NEET - 2013

Test Booklet Code

X

Do not open this Test Booklet until you are asked to do so.

Important Instructions :

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on **side-1** and **side-**2 carefully with **blue/black** ball point pen only.
2. The test is of **3 hours** duration and Test Booklet contains of **180** questions. Each question carries **4** marks. For each correct response, the candidate will get **4** marks. For each incorrect response, **one mark** will be deducted from the total scores. The maximum marks are **720.**
3. Use **Blue / Black Ball Point Pen only** for writing particulars on this page / marking responses.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
5. **On completion of the test, the candidate must handover the Answer Sheet to the invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.**
6. The CODE for this Booklet is **X**. Make sure that the CODE printed on **side−2** of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your roll no. anywhere else except in the specified space in the Test Booklet / Answer sheet.
8. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
9. Each candidate must show on demand his / her Admission Card to the Invigilator.
10. No candidate, without special permission of the Superintendent or Invigilator, would leave his / her seat.
11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet the second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.
12. Use of Electronic / Manual Calculator is prohibited.
13. The candidates are governed by all Rules and Regulations of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.
14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capital letters) : ____________________

Roll Number : in figures ____________________

: in words ____________________

Centre of Examination (in capital) ____________________

Name of Examination Centre (in Capital letters) : ____________________

Candidate's Signature : ____________ Invigilator's Signature : ____________

Fascimile signature stamp of

Centre Superintendent ____________________

Questions and Solutions

Chemistry

1. Which is the monomer of Neoprene in the following?

(1) $CH_2=\underset{\substack{|\\ CH_3}}{C}-CH=CH_2$ (2) $CH_2=\underset{\substack{|\\ Cl}}{C}-CH=CH_2$

(3) $CH_2=CH-C\equiv CH$ (4) $CH_2=CH-CH=CH_2$

1. (2)

Monomer of Neoprene is $CH_2=\underset{\substack{|\\ Cl}}{C}-CH=CH_2$, 2−Chloro−1, 3−butadiene

2. A magnetic moment of 1.73 BM will be shown by one among the following :

(1) $[Ni(CN)_4]^{2-}$ (2) $TiCl_4$ (3) $[CoCl_6]^{4-}$ (4) $[Cu(NH_3)_4]^{2+}$

2. (4)

Magnetic moment = $\sqrt{n(n+2)}$ B.M. = 1.73 B.M

n = 1

i.e. Cu^{2+} $[Cu(NH_3)_4]^{2+}$ $Cu^{2+} = 3d^9$, unpaired electron = 1

3. A metal has a fcc lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g cm^{-3}. The molar mass of the metal is :

(N_A Avogadro's constant = 6.02×10^{23} mol^{-1})

(1) 30 g mol^{-1} (2) 27 g mol^{-1} (3) 20 g mol^{-1} (4) 40 g mol^{-1}

3. (2)

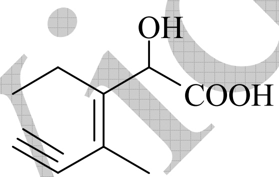
Density (d) = $\dfrac{ZM}{N_0a^3}$ $\Rightarrow 2.72\ g/cm^3 = \dfrac{4\times M}{6.02\times10^{23}\times(404\times10^{-10}\ cm)^3}$

$\Rightarrow M = 27$ g/mol.

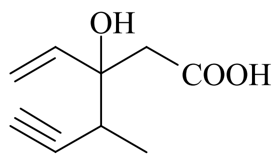
4. Structure of the compound whose IUPAC name is

3−Ethyl−2−hydroxy−4−methylhex−3−en−5−ynoic acid is :

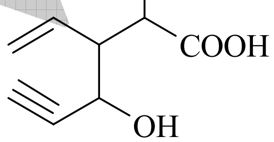
(1)



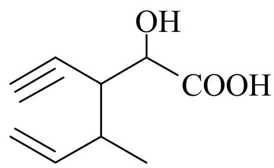
(2)



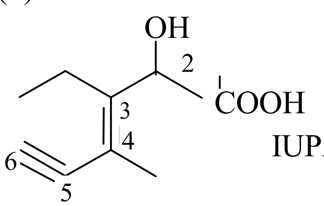
(3)



(4)



4. (1)



IUPAC = 3-Ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid

5. Which of the following structure is similar to graphite?
(1) B (2) B_4C (3) B_2H_6 (4) BN

5. (4)
BN structure is similar to graphite.

6. Some meta − directing substituents in aromatic substitution are given. Which one is most deactivating?
(1) $-SO_3H$ (2) $-COOH$ (3) $-NO_2$ (4) $-C\equiv N$

6. (3)
$-NO_2$ is most deactivating group. Order : $-NO_2 > -CN > -SO_3H > -COOH$

7. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3?
The concentrated acid is 70% HNO_3.
(1) 90.0 g conc. HNO_3 (2) 70.0 g conc. HNO_3
(3) 54.0 g conc. HNO_3 (4) 45.0 g conc. HNO_3

7. (4)
Let the weight of conc. HNO_3 = x g

$$\text{Molarity} = \frac{x\,(0.7)}{63\times 0.250} = 2$$

x = 45 g

8. The order of stability of the following tautomeric compounds is :

$$\underset{\text{I}}{CH_2=\overset{\overset{OH}{|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3} \rightleftharpoons \underset{\text{II}}{CH_3-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3} \rightleftharpoons \underset{\text{III}}{CH_3-\overset{\overset{OH}{|}}{C}=CH-\overset{\overset{O}{\|}}{C}-CH_3}$$

(1) III > II > I (2) II > I > III (3) II > III > I (4) I > II > III

8. (1)

$$\underset{\text{(III)}}{CH_3-\overset{\overset{OH}{|}}{C}=CH-\overset{\overset{O}{\|}}{C}-CH_3} > \underset{\text{(II)}}{CH_3-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3} > \underset{\text{(I)}}{CH_2=\overset{\overset{OH}{|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3}$$

Due to H-bonding

9. Antiseptics and disinfectants either kill or prevent growth of microorganisms. Identify which of the following statements is **not true** :
(1) Chlorine and Iodine are used as strong disinfectants.
(2) Dilute solutions of Boric acid and Hydrogen Peroxide are strong antiseptics.
(3) Disinfectants harm the living tissues.
(4) A 0.2% solution of phenol is an antiseptic while 1% solution acts as a disinfectant.

9. (2)

10. Nylon is an example of :
(1) Polysaccharide (2) Polyamide (3) Polythene (4) Polyester

10. (2)
Nylon is an example of polyamide.

11. Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI?

(1) $CH_3-CH_2-CH(CH_3)-O-CH_3$

(2) $CH_3-C(CH_3)_2-O-CH_3$

(3) $CH_3-CH(CH_3)-CH_2-O-CH_3$

(4) $CH_3-CH_2-CH_2-CH_2-O-CH_3$

11. (2)

$$CH_3-C(CH_3)_2-O-CH_3 + HI \rightarrow CH_3-C(CH_3)_2-I + CH_3OH$$

12. Which of these is not a monomer for a high molecular mass silicone polymer?

(1) Me_2SiCl_2 (2) Me_3SiCl (3) $PhSiCl_3$ (4) $MeSiCl_3$

12. (2)

Factual.

13. Identify the correct order of solubility in aqueous medium

(1) $ZnS > Na_2S > CuS$ (2) $Na_2S > CuS > ZnS$

(3) $Na_2S > ZnS > CuS$ (4) $CuS > ZnS > Na_2S$

13. (3)

$Na_2S > ZnS > CuS$

14. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20°C to 35°C ? ($R = 8.314\ J\ mol^{-1}\ K^{-1}$)

(1) $269\ kJ\ mol^{-1}$ (2) $34.7\ kJ\ mol^{-1}$ (3) $15.1\ kJ\ mol^{-1}$ (4) $342\ kJ\ mol^{-1}$

14. (2)

$$\log_{10}\left(\frac{k_2}{k_1}\right) = \frac{Ea}{2.303\,k}\left(\frac{T_2-T_1}{T_1T_2}\right)$$

$$\log_{10}(2) = \frac{Ea}{2.303\times 8.314}\left(\frac{308-293}{293\times 308}\right)$$

Ea = 34.7 kJ/mol

15. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The oxidation potential of electrode would be?

(1) 0.59 V (2) 0.118 V (3) 1.18 V (4) 0.059 V

15. (1)

$H_2(g) \longrightarrow 2H^+ + 2e^-$

$$E = E_0 - \frac{0.591}{2}\log 10\,[H^+]^2 \quad = 0 + 0.059\,pH$$

$$= 0.591\ V$$

16. The value of Planck's constant is 6.63×10^{-34} Js. The speed of light is 3×10^{17} nm s^{-1}. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of $6\times 10^{15}\ s^{-1}$?

(1) 25 (2) 50 (3) 75 (4) 10

16. (2)

Frequency = $\frac{c}{\lambda}$

$\lambda = \frac{c}{f} = \frac{3\times10^{17}\ \text{nm/sec}}{6\times10^{15}\ \text{sec}^{-1}} = \frac{1}{2}\times100 = 50$

17. What is the maximum numbers of electrons that can be associated with the following set of quantum numbers?
n = 3, ℓ = 1 and m = − 1.
(1) 6 (2) 4 (3) 2 (4) 10

17. (3)
3 p_x or 3 p_y can be associated with two electrons.

18. Which of the following lanthanoid ions is diamagnetic?
(At nos. Ce = 58, Sm = 62, Eu = 63, Yb = 70)
(1) Sm^{2+} (2) Eu^{2+} (3) Yb^{2+} (4) Ce^{2+}

18. (3)
Sm = [Xe] $4f^6\ 6s^2$, Sm^{+2} = [Xe] $4f^6$
Eu = [Xe] $4f^7\ 6s^2$, Eu^{+2} = [Xe] $4f^7$
Yb = [X] $4f^{14}\ 6s^2$, Yb^{+2} = [Xe] $4f^{14}$ $\Rightarrow$ diamagnetic
Ce = [Xe] $4f^1\ 5d^1\ 6s^2$, Ce^{+2} = [Xe] $4f^1\ 5d^1$

19. 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is :
(1) 0.01 M (2) 0.001 M (3) 0.1 M (4) 0.02 M

19. (1)

Conc. of solution = $\frac{6.02\times10^{20}}{6.02\times10^{23}}\times\frac{1}{0.1} = 10^{-2}$ M

20. Based on equation $E = -2.178\times10^{-18}\,\text{J}\left(\frac{Z^2}{n^2}\right)$, certain conclusions are written. Which of them is not correct?
(1) Larger the value of n, the larger is the orbit radius.
(2) Equation can be used to calculate the change in energy when the electron changes orbit.
(3) For n = 1, the electron has a more negative energy than it does for n = 6 which means that the electron is more loosely bound in the smallest allowed orbit.
(4) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.

20. (3)
Factual.

21. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium (III) chloride. The number of moles of AgCl precipitated would be :
(1) 0.002 (2) 0.003 (3) 0.01 (4) 0.001

21. (4)

$$\underset{0.1\times0.01=10^{-3}\ \text{mol}}{[Cr(H_2O)_4Cl_2]Cl} + AgNO_3 \longrightarrow \underset{10^{-3}\ \text{mol}}{AgCl} + [Cr(H_2O)_4Cl_2]NO_3$$

22. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction :

$$3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$$

The reaction can go to completion by removing OH^- ions by adding :

(1) KOH (2) CO_2 (3) SO_2 (4) HCl

22. (2)

23. Which of the following compounds will not undergo Friedal − Craft's reaction easily :

(1) Xylene (2) Nitrobenzene (3) Toluene (4) Cumene

23. (2)

Nitrobenzene will not undergo Friedal−Craft's reactions.

24. Which of these is least likely to acts as a Lewis base?

(1) F^- (2) BF_3 (3) PF_3 (4) CO

24. (2)

BF_3 is a Lewis acid.

25. The basic structural unit of sillicates is :

(1) SiO_4^{4-} (2) SiO_3^{2-} (3) SiO_4^{2-} (4) SiO^-

25. (1)

Factual.

26. Maximum deviation from ideal gas is expected from :

(1) $N_2(g)$ (2) $CH_4(g)$ (3) $NH_3(g)$ (4) $H_2(g)$

26. (3)

Factual.

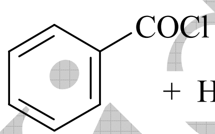
27. Which is the strongest acid in the following ?

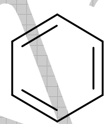
(1) $HClO_3$ (2) $HClO_4$ (3) H_2SO_3 (4) H_2SO_4

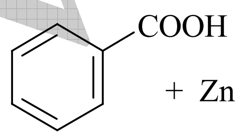
27. (2)

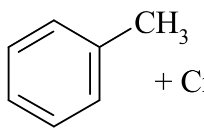
$HClO_4$ is the strongest acid.

28. Reaction by which Benzaldehyde cannot be prepared :

(1)  + H_2 in presence of Pd-$BaSO_4$

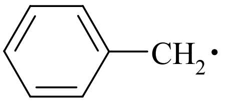
(2)  + CO + HCl in presence of anhydrous $AlCl_3$

(3)  + Zn / Hg and conc. HCl

(4)  + CrO_2Cl_2 in CS_2 followed by H_3O^+

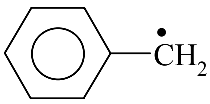
28. (3)

Factual.

29. The radical  is aromatic because it has :

(1) 7 p−orbitals and 6 unpaired electrons
(2) 7 p−orbitals and 7 unpaired electrons
(3) 6 p−orbitals and 7 unpaired electrons
(4) 6 p−orbitals and 6 unpaired electrons

29. (2)

 has 7p−orbitals and 7 unpaired electrons.

30. Roasting of sulphides gives the gas X as a by−product. This is a colorless gas which choking smell of burnt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic, acts as a reducing agent and its acid has never been isolated. The gas X is :
(1) SO_2 (2) CO_2 (3) SO_3 (4) H_2S

30. (1)
Factual.

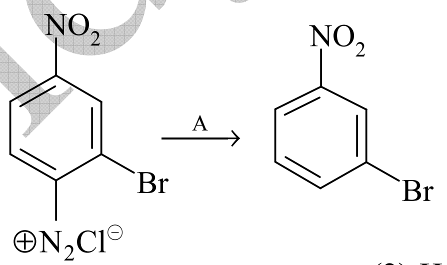
31. At 25°C molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 ohm^{-1} cm^2 mol^{-1} and at infinite dilution its molar conductance is 238 ohm^{-1} cm^2 mol^{-1}. The degree of ionisation of ammonium hydroxide at the same concentration and temperature is :
(1) 20.800% (2) 4.008% (3) 40.800% (4) 2.080%

31. (2)

$$\alpha = = \frac{\wedge}{\wedge_0} = \frac{9.54}{238} = 0.04008 \quad \text{or} \quad 4.008\ \%$$

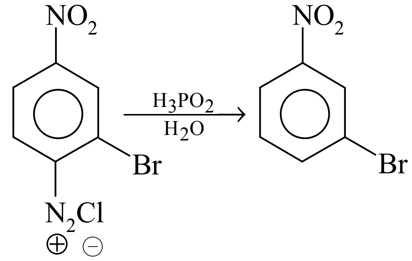
32. Which of the following statements about the interstitial compounds is **incorrect**?
(1) They are chemically reactive
(2) They are much harder than the pure metal
(3) They have higher melting points than the pure metal
(4) They retain metallic conductivity

32. (1)
Factual.

33. In the reaction  A is :

(1) Cu_2Cl_2 (2) H_3PO_2 and H_2O
(3) H^+ / H_2O (4) $HgSO_4 / H_2SO_4$

33. (2)



34. Which of the following is electron−deficient?

(1) $(SiH_3)_2$ (2) $(BH_3)_2$ (3) PH_3 (4) $(CH_3)_2$

34. (2)

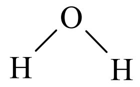
B_2H_6 is electron deficient.

35. Which one of the following molecules contains no π bond?

(1) H_2O (2) SO_2 (3) NO_2 (4) CO_2

35. (1)

H_2O molecule contains no. π − bond.



36. Which of the following does not give oxygen on heating?

(1) $Zn\,(ClO_3)_2$ (2) $K_2Cr_2O_7$ (3) $(NH_4)_2\,Cr_2O_7$ (4) $KClO_3$

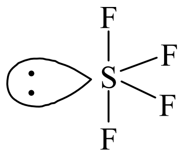
36. (3)

$$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 4H_2O$$

37. Which of the following is a polar molecule?

(1) SF_4 (2) SiF_4 (3) XeF_4 (4) BF_3

37. (1)



SF_4 is a Polar molecule

38. The structure of isobutyl group in an organic compounds is :

(1) $CH_3 - \underset{|}{CH} - CH_2 - CH_3$ (2) $CH_3 - CH_2 - CH_2 - CH_2 -$

(3) $CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} -$ (4) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>\! CH - CH_2 -$

38. (4)

$CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - \equiv$ Isobutyl group

39. Which of the following is paramagnetic?

(1) O_2^- (2) CN^- (3) NO^+ (4) CO

39. (1)

O_2^- is paramagnetic in nature.

40. The number of carbon atoms per unit cell of diamond unit cell is :

(1) 8 (2) 6 (3) 1 (4) 4

40. (1)

Factual.

41. XeF_2 is isostructural with :

(1) ICl_2^- (2) $SbCl_3$ (3) $BaCl_2$ (4) TeF_2

41. (1)

XeF_2 is isostructural with $ICl_2^{\ominus}$ (linear)

42. A reaction having equal energies of activation for forward and reverse reactions has :

(1) $\Delta G = 0$ (2) $\Delta H = 0$

(3) $\Delta H = \Delta G = \Delta S = 0$ (4) $\Delta S = 0$

42. (2)

$\Delta H = E_a^f - E_a^b = 0$

43. Dipole − induced dipole interactions are present in which of the following pairs :

(1) Cl_2 and CCl_4 (2) HCl and He atoms

(3) SiF_4 and H_e atoms (4) H_2O and alcohol

43. (2)

Factual.

44. A button cell used watches functions as following

$Zn(s) + Ag_2O(s) + H_2O(\ell) \rightleftharpoons 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

If half cell potential are $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$; $E^\circ = -0.76$ V

$Ag_2O(s) + H_2O(\ell) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq)$, $E^\circ = 0.34$ V

The cell potential will be :

(1) 0.42 V (2) 0.84 V (3) 1.34 V (4) 1.10 V

44. (4)

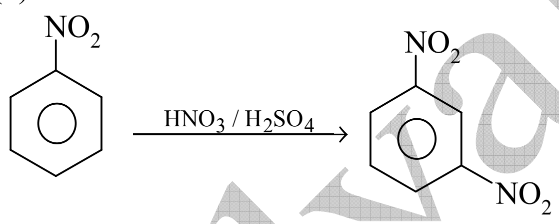
$E^0_{cell} = 0.76 + 0.34 = 1.10$ V

45. Nitrobenzene on reaction with conc. HNO_3/H_2SO_4 at 80−100°C forms which one of the following products?

(1) 1, 3−Dinitrobenzene (2) 1, 4−Dinitrobenzene

(3) 1, 2, 4−Trinitrobenzene (4) 1, 2−Dinitrobenzene

45. (1)



1, 3 - dinitrobenzene

BIOLOGY

46. The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C.

$$\text{DNA} \xrightarrow{A} \text{mRNA} \xrightarrow{B} \text{protein} \xrightarrow[C]{\text{Proposed by}}$$

(1) A − translation B − transcription C − Erevin Chargaff

(2) A − transcription B − translation C − Francis Crick

(3) A − translation B − extension C − Rosalind Franklin

(4) A − transcription B − replication C − James Watson

46. (2)

47. Perisperm differs from endosperm in

(1) having no reserve food

(2) being a diploid tissue

(3) its formation by fusion of secondary nucleus with several sperms

(4) being a haploid tissue

47. (2)

48. Besides paddy fields, cyanobacteria are also found inside vegetative part of :
(1) Cycas (2) Equisetum (3) Psilotum (4) Pinus

48. (1)

49. Which of the following statements is correct in relation to the endocrine system?
(1) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones.
(2) Non - nutrient chemicals produced by the body in trace amount that act as intercellular messenger are known as hormones.
(3) Releasing and inhibitory hormones are produced by the pituitary gland.
(4) Adenohypophysis is under direct neural regulation of the hypothalamus.

49. (4)

50. Megasporangium is equivalent to:
(1) Fruit (2) Nucellus (3) Ovule (4) Embryo sac

50. (2)

51. If two persons with 'AB' blood group marry and have sufficiently large number of children, these children could be classified as 'A' blood group: 'AB' blood group: 'B'' blood group in 1:2:1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of:
(1) Incomplete dominance (2) Partial dominance
(3) Complete dominance (4) Codominance

51. (4)

52. A pregnant female delivers a baby who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin.
This is the result of:
(1) Low secretion of growth hormone (2) Cancer of the thyroid gland
(3) Over secretion of pars distalis (4) Deficiency of iodine in diet

52. (4)

53. Which one of the following organelle in the figure correctly matches with its function?

(1) Golgi apparatus, protein synthesis
(2) Golgi apparatus, formation of glycolipids
(3) Rough endoplasmic reticulum, protein synthesis
(4) Rough endoplasmic reticulum, formation of glycoproteins

53. (3)

54. A phosphoglyceride is always made up of:
(1) only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
(2) a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
(3) a saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule
(4) only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

54. (2)

55. During sewage treatment, biogases are produced which include:
(1) methane, oxygen, hydrogensulphide
(2) hydrogensulphide, methane, sulphur dioxide
(3) hydrogensulphide, nitrogen, methane
(4) methane, hydrogensulphide, carbon dioxide

55. (4)

56. The eye of octopus and eye of cat show different patterns of structure, yet they perform similar function. This is an example of:
(1) Homologous organs that have evolved due to divergent evolution.
(2) Analogous organs that have evolved due to convergent evolution.
(3) Analogous organs that have evolved due to divergent evolution.
(4) Homologous organs that have evolved due to convergent evolution.

56. (2)

57. Which of the following criteria does not pertain to facilitated transport?
(1) High selectivity (2) Transport saturation
(3) Uphill transport (4) Requirement of special membrane proteins

57. (3)

58. The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge, is called :
(1) Convergent evolution (2) Non-random evolution
(3) Adaptive radiation (4) Natural selection

58. (1)

59. Infection of Ascaris usually occurs by:
(1) eating imperfectly cooked pork. (2) Tse-tsefly.
(3) mosquito bite. (4) drinking water containing eggs of Ascaris.

59. (4)

60. The Air Prevention and Control of Pollution Act came into force in:
(1) 1981 (2) 1985 (3) 1990 (4) 1975

60. (1)

61. Which group of animals belong to the same phylum?
(1) Earthworm, Pinworm, Tapeworm (2) Prawn, Scorpion, Locusta
(3) Sponge, Sea anemone, Starfish (4) Malarial parasite, Amoeba, Mosquito

61. (2)

62. Which of the following cannot be detected in a developing foetus by amniocentesis?
(1) Sex of the foetus (2) Down syndrome
(3) Jaundice (4) Klinefelter syndrome

62. (3)

63. The Golgi complex plays a major role:
(1) in digesting proteins and carbohydrates
(2) as energy transferring organelles
(3) in post translational modification of proteins and glycosidation of lipids
(4) in trapping the light and transforming it into chemical energy

63. (3)

64. Select the correct match of the digested products in humans given in column I with their absorption site and mechanism in column II.

	Column I	Column II
(1)	Fructose, Na^+	small intestine, passive absorption
(2)	Glycerol, fatty acids	duodenum, move as chilomicrons
(3)	Cholesterol, maltose	large intestine, active absorption
(4)	Glycine, glucose	small intestine, active absorption

64. (4)

65. Menstrual flow occurs due to lack of:
(1) FSH (2) Oxytocin (3) Vasopressin (4) Progesterone

65. (4)

66. The characteristics and an example of a synovial joint in humans is:

	Characteristics	Examples
(1)	fluid filled between two joints, provides cushion	skull bones
(2)	fluid filled synovial cavity between two bones	joint between atlas and axis
(3)	lymph filled between two bones, limited movement	gliding joint between carpals
(4)	fluid cartilage between two bones, limited movements	Knee joint

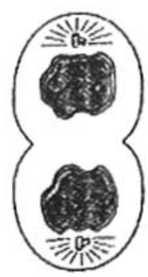
66. (2)

67. Isogamous condition with non-flagellated gametes is found in:
(1) Spirogyra (2) Volvox (3) Fucus (4) Chlamydomonas

67. (1)

68. A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics. :

(1)	Late anaphase	chromosomes move away from equatorial plate, golgi complex not present.
(2)	Cytokinesis	cell plate formed, mitochondria distributed between two daughter cells.
(3)	Telophase	endoplasmic reticulum and nucleolus not reformed yet.
(4)	Telophase	nuclear envelop reforms, golgi complex reforms.

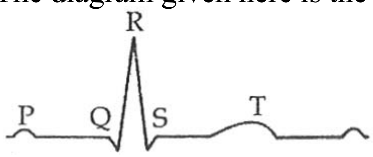


68. (4)

69. Seed coat is not thin, membranous in:
(1) Coconut (2) Groundnut (3) Gram (4) Maize

69. (1)

70. The diagram given here is the standard ECG of a normal person. The P - wave represents the:



(1) Initiation of the ventricular contraction (2) Beginning of the systole
(3) End of systole (4) Contraction of both the atria

70. (4)

71. Which Mendelian idea is depicted by a cross in which the F_1 generation resembles both the parents ?
(1) law of dominance (2) inheritance of one gene
(3) co – dominance (4) incomplete dominance

71. (3)

72. The tendency of population to remain in genetic equilibrium may be disturbed by:
(1) lack of migration (2) lack of mutations
(3) lack of random mating (4) random mating

72. (4)

73. If both parents are carriers for thalessemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child?
(1) 50% (2) 25% (3) 100% (4) no chance

73. (2)

74. In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called :
(1) cross - hybridisation among the selected parents.
(2) evaluation and selection of parents.
(3) germplasm collection.
(4) selection of superior recombinants.

74. (3)

75. The cell - mediated immunity inside the human body is carried out by:
(1) B – lymphocytes (2) Thrombocytes (3) Erythrocytes (4) T - lymphocytes

75. (4)

76. Match the name of the animal (column I), with one characteristics (column II), and the phylum/ class (column III) to which it belongs:

	Column I	Column II	Column III
(1)	Ichthyophis	terrestrial	Reptilia
(2)	Limulus	body covered by chitinous exoskeleton	Pisces
(3)	Adamsia	radially symmetrical	Porifera
(4)	Petromyzon	ectoparasite	Cyclostomata

76. (4)

77. Pigment-containing membranous extensions in some cyanobacteria are:
(1) Basal bodies (2) Pneumatophores
(3) Chromatophores (4) Heterocysts

77. (3)

78. Kyoto Protocol was endorsed at:
(1) CoP-5 (2) CoP-6 (3) CoP-4 (4) CoP-3

78 (4)

79. Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/ deficiency symptom:

	Endocrine gland	Hormone	Function/deficiency symptoms
(1)	Posterior pituitary	Growth Hormone (GH)	Oversecretion stimulates abnormal growth
(2)	Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(3)	Corpus luteum	Testosterone	Stimulates spermatogenesis
(4)	Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth

79. (2)

80. The first stable product of fixation of atmospheric nitrogen in leguminous plants is :
(1) Ammonia (2) NO_3^- (3) Glutamate (4) NO_2^-

80. (1)

81. Natural reservoir of phosphorus is:
(1) Animal bones (2) Rock (3) Fossils (4) Sea water

81. (2)

82. What external changes are visible after the last moult of a cockroach nymph ?
(1) Anal cerci develop
(2) Both fore wings and hind wings develop
(3) Labium develops
(4) Mandibles become harder

82. (2)

83. What is the correct sequence of sperm formation ?
(1) Spermatogonia, spermatocyte, spermatozoa, spermatid
(2) Spermatogonia, spermatozoa, spermatocyte, spermatid
(3) Spermatogonia, spermatocyte, spermatid, spermatozoa
(4) Spermatid, spermatocyte, spermatogonia, spermatozoa

83. (3)

84. Select the wrong statement:
(1) Anisogametes differ either in structure, function or behaviour
(2) In Oomycetes female gamete is smaller and motile, while male gamete is larger and non-motile
(3) Chlamydomonas exhibits both isogamy and anisogamy and Fucus shows oogamy
(4) Isogametes are similar in structure, function and behaviour

84. (2)

85. Monoecious plant of Chara shows occurrence of :
(1) stamen and carpel on the same plant
(2) upper antheridium and lower oogonium on the same plant
(3) upper oogonium and lower antheridium on the same plant
(4) antheridiophore and archegoniophore on the same plant

85. (3)

86. The essential chemical components of many coenzymes are:
(1) Nucleic acids (2) Carbohydrates (3) Vitamins (4) Proteins

86. (3)

87. Which of the following statements is not true of two genes that show 50% recombination frequency?
(1) The genes are tightly linked
(2) The genes show independent assortment
(3) If the genes are present on the same chromosome, they undergo more than one crossovers in every meiosis
(4) The genes may be on different chromosomes

87. (1)

88. Read the following statements (A−E) and answer the question which follows them.
(A) In liverworts, mosses, and ferns gametophytes are free - living
(B) Gymnosperms and some ferns are heterosporous
(C) Sexual reproduction in Fucus, Volvox and Albugo is oogamous
(D) The sporophyte in liverworts is more elaborate than that in mosses
(E) Both, Pinus and Marchantia are dioecious
How many of the above statements are correct?
(1) Two (2) Three (3) Four (4) One

88. (2)

89. The **incorrect** statement with regard to Haemophilia is
(1) It is a recessive disease
(2) It is a dominant disease
(3) A single protein involved in the clotting of blood is affected
(4) It is a sex-linked disease

89. (2)

90. Advantage of cleistogamy is
(1) More vigorous offspring (2) No dependence on pollinators
(3) Vivipary (4) Higher genetic variability

90. (2)

91. Transition state structure of the substrate formed during an enzymatic reaction is
(1) Permanent but unstable (2) Transient and unstable
(3) Permanent and stable (4) Transient but stable

91. (2)

92. In China rose the flowers are
(1) Actionomorphic, epigynous with valvate aestivation
(2) Zygomorphic, hypogynous with imbricate aestivation
(3) Zygomorphic, epigynous with twisted aestivation
(4) Actinomorphic, hypogynous with twisted aestivation

92. (4)

93. Age of a tree can be estimated by
(1) Biomass (2) Number of annual rings
(3) Diameter of its heartwood (4) Its height and girth

93. (2)

94. Which of the following are likely to be present in deep sea water?
(1) Eubacteria (2) Blue-green algae (3) Saprophytic fungi (4) Archaebacteria

94. (4)

95. Variation in gene frequencies within populations can occur by chance rather than by natural selection. This is referred to as
(1) Genetic drift (2) Random mating (3) Genetic load (4) Genetic flow

95. (1)

96. A sedentary sea anemone gets attached to the shell lining of hermit crab. The association is
(1) Symbiosis (2) Commensalism (3) Amensalism (4) Ectoparasitism

96. (2)

97. Which of the following is **not** correctly matched for the organism and its cell wall degrading enzyme?
(1) Plant cells-Cellulase (2) Algae-Methylase
(3) Fungi-Chitinase (4) Bacteria-Lysozyme

97. (2)

98. Product of sexual reproduction generally generates
(1) Prolonged dormancy
(2) New genetic combination leading to variation
(3) Large biomass
(4) Longer viability of seeds

98 (2)

99. Which of the following represent maximum number of species among global biodiversity?
(1) Lichens (2) Fungi (3) Mosses and Ferns (4) Algae

99. (2)

100. One of the legal methods of birth control is
(1) By abstaining from coitus from day 10 to 17 of the menstrual cycle
(2) by having coitus at the time of day break
(3) by a premature ejaculation during coitus
(4) abortion by taking an appropriate medicine

100. (1)

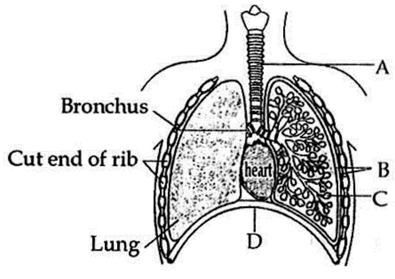
101. Which one of the following processes during decomposition is **correctly** described?
(1) Humification - Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate
(2) Catabolism – Last step in the decomposition under fully anaerobic condition
(3) Leaching – Water soluble inorganic nutrients rise to the top layers of soil
(4) Fragmentation – Carried out by organisms such as earth worm

101. (4)

102. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by
(1) Polymerase chain reaction (2) Electrophoresis
(3) Restriction mapping (4) Centrifugation

102. (2)

103. The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and /or characteristic.



(1) B-pleural membrane - surround ribs on both sides to provide cushion against rubbing.
(2) C - Alveoli - thin walled vascular bag like structures for exchange of gases.
(3) D - Lower end of lungs - diaphragm pulls it down during inspiration.
(4) A - trachea - long tube supported by complete cartilaginous rings for conducting inspired air.

103. (2)

104. Which one of the following is not used for ex situ plant conservation?
(1) Seed banks (2) Shifting cultivation
(3) Botanical Gardens (4) Field gene banks

104. (2)

105. Lenticels are involved in
(1) Gaseous exchange (2) Food transport (3) Photosynthesis (4) Transpiration

105. (1)

106. Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunnhemp, gram, guava, bean, chilli, plum, petunia, tomato, rose, withania, potato, onion, aloe and tulip how many plats have hypogynous flower?
(1) Ten (2) Fifteen (3) Eighteen (4) Six

106. (2)

107. The complex formed by a pair of synapsed homologous chromosomes is called
(1) Kinetochore (2) Bivalent (3) Axoneme (4) Equatorial plate

107. (2)

108. Which one of the following statements is correct?
(1) Sporogenous tissue is haploid
(2) Endothecium produces the microspores
(3) Tapetum nourishes the developing pollen
(4) Hard outer layer of pollen is called intine

108. (3)

109. A major site for synthesis of lipids is
(1) SER (2) Symplast (3) Nucleoplasm (4) RER

109. (1)

110. Select the correct statement with respect to locomotion in humans :
(1) Accumulation of uric acid crystals in joints causes their inflammation.
(2) The vertebral column has 10 thoracic vertebrae.
(3) The joint between adjacent vertebrae is a fibrous joint.
(4) A decreased level of progesterone causes osteoporosis in old people.

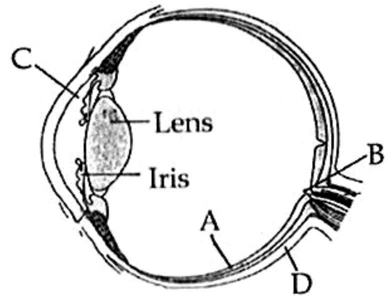
110. (1)

111. A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is :

(1) 15 (2) 05 (3) zero (4) 10

111. (3)

112. Parts A, B, C and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions / characteristics :



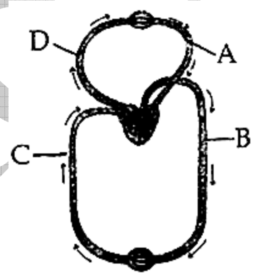
(1) B – Blind spot – has only a few rods and cones.
(2) C – Aqueous chamber – reflects the light which does not pass through the lens.
(3) D – Choroid – its anterior part forms ciliary body.
(4) A – Retina – contains photo receptors – rods and cones.

112. (3)

113. Which of the following are correctly matched with respect to their taxonomic classification ?
(1) Centipede , millipede, spider, scorpion – Insecta
(2) House fly, butterfly, tsetsefly, silverfish – Insecta
(3) Spiny anteater, sea urchin, sea cucumber – Echinodermata
(4) Flying fish, cuttlefish, silverfish – Pisces.

113. (2)

114. Figure shows schematic plan of blood circulation in humans with labels A to D. Identify the label and give its function/s.



(1) B – Pulmonary artery – takes blood from heart to lungs, PO_2 = 90 mm Hg
(2) C – Vena Cava – takes blood from body parts to right auricle, PCO_2 = 45 mm Hg
(3) D – Dorsal aorta – takes blood from heart to body parts, PO_2 = 95 mm Hg
(4) A – Pulmonary vein – takes impure blood from body parts, PO_2 = 60 mm Hg

114. (2)

115. The most abundant intracellular cation is :

(1) Ca^{++} (2) H^+ (3) K^+ (4) Na^+

115. (3)

116. During seed germination its stored food is mobilized by :
(1) Cytokinin (2) ABA (3) Gibberellin (4) Ethylene
116. (3)

117. Secondary productivity is rate of formation of new organic matter by :
(1) Parasite (2) Consumer (3) Decomposer (4) Producer
117. (2)

118. The colonies of recombinant bacteria appear white in contrast to blue colonies of non − recombinant bacteria because of :
(1) Insertional inactivation of alpha − galactosidase in non − recombinant bacteria
(2) Insertional inactivation of alpha − galactosidase in recombinant bacteria
(3) Inactivation of glycosidase enzyme in recombinant bacteria
(4) Non − recombinant bacteria containing beta − galactosidase
118. (2)

119. Which of the following Bt crops is being grown in India by the farmers ?
(1) Cotton (2) Brinjal (3) Soybean (4) Maize
119. (1)

120. Interfascicular cambium develops from the cells of :
(1) Xylem parenchyma (2) Endodermis
(3) Pericycle (4) Medullary rays
120. (4)

121. Which one of the following is not the function of placenta ? It :
(1) Secretes estrogen
(2) facilitates removal of carbon dioxide and waste material from embryo
(3) secretes oxytocin during parturition
(4) facilitates supply of oxygen and nutrients to embryo.
121. (1)

122. Which of the metabolites is common to respiration − mediated breakdown of fats, carbohydrates and proteins ?
(1) Fructose 1, 6 − bisphosphate (2) Pyruvic acid
(3) Acetyl CoA (4) Glucose − 6 − phosphate
122. (3)

123. According to Darwin, the organic evolution is due to :
(1) Interspecific competition.
(2) Competition within closely related species.
(3) Reduced feeding efficiency in one species due to the presence of interfering species.
(4) Intraspecific competition.
123. (4)

124. Which enzyme /s will be produced in a cell in which there is a nonsense mutation in the lac Y gene ?
(1) Lactose permease (2) Transacetylase
(3) Lactose permease and transacetylase (4) β − galactosidase
124. (4)

125. A good producer of citric acid is :
(1) Pseudomonas (2) Clostridium
(3) Saccharomyces (4) Aspergillus
125. (4)

126. Macro molecule chitin is :
(1) phosphorus containing polysaccharide (2) sulphur containing polysaccharide
(3) simple polysaccharide (4) nitrogen containing polysaccharide

126. (4)

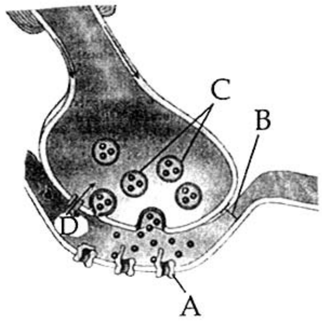
127. The H – zone in the skeletal muscle fibre is due to :
(1) the central gap between myosin filaments in the A – band.
(2) the central gap between actin filaments extending through myosin filaments in the A – band
(3) extension of myosin filaments in the central portion of the A – band.
(4) the absence of myofibrils in the central portion of A – band.

127. (2)

128. Meiosis takes place in :
(1) Conidia (2) Gemmule (3) Megaspore (4) Meiocyte

128. (4)

129. A diagram showing axon terminal and synapse is given. Identify correctly at least two of A – D.



(1) B – Synaptic connection
D – K^+
(2) A – Neurotransmitter
B – Synaptic cleft
(3) C – Neurotransmitter
D – Ca^{++}
(4) A – Receptor
C – Synaptic vesicles

129. (4)

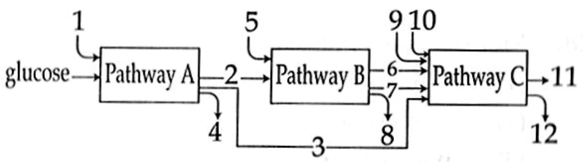
130. Which one of the following is not a correct statement ?
(1) Botanical gardens have collection of living plants for reference.
(2) A museum has collection of photographs of plants and animals.
(3) Key is a taxonomic aid for identification of specimens.
(4) Herbarium houses dried, pressed and preserved plant specimens.

130. (2)

131. Global warming can be controlled by
(1) Reducing reforestation, increasing the use of fossil fuel.
(2) Increasing deforestation, slowing down the growth of human population.
(3) Increasing deforestation, reducing efficiency of energy usage.
(4) Reducing deforestation, cutting down use of fossil fuel

131. (4)

132. The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products.



Arrows numbered 4, 8 and 12 can all be
(1) ATP (2) H_2O (3) FAD^+ or $FADH_2$ (4) NADH

132. (1)

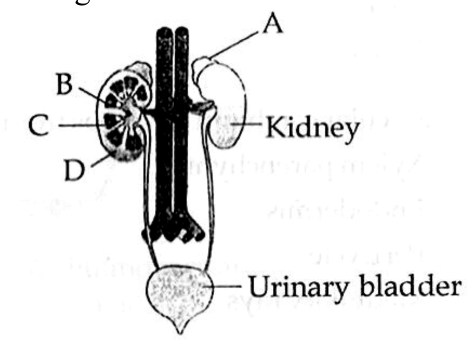
133. Artificial insemination means
(1) transfer of sperms of husband to a test tube containing ova
(2) artificial introduction of sperms of a healthy donor into the vagina
(3) introduction of sperms of a healthy donor directly into the ovary
(4) transfer of sperms of a healthy donor to a test tube containing ova

133. (2)

134. One of the representatives of Phylum Arthropoda is
(1) silverfish (2) pufferfish (3) flying fish (4) cuttlefish

134. (1)

135. Figure shows human urinary system with structures labelled A to D. Select option which correctly identifies them and gives their characteristics and/or functions.



(1) B - Pelvis – broad funnel shaped space inner to hilum, directly connected to loops of Henle.
(2) C - Medulla - inner zone of kidney and contains complete nephrons.
(3) D - Cortex – outer part of kidney and do not contain any part of nephrons.
(4) A – Adrenal gland – located at the anterior part of kidney. Secrete Catecholamines which stimulate glycogen breakdown.

135. (4)

Physics

136. A uniform force of $(3\hat{i}+\hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i}+\hat{k})$ meter of position $(4\hat{i}+3\hat{j}-\hat{k})$ meter. The work done by the force on the particle is :
(1) 6J (2) 13 J (3) 15 J (4) 9 J

136. (4)

$$\vec{f} = 3\vec{i} + \vec{j}$$

$$\vec{s} = (4\vec{i}+3\vec{j}-\vec{k})-(2\vec{i}+\vec{k})$$

$$= 2\vec{i}+3\vec{j}-2\vec{k}$$

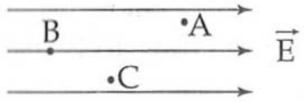
$$\therefore\ w = \vec{f}\cdot\vec{s}$$

$$= (3\vec{i}+\vec{j})\cdot(2\vec{i}+3\vec{j}-2\vec{k}) \qquad (\because\ \vec{i}\cdot\vec{i}=\vec{j}\cdot\vec{j}=\vec{k}\cdot\vec{k}=1)$$

$$= 6 + 3$$

$$= 9J$$

137. A, B and C are three points in a uniform electric field. The electric potential is :



(1) maximum at B
(2) maximum at C
(3) same at all the three points A, B and C
(4) maximum at A

137. (1)
Potential decreases in the direction of the electric field.

138. A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when:
(1) number of turns in the coil is reduced.
(2) a capacitance of reactance $X_C = X_L$ is included in the same circuit.
(3) an iron rod is inserted in the coil.
(4) frequency of the AC source is decreased.

138. (3)
Self-inductance increases due to insertion of iron rod which increases this impedance. Hence current in the circuit decreases.

139. The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by:
(1) $\mu = \dfrac{2}{\tan\theta}$ (2) $\mu = 2\tan\theta$ (3) $\mu = \tan\theta$ (4) $\mu = \dfrac{1}{\tan\theta}$

139. (2)
$g\sin\theta = \mu g\cos\theta - g\sin\theta$
$2g\sin\theta = \mu g\cos\theta$
$2\tan\theta = \mu$

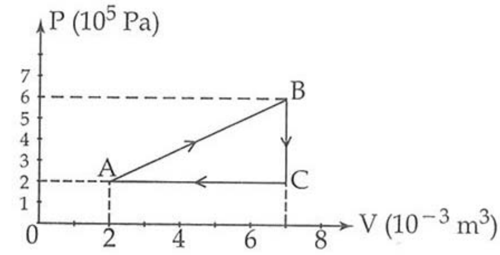
140. The wettability of a surface by a liquid depends primarily on:
(1) surface tension
(2) density
(3) angle of contact between the surface and the liquid.
(4) viscosity

140. (3)
The liquid wets a surface, if the angle of contact is acute.

141. The condition under which a microwave oven heats up a food item containing water molecules most efficiently is:
(1) The frequency of the microwaves has no relation with natural frequency of water molecules.
(2) Microwaves are heat waves, so always produce heating.
(4) Infra-red waves produce heating in a microwave oven.
(4) The frequency of the microwaves must match the resonant frequency of the water molecules.

141. (4)
The energy of the microwaves is absorbed when the resonant frequency of water molecules matches the frequency of microwaves.

142. A gas is taken through the cycle A $\rightarrow$ B $\rightarrow$ C $\rightarrow$ A, as shown. What is the net work done by the gas?



(1) 1000 J (2) Zero (3) −2000 J (4) 2000 J

142. (1)

The net work done by the gas is the area enclosed by the triangle.

$$w = \frac{1}{2} \times \text{base} \times \text{height}$$
$$= \frac{1}{2} \times (5 \times 10^{-3}) \times (4 \times 10^{5})$$
$$= 1000 \text{ J}$$

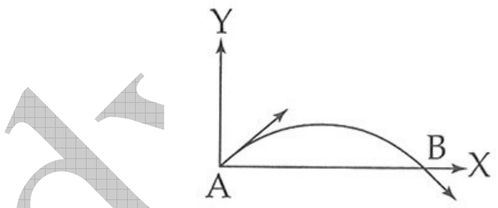
143. A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is :

(1) twice per revolution
(2) four times per revolution
(3) six times per revolution
(4) once per revolution

143. (1)

In one rotation the coil becomes perpendicular to the field two times.

144. The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)$ m/s. It's velocity (in m/s) at point B is:



(1) $-2\hat{i}+3\hat{j}$ (2) $2\hat{i}-3\hat{j}$ (3) $2\hat{i}+3\hat{j}$ (4) $-2\hat{i}-3\hat{j}$

144. (2)

The vertical component is reversed.

145. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied?

(1) length = 100 cm, diameter = 1 mm
(2) length = 200 cm, diameter = 2 mm
(3) length = 300 cm, diameter = 3 mm
(4) length = 50 cm, diameter = 0.5 mm

145. (4)

$$e \propto \frac{L}{A}$$

i.e. $$e \propto \frac{L}{d^2}$$

$\frac{L}{d^2}$ is maximum.

146. A wire of resistance 4 Ω. is stretched to twice its original length. The resistance of stretched wire would be:

(1) 4 Ω (2) 8 Ω (3) 16 Ω (4) 2 Ω

146. (3)

$$R = \rho \frac{\ell}{A}$$

V = constant

$\therefore$ $A\ell = A'2\ell$

$$A' = \frac{A}{2}$$

new resistance, $R' = \rho \frac{\ell'}{A'} = \rho \frac{2\ell}{A/2} = 4\rho \frac{\ell}{A} = 4R = 4 \times 4$

$= 16$

147. A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using:

(1) Wien's displacement Law (2) Kirchoff's Law
(3) Newton's Law of cooling (4) Stefan's Law

147. (1)

$\because$ $\lambda_m T$ = constant according to Wien's displacement Law.

148. A small object of uniform density rolls up a curved surface with an initial velocity V. It reaches upto a maximum height of $\frac{3\upsilon^2}{4g}$ with respect to the initial position. The object is:

(1) Solid sphere (2) Hollow sphere (3) Disc (4) King

148. (3)

From Conservation of energy.

$$mgh = \frac{1}{2}(1+n)mv^2$$

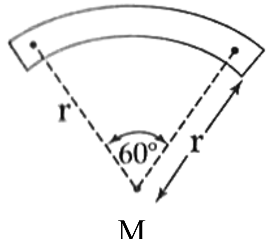
$$mg\frac{3v^2}{4g} = \frac{1}{2}(1+n)mv^2$$

$$1 + n = \frac{3}{2}$$

$$n = \frac{1}{2}$$

$\therefore$ Disc.

149. A bar magnet of length 'l' and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be:



(1) $\frac{3}{\pi}M$ (2) $\frac{2}{\pi}M$ (3) $\frac{M}{2}$ (4) M

149. (1)

Pole strength will not change

$M = m\ell$

New magnetic length = 2r sin 30 = r

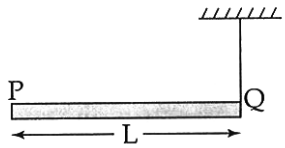
New magnetic moment, $M' = mr$

but $\frac{\pi}{3}r = \ell$

$r = \frac{3\ell}{\pi}$

$M' = m\frac{3\ell}{\pi} = \frac{3M}{\pi}$

150. A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is :



(1) g/L (2) 2g/L (3) $\frac{2g}{3L}$ (4) $\frac{3g}{2L}$

150. (4)

$\because$ torque = force × moment arm

$\therefore \quad \tau = mg \times \frac{\ell}{2}$ … (1)

also $\tau = I\alpha = \frac{1}{3}m\ell^2\alpha$ … (2)

$\therefore$ from eqs. (1) and (2), we get

$mg\frac{\ell}{2} = \frac{1}{3}m\ell^2\alpha$

$\alpha = \frac{3}{2}\frac{g}{\ell}$

151. In a n-type semiconductor, which of the following statement is true:

(1) Electron are minority carriers and pentavalent atoms are dopants.
(2) Holes are minority carriers and pentavalent atoms are dopants.
(3) Holes are majority carriers and trivalent atoms are dopants.
(4) Electrons are majority carriers and trivalent atoms are dopants.

151. (2)

152. In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be:

(1) 1.5 G (2) $\frac{1}{3}G$ (3) $\frac{5}{4}G$ (4) $\frac{2}{3}G$

152. (4)

Voltage gain = $g_m \times R_L$

$\therefore \quad G = g_m \times R_L$

and $A_v = g_m' \times R_L$

$$\frac{A_v}{G} = \frac{g_m{}'}{g_m} = \frac{0.02}{0.03} = \frac{2}{3}$$

$$A_v = \frac{2}{3}G$$

153. For photoelectric emission from certain metal the cutoff frequency is ν. If radiation of frequency 2 ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass):

(1) $\sqrt{h\nu / m}$ (2) $\sqrt{2h\nu / m}$ (3) $2\sqrt{h\nu / m}$ (4) $\sqrt{h\nu / (2m)}$

153. (2)

$$\frac{1}{2}mv_{max}^2 = h\,(2\nu) - h\nu$$

$$v_{max} = \sqrt{2\frac{h\nu}{m}}$$

154. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths λ_a = 12000 Å and λ_2 = 10000 Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other ?

(1) 6 mm (2) 4 mm (3) 3 mm (4) 8 mm

154. (1)

$$x = \frac{n_1 \lambda_1 D}{d} = \frac{n_2 \lambda_2 D}{d}$$

$\therefore$ $n_1 \lambda_1 = n_2 \lambda_2$

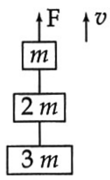
$n_1 \times 12000 = n_2 \times 10000$

$\therefore$ $n_1 \times 6 = n_2\, 5$

$\therefore$ $n_1 = 5$ and $n_2 = 6$

$$\therefore\ x = \frac{5 \times 12000 \times 10^{-10} \times 2}{2 \times 10^{-3}} = 6 \times 10^{3}\text{ m} = 6\text{ mm}$$

155. Three blocks with masses m, 2 m and 3 m are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m ?
(g is the acceleration due to gravity)



(1) 2mg (2) 3mg (3) 6mg (4) zero

155. (4)

As blocks move with constant velocity.

156. A certain mass of Hydrogen is changed to Helium by the process of fusion. The Mass defect in fusion reaction is 0.02866 u. The energy liberated per u is: (given lu = 931 Me V)

(1) 26.7 MeV (2) 6.675 MeV (3) 13.35 MeV(4) 2.67 MeV

156. (2)

Energy liberated = $0.02866 \times 931 = 26.7$ MeV

$$\therefore\ \text{Energy liberated} = \frac{26.7}{4} = 6.675\ \text{Me V}$$

157. If we study the vibration of a pipe open at both ends, then the following statement is not true:
(1) Odd harmonics of the fundamental frequency will be generated
(2) All harmonics of the fundamental frequency will be generated
(3) Pressure change will be maximum at both ends
(4) Open end will be antinode

157. (3)
$\because$ Pipe is open at both the ends.
$\therefore$ It will produce antinodes at both ends which are called pressure nodes hence the pressure change at that point should be minimum.
$\therefore$ Statement (3) is not true.

158. An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second pail of mass 2 kg moves with 8 ms^{-1} speed. If the third part flies off with 4 ms^{-1} speed, then its mass is :
(1) 5 kg (2) 7 kg (3) 17 kg (4) 3 kg

158. (1)
From Conservation of linear momentum
$$m \times 4 = \sqrt{(1\times 12)^2 + (2\times 8)^2}$$
$$m = 5 \text{ kg}$$

159. In an experiment four quantities a, b, c and d are measured with percentage error 1 %, 2%, 3% and 4% respectively. Quantity P is calculated as follows:
$$P = \frac{a^3 b^2}{cd}$$
% error in P is:
(1) 10% (2) 7% (3) 4% (4) 14%

159. (4)
$$\because \; P = \frac{a^3b^2}{cd}$$
$$\therefore \; \text{\% error in P} = \left[3\left(\frac{\Delta a}{a}\right) + 2\left(\frac{\Delta b}{b}\right) + \left(\frac{\Delta c}{c}\right) + \left(\frac{\Delta d}{d}\right)\right] \times 100$$
$= 3\ (1\%) + 2\ (2\%) + (3\%) + (4\%)$
$= 3 + 4 + 3 + 4$
% error in P $= 14\%$

160. A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513Hz. The unknown frequency is :
(1) 246 Hz (2) 240 Hz (3) 260 Hz (4) 254 Hz

160. (4)
$\because$ in 1^{st} case 4 beats/sec are produced with known frequency source 250 Hz.
$\therefore$ Unknown frequency, $x = (250 \pm 4)$ Hz
$= 246$ Hz or 254 Hz
$\because$ 2^{nd} Harmonics of the source i.e. 2x produces 5 beats/sec with known frequency 513 Hz.
$\therefore$ Unknown frequency, $2x = (513 \pm 5)$ Hz
$2x = 508$ Hz or 518 Hz
$\therefore$ $x = 254$ Hz or 259 Hz
$\therefore$ The common frequency in both causes is 254 Hz.
$\therefore$ Unknown frequency = 254 Hz

161. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is:

(1) 0.5 Ω (2) 0.8 Ω (3) 1.0 Ω (4) 0.2 Ω

161. (1)

$$I = \frac{E}{R + r}$$

$$0.2 = \frac{2.1}{10 + r}$$

$\therefore$ $2 + 0.2r = 2.1$

$0.2r = 0.1$

$$r = \frac{1}{2} = 0.5\Omega$$

162. A current loop in a magnetic field:

(1) can be in equilibrium in one orientation.

(2) can be in equilibrium in two orientations, both the equilibrium states are unstable.

(3) can be in equilibrium in two orientations, one stable while the other is unstable.

(4) experiences a torque whether the field is uniform or non uniform in all orientations.

162. (3)

Stable when $\theta = 0°$

at unstable, when $\theta = 180°$

163. The wavelength λ_e of an electron and λ_P of a photon of same energy E are related by:

(1) $\lambda_P \propto \lambda_e$ (2) $\lambda_P \propto \sqrt{\lambda_e}$ (3) $\lambda_P \propto \frac{1}{\sqrt{\lambda_e}}$ (4) $\lambda_P \propto \lambda_e^2$

163. (4)

$$\lambda_p = \frac{h}{p} = \frac{hc}{E}$$

and $$\lambda_e = \frac{h}{\sqrt{2mE}}$$

$\therefore$ $\lambda_P \propto \lambda_e^2$

164. The half life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1 : 7 in a sample of a given rock. The age of the rock is estimated to be :

(1) 60 years (2) 80 years (3) 100 years (4) 40 years

164. (1)

The ratio of the two isotopes is 1 : 7 after time t. If m_0 is the initial mass then the mass after time t is $\frac{m_0}{8}$ and $7\frac{m_0}{8}$. The mass of the isotope 'X' becomes $\frac{1}{8}$ of the original mass.

$$\therefore \quad \frac{m}{m_0} = \frac{1}{8} = \frac{1}{2^n}$$

where n is the number of half-lives.

$\therefore$ $n = 3$

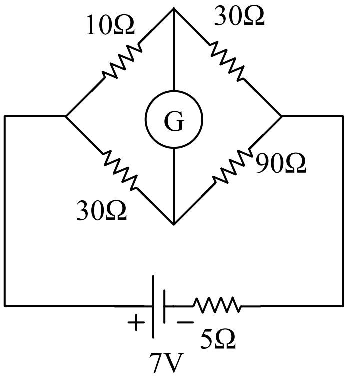
since half-life is 20 years the time

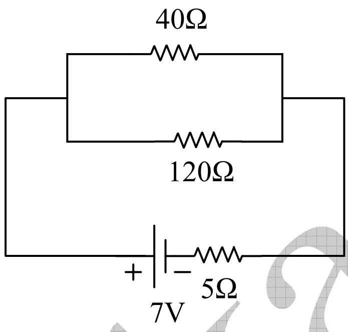
$t = 3 \times 20 = 60$ years

165. The resistances of the four arms P, Q, R and S in a Wheatstone's bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The emf and internal resistance of the cell are 7 Volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be :

(1) 0.2 A (2) 0.1 A (3) 2.0 A (4) 1.0 A

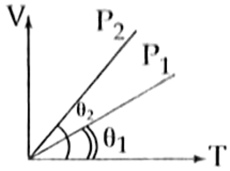
165. (1)





$$I = \frac{7}{35} = \frac{1}{5} = 0.2A$$

166. In the given (V−T) diagram, what is the relation between pressure P_1 and P_2?



(1) $P_2 > P_1$
(2) $P_2 < P_1$
(3) Cannot be predicted
(4) $P_2 = P_1$

166. (2)

From graph

$$\tan\theta = \frac{V}{T}$$

$\tan\theta_2 > \tan\theta_1$

$PV = n\,RT$

$$P = \frac{nRT}{V}$$

$$P \propto \frac{1}{\tan\theta}$$

$\therefore P_2 < P_1$

167. The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to :

(1) $\frac{R}{(\gamma-1)}$ (2) $\frac{(\gamma-1)}{R}$ (3) γR (4) $\frac{1+\gamma}{1-\gamma}$

167. (1)

$\because$ by Mayer's Relation

$C_p - C_v = R$

$\left\{ \because \gamma = \frac{C_p}{C_v} \Rightarrow C_p = \gamma C_v \right\}$

$\therefore \gamma C_v - C_v = R$

$\therefore (\gamma - 1) C_v = R$

$\therefore C_v = \frac{R}{\gamma - 1}$

168. The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1 K to T_2 K is :

(1) $\frac{3}{2}\ N_a k_B (T_2 - T_1)$ (2) $\frac{3}{4}\ N_a k_B (T_2 - T_1)$

(3) $\frac{3}{4} N_a k_B \left(\frac{T_2}{T_1}\right)$ (3) $\frac{3}{8}\ N_a k_B (T_2 - T_1)$

168. (4)

In 1 g of Helium, no. of moles, $n = \frac{1}{4}$

$$\Delta U = \frac{n}{2} f R (T_2 - T_1)$$
$$= \frac{1}{8} 3 R (T_2 - T_1)$$
$$= \frac{3}{8} R (T_2 - T_1)$$
$$= \frac{3}{8} N_a k_B (T_2 - T_1)$$

169. A plano convex lens fits exactly into a plano concave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is :

(1) $\frac{R}{2(\mu_1 - \mu_2)}$ (2) $\frac{R}{(\mu_1 - \mu_2)}$ (3) $\frac{2R}{(\mu_2 - \mu_1)}$ (4) $\frac{R}{2(\mu_1 + \mu_2)}$

169. (2)

For plano convex lens,

$$\frac{1}{f_1} = (\mu_1 - 1)\left(\frac{1}{R}\right)$$

For plano concave lens,

$$\frac{1}{f_2} = -(\mu_2 - 1)\frac{1}{R}$$

$\therefore$ focal length of combination is

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{(\mu_1 - 1)}{R} - \frac{(\mu_2 - 1)}{R}$$
$$= \frac{\mu_1 - 1 - \mu_2 + 1}{R}$$
$$\frac{1}{f} = \frac{\mu_1 - \mu_2}{R}$$
$$\therefore \quad f = \frac{R}{\mu_1 - \mu_2}$$

170. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_P}{C_V}$ for the gas is :

(1) 2 (2) $\frac{5}{3}$ (3) $\frac{3}{2}$ (4) $\frac{4}{3}$

170. (3)

$P \propto T^3$

PT^{-3} = constant

$P^{-\frac{1}{3}}T$

But for Adiabatic process

$$P^{\frac{1-\gamma}{\gamma}}T = \text{constant}$$

$$\therefore \quad \frac{1-\gamma}{\gamma} = -\frac{1}{3}$$

$$3 - 3\gamma = -\gamma$$

$$2\gamma = 3$$

$$\gamma = \frac{3}{2}$$

171. A wave travelling in the + ve x-direction having displacement along y−direction as 1 m, wavelength 2πm and frequency of $\frac{1}{\pi}$Hz is represented by :

(1) $y = \sin(2\pi x - 2\pi t)$
(2) $y = \sin(10\pi x - 20\pi t)$
(3) $y = \sin(2\pi x + 2\pi t)$
(4) $y = \sin(x - 2t)$

171. (4)

$\because$ amplitude a = 1m, frequency n = $\frac{1}{\pi}$Hz

wavelength $\lambda = 2\pi$ m

$\because$ standard wave equation travelling along positive x-direction is given by

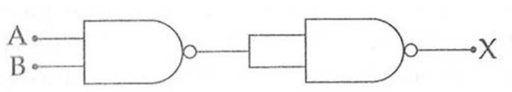
$$y = a\sin\left(2\pi nt - \frac{2\pi x}{\pi}\right)$$

$$\therefore \quad y = 1\sin\left(\frac{2\pi t}{\pi} - \frac{2\pi x}{2\pi}\right)$$

$$\therefore \quad y = \sin(2t - x)$$

$$\therefore \quad y = \sin(x - 2t)$$

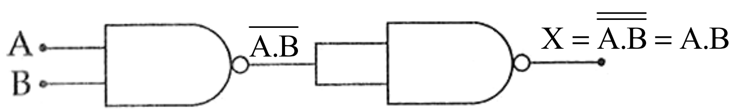
172. The output (X) of the logic circuit shown in figure will be :



(1) $X = \overline{A.B}$ (2) $X = A.B$ (3) $X = \overline{A+B}$ (4) $X = \overline{\overline{A}.\overline{B}}$

172. (2)

Single input NAHD gate is equivalent to not gate



173. A body of mass 'm' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be:

(1) $\frac{2}{3}$ mgR (2) 3 mgR (3) $\frac{1}{3}$ mgR (4) mg2R

173. (1)

$h = 2R$

Change in P.E.= $\frac{GMm}{R} - \frac{GMm}{R+h}$

$= \frac{GMm}{R} - \frac{GMm}{(R+2R)}$

$= GMm\left[\frac{1}{R} - \frac{1}{3R}\right]$

$= GMm\left[\frac{3R-R}{3R^2}\right] = GMm\left[\frac{2R}{3R^2}\right]$

$= gR^2m\left[\frac{2}{3R}\right] \qquad \left\{\because g = \frac{GM}{R^2}\right\}$

$= \frac{2}{3}mgR$

174. Ratio of longest wave lengths corresponding to Lyman and Balmer series in hydrogen spectrum is:

(1) $\frac{3}{23}$ (2) $\frac{7}{29}$ (3) $\frac{9}{31}$ (4) $\frac{5}{27}$

174. (4)

Lyman series for longest wavelength $n = 2 \rightarrow n = 1$

$\frac{hc}{\lambda_L} = \frac{E_1}{4} - E_1 = -\frac{3}{4}E_1$

Balmer series $n = 3 \rightarrow n = 2$

$\frac{hc}{\lambda_B} = \frac{E_1}{9} - \frac{E_1}{4} = -\frac{5}{36}E_1$

$$\frac{\frac{hc}{\lambda_B}}{\frac{hc}{\lambda_L}} = \frac{\frac{-5}{36}E_1}{\frac{-3}{4}E_1}$$

$\frac{\lambda_L}{\lambda_B} = \frac{5}{36} \times \frac{4}{3} = \frac{5}{27}$

175. Infinite number of bodies, each of mass 2 kg are situated on x-axis at distances 1 m, 2 m, 4 m, 8 m,......., respectively, from the origin. The resulting gravitational potential due to this system at the origin will be:

(1) $-\frac{8}{3}G$ (2) $-\frac{4}{3}G$ (3) $-4G$ (4) $-G$

175. (3)

$V = -G \times 2\left[1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}...\right] = -2G\left[\frac{1}{2 - \frac{1}{2}}\right] = -4G$

176. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed υ_0 it moves with an initial acceleration 3_{a_0} towards west. The electric and magnetic fields in the room are :

(1) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{e\upsilon_0}$ down (2) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{e\upsilon_0}$ up

(3) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{e\upsilon_0}$ down (4) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{e\upsilon_0}$ up

176. (1)

When proton at rest only electric field is exerting force

$\therefore$ $eE = ma_0$

$$E = \frac{ma_0}{e} \text{ west}$$

Extra acceleration of $2a_0$ because of magnetic field

$m2a_0 = ev_0B$

$B = \frac{2ma_0}{ev_0}$ downward

177. For a normal eye, the cornea of eye provides a converging power of 40 D and the least converging power of the eye lens behind the cornea is 20 D. Using this information, the distance between the retina and the cornea - eye lens can be estimated to be:

(1) 2.5 cm (2) 1.67 cm (3) 1.5 cm (4) 5 cm

177. (2)

The combined focal power of the cornea and the eye lens is 40 + 20 = 60 D. Hence the combined focal length is

$$f = \frac{1}{60}\text{m} = \frac{100}{60}\text{cm} = 1.67 \text{ cm}$$

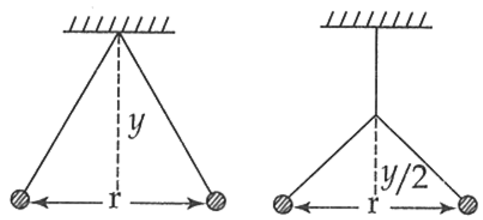
178. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct ?

(1) The angular width of the central maximum of the diffraction pattern will increase.
(2) The angular width of the central maximum will decrease.
(3) The angular width of the central maximum will be unaffected.
(4) Diffraction pattern is not observed on the screen in the case of electrons.

178. (2)

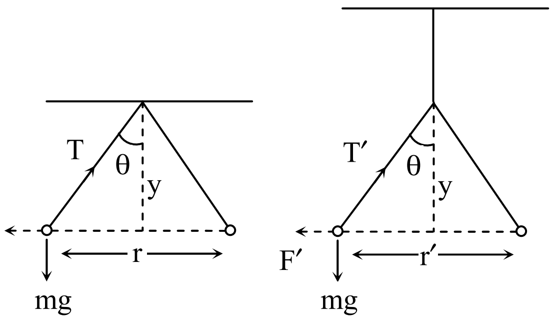
λ will decrease, so angular width of maxima will decrease.

179. Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become:



(1) $\left(\frac{r}{\sqrt[3]{2}}\right)$ (2) $\left(\frac{2r}{\sqrt{3}}\right)$ (3) $\left(\frac{2r}{3}\right)$ (4) $\left(\frac{1}{\sqrt{2}}\right)^2$

179. (1)



$$T\sin\theta = K\frac{q^2}{r^2} \qquad \tan\theta' = \frac{K\dfrac{q^2}{r'^2}}{mg}$$

$$T\cos\theta = mg$$

$$\tan\theta = \frac{K\dfrac{q^2}{r^2}}{mg}$$

$$\frac{\tan\theta}{\tan\theta'} = \frac{r'^2}{r^2}$$

$$\frac{\dfrac{r}{2y}}{\dfrac{r'}{2.\dfrac{y}{2}}} = \frac{r'^2}{r^2}$$

$$r'^3 = \frac{r^3}{2}$$

$$r' = \frac{r}{\sqrt[3]{2}}$$

180. A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is :

(1) $h_1 = \dfrac{h_2}{3} = \dfrac{h_3}{5}$ (2) $h_2 = 3h_1$ and $h_3 = 3h_2$

(3) $h_1 = h_2 = h_3$ (4) $h_1 = 2h_2 = 3h_3$

180. (1)

$$h_1 = \frac{1}{2}g\,.\,5^2$$

$$h_2 = \frac{1}{2}g\,(10^2 - 5^2) = 3h_1$$

$$h_3 = \frac{1}{2}g(15^2 - 10^2) = 5h_1$$

$$\therefore\ h_1 = \frac{h_2}{3} = \frac{h_3}{5}$$

❑ ❑ ❑ ❑ ❑ ❑