrogen and oxygen do not react at room temperature but this reaction is explosive in the presence of platinum catalyst.

Selectivity of a catalyst: It is the ability of a catalyst to direct a reaction to give particular products. For example, CO + H_2 combine to form CH_4 when Ni is the catalyst and methanol is obtained when Cr_2O_3 is catalyst.

Zeolites: Zeolites are porous alumino silicates with general formula $Mn[AlO_2)_n(SiO_2)_4]mH_2O$

Where n = valency of cation.

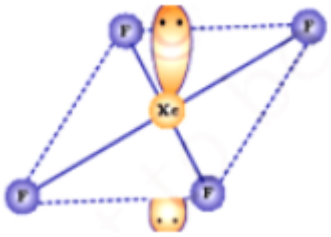
Their pore size varies from 260 pm to 740 pm. Only those molecules which can be adsorbed to those pores are catalysed, i.e. they are selective molecular sizes and selective catalyst. An important zeolite used in petroleum industry is ZSM-5 (zeolite sizes of molecular porosity 5). It converts alcohol into petrol (gasoline).

$$xH - \underset{\underset{H}{|}}{\overset{H}{|}}{C} - OH \xrightarrow{ZSM-5} \underset{Gasoline}{(CH_2)x} + H_2O$$

36. a. i. Disproportionation reaction of H_3PO_3:

$4H_3PO_3 \rightarrow 3H_3PO_4 + PH_3$

ii. Structure of XeF_4:



b. i. Fluorine (F_2) is strong oxidizing agent due to small size and low bond dissociation enthalpy.

ii. As the size increases, electronegativity decreases and non-metallic character also decreases. So, acidic character decreases from N_2O_3 to Bi_2O_3 in group 15.

c. Chemical reaction to test sulphur dioxide gas:

$5SO_2 + 2MnO_4 + 2H_2O \rightarrow 5SO_4^{2-} + 4H^+ + 2Mn^{2+}$

37. a. i. $5Fe^{2+}$ (aq) + MnO_4^- (aq) + $8H^+$ (aq) $\rightarrow$ Mn^{2+} (aq) + $4H_2O$(l) + $5Fe^{3+}$ (aq)

ii. $Cr_2O_7^{2-}$ (aq) + $6I^-$ (aq) + $14H^+$ (aq) $\rightarrow$ $2Cr^{3+}$ (aq) + $7H_2O$(l) + $3I_2$ (g)

b. i. The transition metals have voids in their crystal lattice into which small atoms like H, C, N are trapped inside resulting in the formation of interstitial compounds.

ii. Cr^{2+} ion is reducing as its configuration changes from d^4 (in Cr^{+2}) to d^3 (in Cr^{+3}), the latter +3 oxidation state is stable because it has half filled t_{2g} configuration. While Mn^{+3} is oxidizing as its configuration changes from d^4 (in Mn^{+3}) to d^5 (in Mn^{+2}), the latter +2 oxidation state is stable due to half filled d^5 configuration.

iii. Because of large number of unpaired electrons in their atoms they have stronger interatomic interaction and hence stronger bonding between atoms resulting in higher enthalpies of atomization.

Solution

Class 12 - Mathematics

Half Yearly Mathematics

Section A

1. (b)
   an equivalence relation

   Explanation:
   For R={(a,b): a+b is even,$\forall$ a,b $\in$ N}, Reflexive prop: (a,b) $\in$ R $\Rightarrow$ a+ b is even.now put b=a, a+a is also even $\Rightarrow$ (a,a) $\in$ R , R is reflexive
   Symmetric property: (a,b) $\in$ R $\Rightarrow$ a+ b is even $\Rightarrow$ b+ a is also even $\Rightarrow$ (b,a) $\in$ R $\Rightarrow$ R is Symmetric
   Transitive property: (a,b) $\in$ R,(b,c) $\in$ R $\Rightarrow$ a+ b is even and b+ c is even $\Rightarrow$ a+ c is also even $\Rightarrow$ (a,c) $\in$ R , so R is transitive. Hence R is an equivalence relation
2. (c)
   g(f(x)), $\forall$ x $\in$ A

   Explanation:
   Let $f : A \rightarrow B$ and $g : B \rightarrow C$ be two functions. Then the composition of f and g is defined as (gof) (x) = g(f(x)) for all x belongs to A.
3. (b)
   $f^{-1}o\ g^{-1}$

   Explanation:
   Let $f : A \rightarrow B$ and $g : B \rightarrow C$ be the two bijective functions , then $(gof) : A \rightarrow C$ is invertible and $(gof)^{-1} = f^{-1}o\ g^{-1}$.
4. [0, π]
5. 0.96
6. (a)
   0

   Explanation:
   We know that $\tan^{-1}\left(\frac{x-y}{1+xy}\right) = \tan^{-1}x - \tan^{-1}y$
   $\tan^{-1}\left(\frac{a-b}{1+ab}\right) + \tan^{-1}\left(\frac{b-c}{1+bc}\right) + \tan^{-1}\left(\frac{c-a}{1+ca}\right)$
   $\tan^{-1}a - \tan^{-1}b + \tan^{-1}b - \tan^{-1}c + \tan^{-1}c - \tan^{-1}a = 0$

   OR

   (a)
   $\frac{1}{2}\cos^{-1}\frac{3}{5}$

   Explanation:
   $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right) = \tan^{-1}\left(\frac{\frac{1}{4}+\frac{2}{9}}{1-\frac{1}{4}.\frac{2}{9}}\right)$
   $= \tan^{-1}\left(\frac{17}{34}\right) = \tan^{-1}\left(\frac{1}{2}\right) = \frac{1}{2}(2\tan^{-1}\left(\frac{1}{2}\right))$
   $\Rightarrow \frac{1}{2}\cos^{-1}\left(\frac{1-\left(\frac{1}{2}\right)^2}{1+\left(\frac{1}{2}\right)^2}\right) = \frac{1}{2}\cos^{-1}\left(\frac{3}{5}\right),$
   $\left\{\because\ 2\tan^{-1}x = \cos^{-1}\frac{1-x^2}{1+x^2}\right\}$
7. (b)

A - A^t

Explanation:
For every square matrix (A – A') is always skew – symmetric.

8. (d)
$\begin{bmatrix} 2 & 0 & 0 \\ -5 & 1 & 0 \\ 32 & -6 & 2 \end{bmatrix}$

Explanation:
adj. A = $\begin{bmatrix} 2 & -5 & 32 \\ 0 & 1 & -6 \\ 0 & 0 & 2 \end{bmatrix} = \begin{bmatrix} 2 & 0 & 0 \\ -5 & 1 & 0 \\ 32 & -6 & 2 \end{bmatrix}$

9. (a)
infinitely many solutions

Explanation:
For infinitely many solutions , $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$., for given system of equations we have : $\frac{2}{14} = \frac{3}{21} = \frac{7}{49}$.

10. (d)
abc

Explanation:
$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$

$\Rightarrow abc \begin{vmatrix} 1+\frac{1}{a} & \frac{1}{a} & \frac{1}{a} \\ \frac{1}{b} & 1+\frac{1}{b} & \frac{1}{b} \\ \frac{1}{c} & \frac{1}{c} & 1+\frac{1}{c} \end{vmatrix}$

Apply, $R_1 \rightarrow R_1 + R_2 + R_3$

$abc \begin{vmatrix} 1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c} & 1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c} & 1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c} \\ \frac{1}{b} & 1+\frac{1}{b} & \frac{1}{b} \\ \frac{1}{c} & \frac{1}{c} & 1+\frac{1}{c} \end{vmatrix} \left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0\right)$

$\Rightarrow abc \begin{vmatrix} 1 & 1 & 1 \\ \frac{1}{b} & 1+\frac{1}{b} & \frac{1}{b} \\ \frac{1}{c} & \frac{1}{c} & 1+\frac{1}{c} \end{vmatrix}$

Apply $C_2 \rightarrow C_2 - C_1$, $C_3 \rightarrow C_3 - C_1$

$\Rightarrow abc \begin{vmatrix} 1 & 0 & 0 \\ \frac{1}{b} & 1 & 0 \\ \frac{1}{c} & 0 & 1 \end{vmatrix}$

expanding along R_1

$\Rightarrow$(abc)(1) (1 - 0) =abc

11. (d)
0

Explanation:

$$\begin{vmatrix} \sin(A+B+C) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(A+B) & -\tan A & 0 \end{vmatrix}$$

$$\Rightarrow \begin{vmatrix} \sin(\pi) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(\pi - C) & -\tan A & 0 \end{vmatrix}$$

$$\Rightarrow \begin{vmatrix} 0 & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ -\cos C & -\tan A & 0 \end{vmatrix}$$

Now expanding along R_1

$\Rightarrow 0 - \sin B(0 + \tan A \cos C) + \cos C(\tan A \sin B - 0)$

$\Rightarrow -\tan A \sin B \cos C + \tan A \sin B \cos C = 0$

12. (c)

(AB)' = B'A'

Explanation:

By the property of transpose of a matrix, (AB)' = B'A'.

13. $\frac{\cos x}{2y-1}$

OR

(c)

$2\sqrt{1-x^2}$

Explanation:

$y = x\sqrt{1-x^2} + \sin^{-1}(x)$

$\Rightarrow \frac{dy}{dx} = x\left\{\frac{1}{2\sqrt{1-x^2}}(-2x)\right\} + \sqrt{1-x^2} + \frac{1}{\sqrt{1-x^2}}$

$\Rightarrow \frac{dy}{dx} = \frac{-x^2}{\sqrt{1-x^2}} + \sqrt{1-x^2} + \frac{1}{\sqrt{1-x^2}}$

$\Rightarrow \frac{dy}{dx} = \frac{-x^2+1-x^2+1}{\sqrt{1-x^2}}$

$\Rightarrow \frac{dy}{dx} = \frac{-2x^2+2}{\sqrt{1-x^2}}$

$\Rightarrow \frac{dy}{dx} = 2\sqrt{1-x^2}$

14. (a)

– tan t

Explanation:

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{3a\sin^2 t \cos t}{3a\cos^2 t(-\sin t)} = -\tan t$

15. (c)

$-m^2y$

Explanation:

$y = a\sin mx + b\cos mx \Rightarrow y_1 = am\cos mx - bm\sin mx$

$\Rightarrow y_2 = -am^2 \sin mx - bm^2 \cos mx$

$\Rightarrow y_2 = -m^2(a\sin mx + b\cos mx) = -m^2 y$

16. (b)

$\frac{1}{2}$

Explanation:

Let f(x) = sinx . cosx

$\Rightarrow f(x) = \frac{1}{2}(sin2x)$

Now, f'(x)=$\frac{1}{2}(cos2x).2 = cos2x$

For maximum and minimum values of x, we have f'(x) = 0

f'(x) = 0$\Rightarrow cos2x = 0$

$\Rightarrow x = \frac{\pi}{4}$

Now, f''(x) = -2sin2x

i.e, f''($\frac{\pi}{4}$) = -2sin$\frac{\pi}{2}$ = -2 < 0

Hence, f(x) has a maximum value at x = $\frac{\pi}{4}$ and the max value of f($\frac{\pi}{4}$)= sin$\frac{\pi}{4}$cos$\frac{\pi}{4}$=$\frac{1}{2}$

17. (a)

tan θ

Explanation:

Given $x = a(cos\theta + \theta sin\theta), \quad y = a(sin\theta - \theta cos\theta)$

$\frac{dx}{d\theta} = a\left[-sin\theta + \theta.cos\theta + sin\theta\right] = a\theta\cos\theta, \frac{dy}{d\theta} = a\left[cos\theta - (\theta.-\sin\theta + cos\theta)\right] = a\theta\sin\theta$

Slope of the tangent $= \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{a\theta sin\theta}{a\theta cos\theta} = tan\theta$

18. (a)

x – y = 0

Explanation:

$2y = 3 - x^2$

$\Rightarrow 2\frac{dy}{dx} = -2x$

$\Rightarrow \frac{dy}{dx} = -x$

$\Rightarrow \frac{dy}{dx}at(1,1) = -1$

Slope of tangent = m = -1

Hence, equation of normal is $y - y_1 = \frac{-1}{m}(x - x_1)$

$\Rightarrow y - 1 = 1(x - 1)$

$\Rightarrow x - y = 0$

19. (d)

$x\ \tan^{-1}x - \frac{1}{2}\log(1 + x^2) + C$

Explanation:

$= \int 1.\tan^{-1}x\ dx$

(Apply By Part, Take 1 as II function)

$= (tan^{-1}x)x - \int \frac{1}{1+x^2}.xdx$

$= x\ \tan^{-1} - \frac{1}{2}\int \frac{2x}{1+x^2}dx$

$= x\ \tan^{-1} - \frac{1}{2}\log\left|1 + x^2\right| + C$

20. (c)

$\frac{x}{2}\sqrt{x^2 + a^2} + \frac{a^2}{2}\log(x + \sqrt{(x^2 + a^2)}$

Explanation:

=$\frac{x}{2}\sqrt{x^2 + a^2} + \frac{a^2}{2}\log(x + \sqrt{(x^2 + a^2)}$

Standard Formulae

Can be done by By-Part taking '1' as the second function and $\sqrt{a^2 + x^2}$as first function.

OR

(b)

x sin (log x) +C

Explanation:

$\int (sin(log\ x) + cos(log\ x))dx$

(Use By Part, Take 1 as II function)

$= \int \sin(log\ x).1dx + \int \cos(\log\ x)dx$

$= (\sin(\log x)).x - \int \cos(\log x)\frac{1}{x}.xdx + \int \cos(log\ x)dx.$

$= x\sin(\log x) + C$

Section B

21. i. A $\subset$ A $\therefore$ R is reflexive.

ii. If A $\subset$ B then B $\subset$ A is not true $\therefore$ R is not symmetric.

iii. If A $\subset$ B, B $\subset$ C, then A $\subset$ C $\therefore$ R is transitive.

Therefore, R is not equivalent relation.

22. We have, $2\tan^{-1}(\cos\theta) = \tan^{-1}(2\cos ec\theta)$,

$\Rightarrow \tan^{-1}\left(\frac{2\cos\theta}{1-\cos^2\theta}\right) = \tan^{-1}(2\cos ec\theta)$

$\left[\because 2\tan^{-1}x = \tan^{-1}\left(\frac{2x}{1-x^2}\right)\right]$

$\Rightarrow \left(\frac{2\cos\theta}{\sin^2\theta}\right) = (2\cos ec\theta)$

$\Rightarrow (\cot\theta.2\cos ec\theta) = (2\cos ec\theta) \Rightarrow \cot\theta = 1$

$\Rightarrow \cot\theta = \cot\frac{\pi}{4} \Rightarrow \theta = \frac{\pi}{4}$

OR

The given equation is:

$\tan^{-1}\left(\frac{x-2}{x-4}\right) + \tan^{-1}\left(\frac{x+2}{x+4}\right) = \frac{\pi}{4}$

or $\tan^{-1}\left(\frac{x-2}{x-4}\right) = \tan^{-1}1 - tan^{-1}\left(\frac{x+2}{x+4}\right)$

= $\tan^{-1}\left(\frac{1-\frac{x+2}{x+4}}{1+\frac{x+2}{x+4}}\right)$

= $\tan^{-1}\left(\frac{2}{2x+6}\right)$

$\therefore \frac{x-2}{x-4} = \frac{1}{x+3}$

or $x^2 + x - 6 = x - 4$ or $x^2 = 2$

$\therefore x = \pm\sqrt{2}$

23. Given: $x\begin{bmatrix}2\\3\end{bmatrix} + y\begin{bmatrix}-1\\1\end{bmatrix} = \begin{bmatrix}10\\5\end{bmatrix}$

$\Rightarrow \begin{bmatrix}2x\\3x\end{bmatrix} + \begin{bmatrix}-y\\y\end{bmatrix} = \begin{bmatrix}10\\5\end{bmatrix}$

$\Rightarrow \begin{bmatrix}2x-y\\3x+y\end{bmatrix} = \begin{bmatrix}10\\5\end{bmatrix}$

Equating corresponding entries, we have

2x - y = 10 .....(i) and 3x + y = 5 .....(ii)

Adding eq. (i) and (ii), we have $5x = 15 \Rightarrow x = 3$

Putting x = 3 in eq. (ii), $9 + y = 5 \Rightarrow y = -4$

OR

3A – 5B = $3\begin{bmatrix}\frac{2}{3} & 1 & \frac{5}{3}\\ \frac{1}{3} & \frac{2}{3} & \frac{4}{3}\\ \frac{7}{3} & 2 & \frac{2}{3}\end{bmatrix} - 5\begin{bmatrix}\frac{2}{5} & \frac{3}{5} & 1\\ \frac{1}{5} & \frac{2}{5} & \frac{4}{5}\\ \frac{7}{5} & \frac{6}{5} & \frac{2}{5}\end{bmatrix}$

$= \begin{bmatrix} 2 & 3 & 5 \\ 1 & 2 & 4 \\ 7 & 6 & 2 \end{bmatrix} - \begin{bmatrix} 2 & 3 & 5 \\ 1 & 2 & 4 \\ 7 & 6 & 2 \end{bmatrix}$

$= \begin{bmatrix} 2-2 & 3-3 & 5-5 \\ 1-1 & 2-2 & 4-4 \\ 7-7 & 6-6 & 2-2 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

24. Let $\Delta = \begin{bmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{bmatrix}$

Expanding along first row,

$\Delta = x\begin{vmatrix} -x & 1 \\ 1 & x \end{vmatrix} - \sin\theta\begin{vmatrix} -\sin\theta & 1 \\ \cos\theta & x \end{vmatrix} + \cos\theta\begin{vmatrix} -\sin\theta & -x \\ \cos\theta & 1 \end{vmatrix}$

$\Rightarrow \Delta = x\left(-x^2-1\right) - \sin\theta\left(-x\sin\theta - \cos\theta\right) + \cos\theta\left(-\sin\theta + x\cos\theta\right)$

$\Rightarrow \Delta = -x^3 - x + x\sin^2\theta + \sin\theta\cos\theta - \sin\theta\cos\theta + x\cos^2\theta$

$\Rightarrow \Delta = -x^3 - x + x\left(\sin^2\theta + \cos^2\theta\right)$ = $-x^3 - x + x = -x^3$ which is independent of θ

25. Given: $\sin^2 x + \cos^2 y = 1$

$\Rightarrow \frac{d}{dx}\left(\sin^2 x\right) + \frac{d}{dx}\left(\cos^2 y\right) = \frac{d}{dx}(1)$

$\Rightarrow 2\sin x\frac{d}{dx}\sin x + 2\cos y\frac{d}{dx}\cos y = 0$

$\Rightarrow 2\sin x\cos x + 2\cos y\left(-\sin y\frac{dy}{dx}\right) = 0$

$\Rightarrow \sin 2x - \sin 2y\frac{dy}{dx} = 0$

$\Rightarrow -\sin 2y\frac{dy}{dx} = -\sin 2x$

$\Rightarrow \frac{dy}{dx} = \frac{\sin 2x}{\sin 2y}$

OR

Given: $f(x) = \begin{cases} 2x+3, & if\ x \leqslant 2 \\ 2x-3, & if\ x > 2 \end{cases}$

Here f(x) is defined for $x \leqslant 2$ i.e., on $(-\infty, 2]$ and also for $x > 2$ i.e., on $(2, \infty)$

$\therefore$ Domain of f is $(-\infty, 2] \cup (2, \infty) = (-\infty, \infty) = R$

$\therefore$ For all $x < 2, f(x) = 2x + 3$ is a polynomial and hence continuous and for all $x > 2, f(x) = 2x - 3$ is a continuous and hence f(x) is continuous on R – {2}.

Now Left Hand limit at x=2= $\lim\limits_{x\to 2^-} f(x) = \lim\limits_{x\to 2^-}(2x+3) = 2\times 2 + 3 = 4 + 3 = 7$

Right Hand limit at x=2= $\lim\limits_{x\to 2^+} f(x) = \lim\limits_{x\to 2^+}(2x-3) = 2\times 2 - 3 = 4 - 3 = 1$

Since $\lim\limits_{x\to 2^-} f(x) \neq \lim\limits_{x\to 2^+} f(x)$

Therefore, $\lim\limits_{x\to 2} f(x)$ does not exist and hence f(x) is discontinuous at x =2 (only)

26. $x = 3, \Delta x = 0.02$

$f(x + \Delta x) = f(x) + f'(x)\Delta x$

$f(x + \Delta x) = \left(3x^2 + 5x + 3\right) + (6x + 15) \times 0.02$

Put $x = 3, \Delta x = 0.02$

$f(3.02) = 3 \times 3^2 + 15 \times 3 + 5 + 0.02(6 \times 3 + 15) = 77 + 0.66$

$f(3.02) = 77.66$

27. Let $I = \int \frac{x^3 \sin\left(\tan^{-1}x^4\right)}{1+x^8}dx$

$= \frac{1}{4}\int \sin\left(\tan^{-1}x^4\right).\frac{4x^3}{1+x^8}dx$...(i)

Putting $\tan^{-1}x^4 = t$

$\Rightarrow \frac{1}{1+\left(x^4\right)^2}\frac{d}{dx}x^4 = \frac{dt}{dx}$

$\Rightarrow \frac{4x^3}{1+x^8}dx = dt$

$\therefore$ From eq. (i), $I = \frac{1}{4}\int \sin t dt$

$= \frac{-1}{4}\cos t + c$

$= \frac{-1}{4}\cos\left(\tan^{-1}x^4\right) + c$

Section C

28. The given function is f : X $\rightarrow$ Y and relation on X is R = {(a, b) : f (a) = f (b)}

Reflexive Since, for every x∈X, we have

$f(x) = f(x)$

$\Rightarrow (x, x)$∈R ∀ x∈X

$\therefore R\ is\ reflexive.$

Symmetric Let (x, y)∈R

Then, $f(x) = f(y)$

$\Rightarrow f(y) = f(x)$

$\Rightarrow (y, x)$∈R

$\therefore R\ is\ symmetric.$

Transitive Let x, y, z∈X such that (x, y)∈Rand (y, z)∈R

Then $f(x) = f(y)$.....(i)

and $f(y) = f(z)$.....(ii)

From Equation (i) and (ii), we get

$\Rightarrow f(x) = f(z)$

⇒(x, z) ∈ R

Thus, (x, y)∈R and (y, z)∈R

⇒(x, z) ∈ R ∀ x, y, z∈X

$\therefore R\ is\ transitive.$

Therefore, R is transitive.Since, R is reflexive, symmetric and transitive, so it is an equivalence relation.

OR

We have to Show that the relation S in the set R of real numbers defined as S = {(a, b): a, b ∈ Rand a $\leq$ b^3} is neither reflexive nor symmetric nor transitive.

Reflexive :

As $\frac{1}{2} \leq \left(\frac{1}{2}\right)^3$ where $\frac{1}{2}$ ∈ R, is not true.

$\therefore \quad \left(\frac{1}{2}, \frac{1}{2}\right) \notin S$

Thus, S is not reflexive.

Symmetric:

As -2≤$(3)^3$, where -2, 3 ∈ R is true but 3≤$(-2)^3$ is not true,

i.e. (- 2, 3) ∈ S but (3, - 2) ∈ S.

Therefore, S is not symmetric.

Transitive :

As $3 \leq \left(\frac{3}{2}\right)^3$ and $\frac{3}{2} \leq \left(\frac{4}{3}\right)^3$where

3, $\frac{3}{2}, \frac{4}{3} \in R$ are true but $3 \leq \left(\frac{4}{3}\right)^3$ is not true.

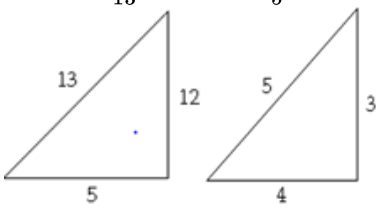
i.e., $\left(3, \frac{3}{2}\right)$ ∈ S and $\left(\frac{3}{2}, \frac{4}{3}\right) \in S$ but $\left(3, \frac{4}{3}\right) \in S$

Therefore, S is not transitive.

Hence, S is neither reflexive nor symmetric nor transitive.

29. Let $\sin^{-1}\frac{12}{13} = x, \cos^{-1}\frac{4}{5} = y, \tan^{-1}\frac{63}{16} = z$

$\sin x = \frac{12}{13}$, $cosy = \frac{4}{5}$, $tanz = \frac{63}{16}$



$\tan x = \frac{12}{5},\ \tan y = \frac{3}{4}$

$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x.\tan y}$

$= \frac{\frac{12}{5}+\frac{3}{4}}{1-\frac{12}{5}\times\frac{3}{4}}$

$= \frac{\frac{48+15}{20}}{\frac{20-36}{20}}$

$= -\frac{63}{16}$

tan (x + y) = - tan z

tan (x + y) = tan (-z)

x + y = -z

$x + y \neq -z$

or

$\tan(x+y) = \tan(\pi - z)$

$x + y = \pi - z$

$x + y + z = \pi$

$\sin^{-1}\frac{12}{13} + \cos^{-1}\frac{4}{5} + \tan^{-1}\frac{63}{16} = \pi$

30. 3X = 5B - 2A

$= 5\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix} - 2\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$

$= \begin{bmatrix} 10 & -10 \\ 20 & 10 \\ -25 & 5 \end{bmatrix} + \begin{bmatrix} -16 & 0 \\ -8 & 4 \\ -6 & -12 \end{bmatrix}$

$= \begin{bmatrix} -6 & -10 \\ 12 & 14 \\ -31 & -7 \end{bmatrix}$

$X = \frac{1}{3}\begin{bmatrix} -6 & -10 \\ 12 & 14 \\ -31 & -7 \end{bmatrix}$

31. Let $\frac{1}{x} = 4, \frac{1}{y} = v, \frac{1}{z} = w$

$24 + 3v + 10v = 4$

$44 - 64 + 5w = 1$

$64 + 9v - 20w = 2$

$A = \begin{bmatrix} 2 & 3 & 10 \\ 4 & 6 & 5 \\ 6 & 9 & -20 \end{bmatrix} y = \begin{bmatrix} y \\ v \\ w \end{bmatrix} B = \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix}$

$|A| = 1200 \neq 0$

Here,$A_{11} = 75, A_{12} = 110, A_{13} = 72$

$A_{21} = 150, A_{22} = -100, A_{23} = 0$

$A_{31} = 75, A_{32} = 30, A_{33} = -24$

$adjA = \begin{bmatrix} 75 & 150 & 75 \\ 110 & -100 & 30 \\ 72 & 0 & -24 \end{bmatrix}$

$A^{-1} = \frac{1}{|A|}(adjA) = \frac{1}{1200}\begin{bmatrix} 75 & 150 & 75 \\ 110 & -100 & 30 \\ 72 & 0 & -24 \end{bmatrix}$

$y = A^{-1}B$

$= \frac{1}{1200}\begin{bmatrix} 600 \\ 400 \\ 240 \end{bmatrix}$

$= \begin{bmatrix} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{5} \end{bmatrix}$

$\begin{bmatrix} y \\ v \\ w \end{bmatrix} = \begin{bmatrix} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{5} \end{bmatrix}$

$u = \frac{1}{2}, v = \frac{1}{3}, w = \frac{1}{5}$

$\frac{1}{x} = \frac{1}{2}, \frac{1}{y} = \frac{1}{3}, \frac{1}{z} = \frac{1}{5}$

$x = 2, y = 3, z = 5$

OR

Given matrix is A = $\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

Here, we use elementary row transformations, so we consider

A = IA $\Rightarrow \begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$

On applying $R_3 \rightarrow R_3$- 2R_2, we get

$\begin{bmatrix} 8 & 4 & 3 \\ 23 & 1 & 1 \\ -3 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -2 & 1 \end{bmatrix} A$

On applying $R_3 \rightarrow -\frac{1}{3}$ R_3, we get

$\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \frac{2}{3} & -\frac{1}{3} \end{bmatrix} A$

On applying $R_3 \leftrightarrow R_1$, we get

$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 1 \\ 8 & 4 & 3 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} A$

On applying $R_3 \rightarrow R_3$ - 4 R_2, we get

$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 1 \\ 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 0 & 1 & 0 \\ 1 & -4 & 0 \end{bmatrix} A$

On applying $R_2 \rightarrow R_2$ - 2R_1, we get

$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 0 & -\frac{1}{3} & \frac{2}{3} \\ 1 & -4 & 0 \end{bmatrix} A$

On applying $R_2 \rightarrow R_2$ + R_3, we get

$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 1 & -\frac{13}{3} & \frac{2}{3} \\ 1 & -4 & 0 \end{bmatrix} A$

On applying $R_3 \rightarrow$(-1) R_3, we get

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 1 & -\frac{13}{3} & \frac{2}{3} \\ -1 & 4 & 0 \end{bmatrix} A$$

Thus, $A^{-1} = \begin{bmatrix} 0 & \frac{2}{3} & -\frac{1}{3} \\ 1 & -\frac{13}{3} & \frac{2}{3} \\ -1 & 4 & 0 \end{bmatrix}$

Given system of equations can be written in matrix form as

AX = B,

where, $A = \begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 9 & 2 & 2 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ and $B = \begin{bmatrix} 19 \\ 5 \\ 7 \end{bmatrix}$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 + \frac{10}{3} - \frac{7}{3} \\ 19 - \frac{65}{3} + \frac{14}{3} \\ -19 + 20 + 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$$

On comparing the corresponding elements, we get

x = 1, y = 2 and z = 1.

32. According to the question, $x^y = e^{x-y}$

Taking log both sides ,

$\Rightarrow ylog_e x = (x-y)log_e e$

$\Rightarrow ylog_e x = (x-y)$

$\Rightarrow y(1 + logx) = x$

$\Rightarrow y = \frac{x}{1+\log x}$

Differentiating both sides w.r.t x,

$\Rightarrow \frac{dy}{dx} = \frac{(1+\log x)\frac{d}{dx}(x) - x\frac{d}{dx}(1+\log x)}{(1+\log x)^2}$[Using quotient rule of derivative]

$= \frac{1+\log x - x\cdot\frac{1}{x}}{(1+\log x)^2} = \frac{1+\log x - 1}{(1+\log x)^2}$

$\therefore \frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$

Hence Proved

33. Given, f(x) = (x - 1)(x - 2)^2

On differentiating both sides w.r.t. x, we get

f'(x) = (x - 1)$\frac{d}{dx}(x-2)^2 + (x-2)^2\frac{d}{dx}(x-1)$[by using product rule of derivative]

$\Rightarrow$ f'(x) = 2(x - 1)(x - 2) + (x - 2)$^2 \cdot 1$

$\Rightarrow$ f'(x) = 2(x - 1)(x - 2) + (x - 2)^2

$\Rightarrow$ f'(x) = (x - 2) [2x - 2 + x - 2]

$\Rightarrow$ f'(x) = (x - 2) (3x - 4)

On putting f'(x) = 0, we get

(x - 2) (3x - 4) = 0

$\Rightarrow$ x - 2 = 0 or 3x - 4 = 0

Now, we find the intervals in which f(x) is strictly increasing or strictly decreasing.

Interval	f'(x) =(x - 2)(3x - 4)	Sign of f'(x)
x<$\frac{4}{3}$	(-)(-)	+ve
$\frac{4}{3}$<x<2	(-)(+)	-ve
x > 2	(+)(+)	+ve

We know that, a fuction f(x) is sad to be a strictly increasing fuction, if f'(x) > 0 and strictly decreasing function when f'(x) < 0. So, f(x) is increasing on $\left(-\infty, \frac{4}{3}\right)$ and $(2, \infty)$ and decreasing on $\left(\frac{4}{3}, 2\right)$.

Since, f(x) is a polynomial function, so it is continuous at x = 4/3 and 2.

Hence, given function is increasing on interval $\left(-\infty, \frac{4}{3}\right]$ and $[2, \infty)$ and decreasing on interval $\left[\frac{4}{3}, 2\right]$.

34. According to the question, $I = \int \frac{(2x-5)e^{2x}}{(2x-3)^3} dx$

$= \int \frac{(2x-3-2)e^{2x}}{(2x-3)^3} dx$

$= \int \frac{(2x-3)e^{2x}}{(2x-3)^3} dx - 2\int \frac{e^{2x}}{(2x-3)^3} dx$

$= \int \frac{e^{2x}}{(2x-3)^2} dx - 2\int \frac{e^{2x}}{(2x-3)^3} dx$

$= \int\limits_{II} e^{2x} \underset{I}{(2x-3)^{-2}} dx - 2\int e^{2x}(2x-3)^{-3} dx \left[\because \frac{1}{a^n} = a^{-n}\right]$

Using integration by parts for first part ,

$=(2x-3)^{-2}\int e^{2x} dx - \int \left\{\frac{d}{dx}(2x-3)^{-2} . \int e^{2x} dx\right\} dx - 2\int e^{2x}(2x-3)^{-3} dx$

$= (2x-3)^{-2}\frac{e^{2x}}{2} - \int -2(2x-3)^{-3} . 2 \times \frac{e^{2x}}{2} dx - 2\int e^{2x}(2x-3)^{-3} dx$

$= \frac{e^{2x}(2x-3)^{-2}}{2} + C + 2\int e^{2x}(2x-3)^{-3} dx - 2\int e^{2x}(2x-3)^{-3} dx$

$= \frac{e^{2x}(2x-3)^{-2}}{2} + C$

OR

According to the question , $I = \int \sin x . \sin 2x . \sin 3x dx$

On multiplying numerator and denominator by 2 , we get

$= \frac{2}{2}\int \sin x . \sin 2x . \sin 3x dx$

$= \frac{1}{2}\int \sin x (2 \sin 2x \sin 3x) dx$

$= \frac{1}{2}\int \sin x [\cos(2x - 3x) - \cos(2x + 3x)] dx$ [$\because$ 2 sin A sin B =cos (A - B) - cos (A + B)]

$= \frac{1}{2}\int \sin x [\cos(-x) - \cos 5x] dx$

$= \frac{1}{2}\int \sin x (\cos x - \cos 5x) dx [\because \cos(-x) = \cos x]$

$= \frac{1}{2}\int \sin x \cos x dx - \frac{1}{2}\int \sin x \cos 5x dx$

On multiplying numerator and denominator by 2 ,we get

$= \frac{2}{2}\left[\frac{1}{2}\int \sin x \cos x dx - \frac{1}{2}\int \sin x \cos 5x dx\right]$

$= \frac{1}{4}\int 2 \sin x \cos x dx - \frac{1}{4}\int (2 \sin x \cos 5x) dx$

$= \frac{1}{4}\int \sin 2x dx - \frac{1}{4}\int \{\sin(x + 5x) + \sin(x - 5x)\} dx$

$\left[\because 2 \sin x \cos x = \sin 2x \text{ and } 2 \sin A \cos B = \sin(A + B) + \sin(A - B)\right]$

$= \frac{1}{4}\int \sin 2x dx - \frac{1}{4}\int [\sin 6x + \sin(-4x)] dx$

$= \frac{1}{4}\int \sin 2x dx - \frac{1}{4}\int (\sin 6x - \sin 4x) dx [\because \sin(-\theta) = -\sin\theta]$

$= \frac{-1}{4} \cdot \frac{\cos 2x}{2} - \frac{1}{4}\left[\frac{-\cos 6x}{6} + \frac{\cos 4x}{4}\right] + C \left[\because \int \sin ax dx = \frac{-\cos ax}{a}\right]$

$= \frac{-\cos 2x}{8} + \frac{\cos 6x}{24} - \frac{\cos 4x}{16} + C$

$\therefore I = \frac{-\cos 2x}{8} + \frac{\cos 6x}{24} - \frac{\cos 4x}{16} + C$

Section D

35. A = R – {3} and B = R – {1} and $f(x) = \frac{x-2}{x-3}$

Let $x_1, x_2 \in$ A, then $f(x_1) = \frac{x_1-2}{x_1-3}$ and $f(x_2) = \frac{x_2-2}{x_2-3}$

Now, for $f(x_1) = f(x_2)$

$\Rightarrow \frac{x_1-2}{x_1-3} = \frac{x_2-2}{x_2-3}$

$\Rightarrow (x_1 - 2)(x_2 - 3) = (x_2 - 2)(x_1 - 3)$

$\Rightarrow x_1x_2 - 3x_1 - 2x_2 + 6 = x_1x_2 - 2x_1 - 3x_2 + 6$

$\Rightarrow -3x_1 - 2x_2 = -2x_1 - 3x_2$

$\Rightarrow x_1 = x_2$

$\therefore$ f is one-one function.

Now $y = \frac{x-2}{x-3}$

$\Rightarrow$ y(x - 3) = x - 2

$\Rightarrow$ xy - 3y = x - 2

$\Rightarrow$ x(y - 1) = 3y - 2

$\Rightarrow x = \frac{3y-2}{y-1}$

$\therefore f\left(\frac{3y-2}{y-1}\right) = \frac{\frac{3y-2}{y-1}-2}{\frac{3y-2}{y-1}-3} = \frac{3y-2-2y+2}{3y-2-3y+3} = y$

$\Rightarrow f(x) = y$

Therefore, f is an onto function.

36. Let $\triangle = \begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix}$

Since each element of the second column is a sum of two elements. Therefore, A can be written as the sum of two determinants as follows:

$\triangle = \begin{vmatrix} a & a & a+b+c \\ 2a & 3a & 4a+3b+2c \\ 3a & 6a & 10a+6b+3c \end{vmatrix} + \begin{vmatrix} a & b & a+b+c \\ 2a & 2b & 4a+3b+2c \\ 3a & 3b & 10a+6b+3c \end{vmatrix}$

$\Rightarrow \triangle = \begin{vmatrix} a & a & a+b+c \\ 2a & 3a & 4a+3b+2c \\ 3a & 6a & 10a+6b+3c \end{vmatrix} + ab \begin{vmatrix} 1 & 1 & a+b+c \\ 2 & 2 & 4a+3b+2c \\ 3 & 3 & 10a+6b+3c \end{vmatrix}$ [Taking a and b common from C_1 and C_2 of second determinant]

$\Rightarrow \triangle = \begin{vmatrix} a & a & a+b+c \\ 2a & 3a & 4a+3b+2c \\ 3a & 6a & 10a+6b+3c \end{vmatrix} + ab \times 0$ [$\because$ C_1 and C_2 are indentical in second determinant]

$\Rightarrow \triangle = \begin{vmatrix} a & a & a \\ 2a & 3a & 4a \\ 3a & 6a & 10a \end{vmatrix} + \begin{vmatrix} a & a & b \\ 2a & 3a & 3b \\ 3a & 6a & 6b \end{vmatrix} + \begin{vmatrix} a & a & c \\ 2a & 3a & 2c \\ 3a & 6a & 3c \end{vmatrix}$

$\Rightarrow \triangle = a^3 \begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 4 \\ 3 & 6 & 10 \end{vmatrix} + a^2b \begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 3 \\ 3 & 6 & 6 \end{vmatrix} + a^2c \begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 6 & 3 \end{vmatrix}$

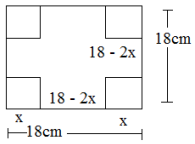
$\Rightarrow \triangle = a^3 \begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 4 \\ 3 & 6 & 10 \end{vmatrix} + a^2\,b \times 0 + a^2\,c \times 0$ [$\because$ C_2 and C_3 are identical in second det. and C_1 and C_3 are identical in third det.]

$\Rightarrow \triangle = a^3 \begin{vmatrix} 1 & 0 & 0 \\ 2 & 1 & 2 \\ 3 & 3 & 7 \end{vmatrix}$ [Applying $C_2 \rightarrow C_2 - C_1$, $C_3 \rightarrow C_3 - C_1$]

$\Rightarrow \triangle = a^3 \times 1 \times \begin{vmatrix} 1 & 2 \\ 3 & 7 \end{vmatrix}$ [Expanding along R_1]

$\Rightarrow \triangle = a^3 (7 - 6) = a^3$

37. Let side of square piece cut from the corner is = x



l = (18 - 2x)cm

b = (18 - 2x)cm

h = x cm

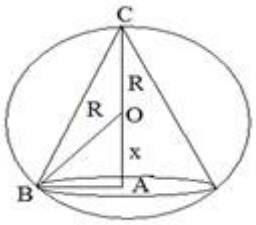
$v = l \times b \times h$

$v = (18 - 2x) \times (18 - 2x) \times x$

$v = (18 - 2x)^2 \times x$

$\frac{dv}{dx} = (18-2x)^2.(1) + (x).2(18-2x)(-2)$
$\frac{dv}{dx} = (18-2x)[(18-2x) - 4x]$
For maximum/minimum
$0 = (18-2x)(18-6x)$
Now 18 - 2x = 0
$\Rightarrow$x = 9 (neglect)
Now 18 - 6x =0
$\Rightarrow$ x = 3
$\frac{d^2y}{dx^2} = (18-2x)(-6) + (18-6x)(-2)$
$\frac{d^2y}{dx^2}\Big]_{x=3} = 12 \times (-6)$
= - 72<0 , Hence maximum
$l = 18 - 2 \times 3 = 12cm$
b = 12 cm
h = 3 cm
Side of square piece cut at the corner is 3cm so that the volume of the box become maximum

OR



$v = \frac{1}{3}\pi r^2 h \left[r^2 = \sqrt{R^2 - x^2}\right]$
$V = \frac{1}{2}\pi.\left(R^2 - x^2\right).(R+x)$
$\frac{dy}{dx} = \frac{1}{3}\pi\left[\left(R^2 - x^2\right)(1) + (R+x)(-2x)\right]$
$= \frac{1}{3}\pi[(R+x)(R-x) - 2x(R+x)]$
$= \frac{1}{3}\pi(R+x)[R - x - 2x]$
$= \frac{1}{3}\pi(R+x)(R-3x)$....(1)
Put $\frac{dv}{dr} = 0$
R = - x (neglecting)
R = 3x
$\frac{R}{3} = x$
On again differentiating equation (1)
$\frac{d^2v}{dx^2} = \frac{1}{3}\pi[(R+x)(-3) + (R-3x)(1)]$
$=\frac{d^2v}{dx^2}\Big]_{x=\frac{R}{3}} = \frac{1}{3}\pi\left[\left(R + \frac{R}{3}\right)(-3) + \left(R - 3.\frac{R}{3}\right)\right]$
$\frac{1}{3}\pi\left[\frac{4R}{3} \times -3 + 0\right]$
$= \frac{-1}{3}\pi 4R$
$\frac{d^2v}{dx^2} < 0$ Hence maximum
Now $v = \frac{1}{3}\pi\left[\left(R^2 - x^2\right)(R+x)\right]\left[x = \frac{R}{3}\right]$
$v = \frac{1}{3}\pi\left[\left(R^2 - \left(\frac{R}{3}\right)^2\right)\left(R + \left(\frac{R}{3}\right)\right)\right]$
$= \frac{1}{3}\pi\left[\frac{8R^2}{9} \times \frac{4R}{3}\right]$
$v = \frac{8}{27}\left(\frac{4}{3}\right)\pi R^3$
$v = \frac{8}{27}$ Volume of sphere
Volume of cone $= \frac{8}{27}$ of volume of sphere.

Solution

Class 12 - Biology

Half Yearly (2019-20)

Section A

1. (b)
   Produce pure line

   Explanation:
   Self-pollination involves transfer of pollen grain from anther to stigma of same flower. The two fusing gametes are genetically similar to each other as they are produced by same plant. Continued self – pollination results into pure line and breeding depression.
2. Tt and tt

   OR

   Karyokinesis
3. The enzyme involved in continous replication of dna strand is DNA dependent DNA polymerase.
   The polarity of the template strand is $3' \rightarrow 5'$

   OR

   In male - Vasectomy
   In female - Tubectomy
4. Plasmodium falciparum is a unicelluar protozoan parasite of humans, and the deadliest species of Plasmodium that cause malaria in humans. It is transmitted through the bite of a female Anopheles mosquito. It causes the disease's most dangerous form called falciparum malaria.
5. Distillation increases alcohol content in alcoholic drinks.

Section B

6. A gene mutation involving a change in single nucleotide or nitrogenous base of DNA is called point of mutation.

   Example: Sickle cell anaemia (The defect is caused by the substitution of Glutamic acid by valine at the sixth position of the beta globin chain of the haemoglobin.
7. The organs, which have the same fundamental structure but are different in functions are called homologous organs. The homologous structures are a result of divergent evolution.
   The forelimbs of pigeon is an organ homologous to hand of man.
8. (i) de Vries - Mutation
   (ii) Darwin - Branching descent and natural selection.
9. The fossils support organic evolution. Study of fossils in different sedimentary layers indicates the geological period in which they exist.
   - The fossil records have helped in building the broad historical sequence of biological evolution.

   OR

   The process of covering the emasculated flowers or the female flowers, after dusting with the desired pollen, with bags of butter paper.
   This technique ensures the use of only desired pollen grains for pollination and protection of stigma from contamination (from unwanted pollen).
10. Body part Host
    (a) Intestine Anopheles
    (b) RBCs Man
    (c) In the blood of man through the saliva of mosquito Man
    (d) Liver cells and RBCs Man
11. Biofortification is the process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding, or modern biotechnology. Biofortification differs from conventional fortification in that biofortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops. Biofortification may therefore present a way to reach

populations where supplementation and conventional fortification activities may be difficult to implement and/or limited.

Examples of biofortification projects include:

- iron-biofortification of rice, beans, sweet potato, cassava and legumes;
- zinc-biofortification of wheat, rice, beans, sweet potato and maize;
- provitamin a carotenoid-biofortification of sweet potato, maize and cassava; and amino acid and protein-biofortification of sourghum and cassava.

12. The beneficial predatory and parasitic insects which depend on these specific insect-pests for food are able to control the pests. For example:

i. Ladybird beetle and Praying Mantis are useful to get rid of aphids which feed on plant sap.
ii. Dragonflies control mosquitoes by feeding on its larvae.

OR

- Avoid sex with an unknown partner/ multiple partners.
- Always use condoms during intercourse.
- If any doubt, go to a qualified doctor for complete treatment.

Section C

13.

	Asexual reproduction		**Sexual reproduction**
1	It is always uniparental.	1	It is usually bi-parental.
2	There is no formation and fusion of gametes.	2	Formation and fusion of gametes takes place.
3	Only mitotic cell division takes place.	3	It involves both meiosis and mitosis.
4	Offspring are genetically identical to the parent.	4	Offspring genetically differ from the parent.

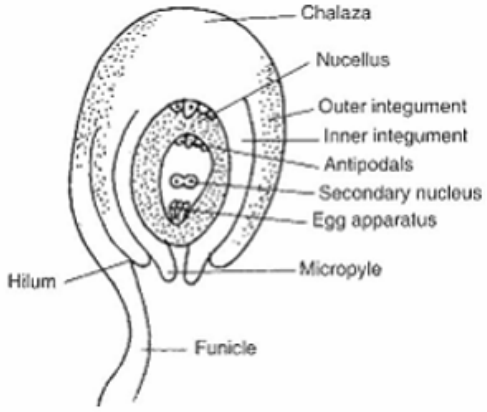
- Vegetative reproduction involves single parent and its offspring are genetically identical hence it is considered as a type of asexual reproduction.

OR

	Organism	**Chromosome Number (n)**
(i)	House fly	6
(ii)	Rat	21
(iii)	Rice	12
(iv)	Onion	16
(v)	Fruitfly	4
(vi)	Maize	10

(b) Earthworm, Taenia and Leech are hermaphrodite

14.

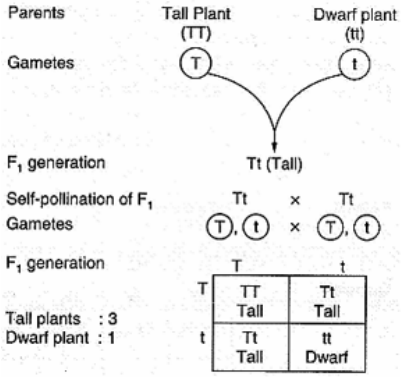


15. (a) Corpus luteum : It secretes progesterone hormone, which is essential for the continuation of pregnancy.
(b) Endometrium: It is the innermost lining of uterus which undergoes cyclic changes during menstrual cycle to prepare itself for the implantation of blastocyst.

(c) Acrosome: It secretes sperm lysine which contains hydrolytic enzyme to penetrate the ovum for fertilization.
(d) Sperm tail: It helps the spermatozoan in movement.
(e) Fimbriae: These are finger like projections present on the margins of infundibulum for the collection of ovum from the ovary after ovulation.

OR

- This law gives the explanation for expression of only one of the parental trait in F_1 hybrid.
- This law states that out of a pair of contrasting characters only one is able to express itself phenotypically in F_1 hybrid called as dominant while the alternate form remains hidden and called recessive.
- In a cross between true breeding tall pea plant and a true breeding dwarf pea plant, all the plants of F_1 generation were tall.
- When the F_1 individuals were self-pollinated it was observed that the tall and dwarf plants in F_1 generation were in the ratio of 3 : 1.
- further, when dwarf plants were self-pollinated, the successive generation produced only dwarf plants showing their homozygous/true breeding nature.
- On self-pollination of tall plants, some of them produced only tall plants in successive generations while others produced both tall and dwarf plants showing their Heterozygous nature.



16. Diseases or infections which are transmitted through sexual intercourse are collectively called sexually transmitted diseases or venereal diseases or reproductive tract infections.

Name of STD	**Causative agent**
(1) Trichomoniasis	(1) Trichomonas Vaginalis (A protozoan)
(2) Genital Herpes	(2) Herpes simplex (A virus)
(3) Syphilis	(3) Treponema pallidum (A bacterium)
(4) Gonorrhoea	(4) Neisseria gonorrhoeae (A bacterium)
(5) AIDS	(5) HIV (A retrovirus)

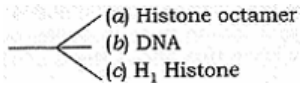
17. The function of the ovum and sperm is done outside the woman's body to form a zygote under stimulated conditions in the laboratory. The zygote is then allowed to divide to form embryo. The embryo is then implanted in uterus where it develops into a foetus, which in turn develops into a child. A baby produced by this technique is called test tube baby.
18. (i) Mendel selected garden pea for his experiments because:-
(a) Pure varieties of pea were available in which self as well as cross pollination could be carried out.
(b) Pea plant showed a number of easily detectable contrasting characters.
Biological name of garden pea is Pisum sativum
(ii) Law of segregation: This law states that at the time of gametogenesis the two factors for a character separate, and get randomly distributed to different gametes.

OR

influenza pandemic after World War I, by using two strains of the Streptococcus pneumoniae bacterium. The smooth strain (S strain) had a polysaccharide capsule and was virulent when injected, causing pneumonia and killing mice in a day or two. The capsule is a slimy on the cell's surface that allows the bacteria to resist the human immune system. The rough strain (R strain) did not cause pneumonia when injected into mice (it was avirulent) since it lacked a capsule. When the virulent S strain was heated to kill it, and then injected into mice, it produced no ill effects. However, when dead S strain mixed with live R strain was injected into the mouse, the R/S mouse died. Griffith Observations: After isolating bacteria from the blood of the R/S mice, Griffith discovered that the previously a virulent R bacteria had acquired capsules. The bacteria isolated from the mice infected with the mixture of live type II R and heat killed type III S were now all of the type III S strain, and maintained this phenotype over many generations. Griffith hypothesized that some "transforming principle" from the heat killed type III S strain converted the type II R strain into the virulent type III S strain.

19. i. Nucleosome

ii.



iii. In prokaryotes, the DNA is held with some positively charged proteins to form a nucleoid. The DNA is then organized as large loops held by the proteins.

20. i. The doctor was assertive, patient and pragmatic.

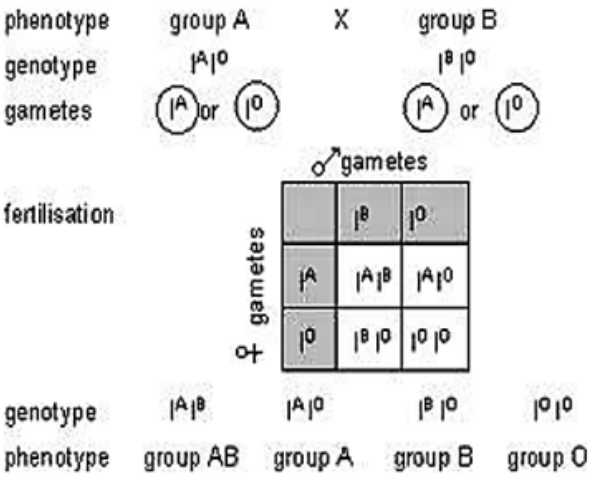
ii. It is possible if the parents are heterozygotes, i.e. Ai x Bi. If the child receives i from both the parents, it becomes ii, and expresses the O blood group. See the chart below:

Summary of possible Child blood types

Parent A blood type	Parent B blood type	possible Child Blood type
A	A	A, O
A	B	A, AB, B, O
A	AB	A, AB, B
AB	AB	A, AB, B
B	B	B, O
B	AB	A, AB, B
O	O	O
O	A	A, O
O	AB	A, B
Rh+	Rh-	RH+, Rh-
Rh-	Rh-	Rh-
Rh+	Rh+	Rh+, RH-

iii. DNA fingerprinting

iv. A or B or AB



21. **Convergent evolution:** Different structures evolving for the same function but are different in their structural details and origin. The analogous structures are the result of convergent evolution.
e.g. Flippers of Dolphins and Penguins
Divergent evolution: Different structures evolving for the different functions but are similar in anatomical structure. The homology indicates divergent evolution.
e.g. The forelimbs of whales, Bats, cheetah and Human.

OR

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. Biofertilizers are added to soil to increase its fertility.
Nitrogen and phosphorus elements are added by biofertilizers.

22. The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reckless behavior, vandalism and violence. Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage. A combination of drugs or their intake along with alcohol generally results in overdosing and even deaths.
Effect on Society and family: There may even be some far reaching implications of drug / alcohol abuse. If a abuser is unable to get money to buy drugs/ alcohol he / she may turn to stealing. The adverse effects are just not restricted to the person who is using drugs or alcohol. At times, a drug / alcohol addict becomes the cause of mental and financial distress to his / her entire family and friends.
Effects of intravenous drug administration: Those who take drugs intravenously (direct injection into the vein using a needle and syringe), are much more likely to acquire serious infections like AIDS and hepatitis B.
Long term implications of Alcohol Abuse : The use of alcohol during adolescence may also have long term effects. It could lead to heavy drinking in adulthood. The chronic use of drugs and alcohol damages nervous system and liver (cirrhosis).
The use of drugs and alcohol during pregnancy is also known to adversely affect the foetus.
Implications of Performance enhancement drugs on athletes: The side effects of the use of anabolic steroids in females include masculinisation (features like males), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice. In males it includes acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney and liver dysfunction, breast enlargement premature baldness, enlargement of the prostate gland. In the adolescent male or female, severe facial and body acne, and premature closure of the growth centres of the long bones may result in stunted growth.
23. The apical and axillary's meristem are the best suited parts of plant for the production of virus free plants. These parts are generally free from virus due to the absence of vascular tissue through which viruses are transported.
24. Biological oxygen demand (BOD) is the method of determining the amount of oxygen required by micro-organisms to decompose the waste present in the water supply. If the quantity of organic wastes in the water supply is high, then the number of decomposing bacteria present in the water will also be high. As a result, the BOD value will increase.
Therefore, it can be concluded that if the water supply is more polluted, then it will have a higher BOD value.
Out of the above three samples, sample C is the most polluted since it has the maximum BOD value of 400 mg/L. After untreated sewage water, secondary effluent discharge from a sewage treatment plant is most polluted.
Thus, sample A is secondary effluent discharge from a sewage treatment plant and has the BOD value of 20 mg/L, while sample B is river water and has the BOD value of 8 mg/L.
Hence, the correct label for each sample is:

Label	BOD value	Sample
A.	20 mg/L	Secondary effluent discharge from a sewage treatment plant
B.	8 mg/L	River water
C.	400 mg/L	Untreated sewage water

Section D

25. i. Hormone X = Luteinising hormone (LH)
Hormone Y = Follicle stimulating hormone (FSH)

ii. a. Follicular / Proliferative phase
b. Ovulatory phase
c. Luteal / Secretory phase

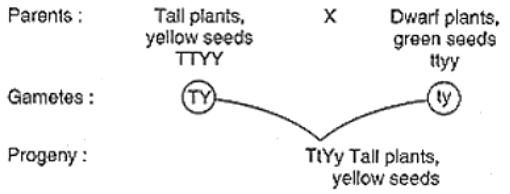
iii. a. The secretion of gonadotropins (LH and FSH) during the follicular phase stimulate the development of follicle as well as secretion of estrogens by the growing follicles.
b. Rapid secretion of LH leading to LH surge which induces mature follicle to rupture and release of secondary the oocyte (ovulation)
c. The ruptured follicle transforms into corpus luteum which secrete progesterone.

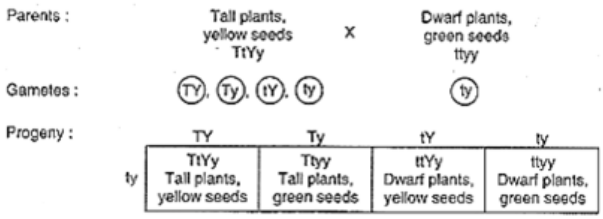
OR

Geitonogamy is a type of self pollination in which the pollen grains from the anthers of one flower are transferred to the stigma of another flower borne on the same plant. However they require a pollinating agent. Example: Cucurbits

	Geitonogamy		**Xenogamy**
1	It refers to the transfer of pollen grains from the anthers of one flower to the stigma of another flower on the same plant.	1	It refers to transfer of pollen grains from the anthers of one flower to the stigma of another flower on a differ plant.
2	It is a type of self pollination.	2	It is cross pollination.

26. (a) The given plant has to be crossed with a dwarf plant with green seeds. Tallness and yellow seeds are dominant traits whereas dwarfness and green seeds are recessive traits. If the progeny consists of tall plants with yellow seeds, the given plant is homozygous. (Cross 1) If the progeny shows four phenotypes in the ratio of 1 : 1 : 1 : 1 , the given plant is heterozygous for both the traits. (Cross 2) Cross 1 : Homozygous pure for both the traits.



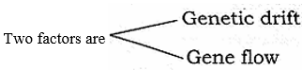


OR

i. When the allele frequencies in a population remain stable and is constant from generation to generation, it is said to be in genetic equilibrium, it means the gene pool of the population remains constant.

ii. Hardy Weinberg principle

iii.



iv. Gene flow/ Migration. When the individuals of a population migrate to another population, gene frequencies change in both the populations.
- New genes/alleles are added to the second population while they are lost from the first population. If this migration happens a number of times, there will be gene flow.

27. **Steps in plant breeding:**
(i) Collection of variability: Collection and preservation of all the different wild varieties, species and relatives of the
cultivated species is a prerequisite for effective exploitation of natural genes available in the populations. The entire collection (of plants / seeds) having all the diverse alleles for all genes in a given crop is called

germplasm collection.
(ii) Evaluation and selection of parents: The germplasm is evaluated so as to identify plants with desirable combination of characters.
The selected plants are multiplied and used in the process of hybridization. Pure lines are created wherever desirable and possible.
(iii) Cross hybridization among the selected parents: The desired characters have very often to be combined from two
different plants (parents), for example high protein quality of one parent may need to be combined with disease resistance from another parent.
This is possible by cross hybridizing the two parents to produce hybrids that genetically combine the desired characters in one plant.
(iv) Selection and testing of superior recombinants : This step consists of selecting, among the progeny of the hybrids, those plants
that have the desired character combination. The selection process is crucial to the success of the breeding objective and requires careful
scientific evaluation of the progeny. This step yields plants that are superior to both of the parents (very often more than one superior progeny plant may become available).
These are self pollinated for several generations till they reach a state of uniformity (homozygosity), so that the characters will not segregate in the progeny.
(v) Testing, release and commercialization of new cultivars: The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc.
This evaluation is done by growing these in the research fields and recording their performance under ideal fertilizer application irrigation, and other crop management practices.
The evaluation in research fields is followed by testing the materials in farmers' fields, for at least three growing seasons at several locations in the country,
representing all the agroclimatic zones where the crop is usually grown. The material is evaluated in comparison to the best available local crop cultivar - a check or reference cultivar.

OR

The treatment involves two steps:
(i) Primary treatment
(ii) Secondary treatment

(i) Primary treatment
- It is a physical process of removing small and large particles through filtration and sedimentation.
Firstly, the sewage is passed through the wire mesh of screens of sequentially smaller pore sizes to remove floating.
- Then the grit is sedimented by passing the sewage into a grit chamber.
The sewage is then kept in settling tanks, where the suspended materials settle down to form the primary sludge.
- The effluent is then taken for secondary treatment.

(ii) Secondary treatment
- It is a biological process by the heterotrophic bacteria naturally present in the sewage.
The primary effluent is passed into large aeration tanks where it is constantly agitated and air is pumped out.
This causes the rapid growth of aerobic microbes into 'flocs' which consume the organic matter of sewage leading to the reduction in biochemical oxygen demand (BOD).
After the significant reduction in BOD of sewage, the effluent is passed into settling tanks were flocs are sedimented leading to the formation of activated sludge.
- A part of this activated sludge is used as inoculum which is pumped back into the aeration tanks.
The major part of this sludge is pumped into anaerobic sludge digesters, where its digestion occurs by the anaerobic bacteria producing methane, hydrogen sulphide and carbon dioxide. These gases form biogas.
- After secondary treatment the effluent is released into natural water bodies like streams and rivers.
The ministry of environment and forests has initiated the programmes like Ganga Action Plan and Yamuna Action Plan for the treatment of sewage before it is released into the rivers.

Solution

Class 12 - Physical Education

Half Yearly (2019-20)

Section A

1. Seeding is a privilege given to the teams so that such seeded teams will not compete in the initial rounds.
2. matches between loser accept semi finalist
3. cutting of normal diet or fasting
4. cant digest particular food items

   OR

   Salicylates,Benzoates
5. High BP
6. Disability is an injury that restricts the functions or movements of an individual.
7. Atrial septum disorder and Obsessive compulsive disorder

   OR

   cant be attentive, cant concentrate etc
8. Gross and fine motor development.
9. late or absence of menses

   OR

   Female athlete triad is a syndrome in which anaemia, osteoporosis and amenorrhea, eating disorders affect adversely on the body.
10. The test I would suggest grand mother for measuring upper body flexibility is Back scratch test.
11. Barrow

    OR

    Three senior citizen fitness test are:

    a. Chair stand test
    b. Chair sit and reach test.
    c. Back scratch test

Section B

12. 1111

    OR

    1111
13. 11
14. 11

15. 111
16. qqq

OR

The advantages of physical activities for children with Special needs are:

a. **Reduced level of anxiety, stress and depression:** physical activities may help in reducing the level of anxiety, stress and depression of children with disabilities.
b. **Improved social interaction:** physical activities provide ample opportunities for improving the social interaction among children with special needs. Social relations are developed during involvement in physical activities.
c. **Better emotional and psychological health:** physical activities are beneficial for children with special needs because such activities improve psychological and emotional health.
d. **Cognitive benefits:** physical activities lead to cognitive skill improvement in children with disabilities. These activities allow them to discover and access strengths that cannot be challenged in the classroom setting.

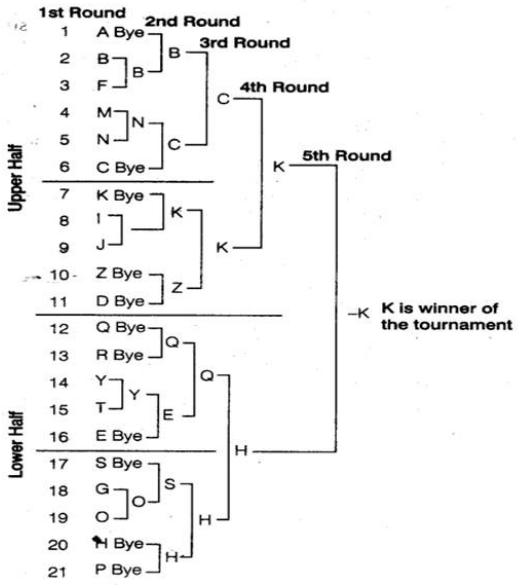
17. 11
18. 111
19. Recovery phase is measured by Harvard step test The formula to measure is :- 100× test duration in seconds divided by 2 × sum of heart beats in recovery periods

OR

11

Section C

20. No. of teams = 21 ,
    Total No. of matches = N-1 = 21-1 = 20
    No. of teams in upper half N+1/2 = 21 + 1 = 11
    No. of teams in lower half N-1/2 = 21 - 1 = 10
    Total no. of byes = 32-21= 11 byes,
    No. of byes in upper half = NB-1/2 = 11 - 1 = 5
    No. of byes in lower half = NB + 1/2 = 11 + 1 = 6
    Total rounds = 5



21. Cardohydrates vitamins protein minerals fat.
22. Respiratory diseases cardiovascular diseases etc
23. ADHD,OCD
24. defect in normal posture.

OR

111

25. 5
26. league.

OR

1111