| Subject | Topic | Mock Test – 04 | Date |
|---|---|---|---|
| C + P + B | Complete Syllabus | NEET – CT N-20250419 | 19th May 2026 |

**Max. Marks: 720** **Duration: 3 Hours**

1. **This paper consists of 180 questions with 3 parts of Chemistry, Physics and Biology**

   - **Chemistry: *(Q. No. 1 to 45) Multiple Choice Questions with one correct answer. A correct answer carries 4 Marks. A wrong answer carries a penalty of 1 mark.***
   - **Physics: *(Q. No. 46 to 90) Multiple Choice Questions with one correct answer. A correct answer carries 4 Marks. A wrong answer carries a penalty of 1 mark.***
   - **Biology: *(Q. No. 91 to 180) Multiple Choice Questions with one correct answer. A correct answer carries 4 Marks. A wrong answer carries a penalty of 1 mark.***

2. **The OMR sheet NEET-2026-180Q is to be used**

3. **Use of calculators and log tables is prohibited**

4. **Darken the appropriate bubble using a pen in the OMR sheet provided to you. Once entered, the answer cannot be changed. Any corrections or modifications will automatically draw a penalty of 1 mark**

5. **No clarification will be entertained during the examination. Doubts in the paper can be reported to the coordinator after the exam**

6. **If the details in the OMR Sheet are not filled, If the OMR sheet is mutilated, torn, white Ink used, the circles filled and scratched, then the OMR sheet will not be graded**

   **All the best!!**

## Useful Data

**At. Wt.:**

$N = 14;\ O = 16;\ H = 1;\ S = 32;\ Cl = 35.5;\ Mn = 55;\ Na = 23;\ C = 12;\ Ag = 108;\ K = 39;\ Fe = 56;\ Pb = 207$

**Physical Constants:**

$h = 6.626 \times 10^{-34}\ \text{Js}$, $N_a = 6.022 \times 10^{23}\ \text{mol}^{-1}$, $c = 2.998 \times 10^{8}\ \text{m s}^{-1}$, $m_e = 9.1 \times 10^{-31}\ \text{kg}$, $R = 8.314\ \text{J mol}^{-1}\ \text{K}^{-1}$

## Chemistry

**Multiple Choice Questions with one correct answer. A correct answer carries 4 marks. A wrong answer carries a penalty of 1 mark.** **45 x 4 = 180**

1. The osmotic pressure of 1 M solution of glucose is x atm then what will be the osmotic pressure of 0.2 M solution of $KBr$?

   (a) $0.4\ x$ (b) $0.2\ x$ (c) $2x$ (d) $x$

   Sol: $\frac{\pi_{\text{glucose}}}{\pi_{KBr}} = \frac{i_1 \times C_1}{i_2 \times C_2} = \frac{1 \times 1}{2 \times 0.2}$

   $\therefore \pi_{KBr} = 0.4\ \pi_{\text{glucose}}$

   Ans: (a)

2. In a period, atom with smallest radius generally is

   (a) Chalcogen (b) Halogen (c) Aerogen (d) Pnicogen

   Sol: Halogen

   Ans: (b)

3. A compound which is a strong oxidising agent and has orange coloured crystal. Identify the compound:

   (a) Hydrogen peroxide (b) Potassium permanganate

   (c) Sodium chromate (d) Potassium dichromate

   Sol: $K_2Cr_2O_7$ is orange coloured crystal

   Ans: (d)

4. The oxidation potential of $Zn, Cu, Ag, H_2$ and $Ni$ are $0.76\ \text{V}, -0.34\ \text{V}, -0.80\ \text{V}, 0\ \text{V}, 0.55\ \text{V}$ respectively. Which of the following reaction will provide maximum voltage?

   (a) $Zn + Cu^{2+} \longrightarrow Cu + Zn^{2+}$ (b) $Zn + 2Ag^{+} \longrightarrow 2Ag + Zn^{2+}$

   (c) $H_2 + Cu^{2+} \longrightarrow 2H^{+} + Cu$ (d) $H_2 + Ni^{2+} \longrightarrow 2H^{+} + Ni$

   Sol: $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$ ($E^{\circ}$ =standard reduction potential)

   Ans: (b)

5. Which of the following species are hypervalent?

(I) $ClO_4^-$ (II) $BF_3$ (III) $SO_4^{2-}$ (IV) $CO_3^{2-}$

(a) I, II, III (b) I, III (c) III, IV (d) I, III, IV

Sol: Hypervalent $\rightarrow$ more than $8e^-$

Ans: (b)

6. Arrange the compounds in order of decreasing acidity:

(1) $Cl - CH_2 - CH_2 - SH$

(2) $Cl_2CH - CH_2 - SH$

(3) $Cl - CH_2 - CH_2 - OH$

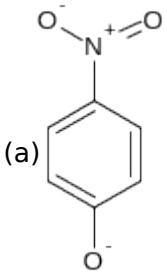
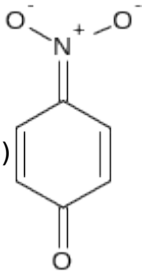
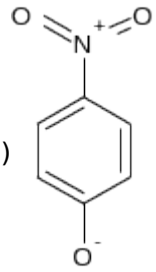
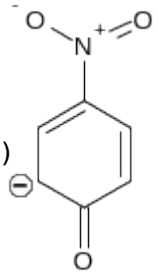
(4) $CH_3 - CH_2 - OH$

(a) $4 > 3 > 2 > 1$ (b) $1 > 2 > 3 > 4$ (c) $1 > 2 > 4 > 3$ (d) $2 > 1 > 3 > 4$

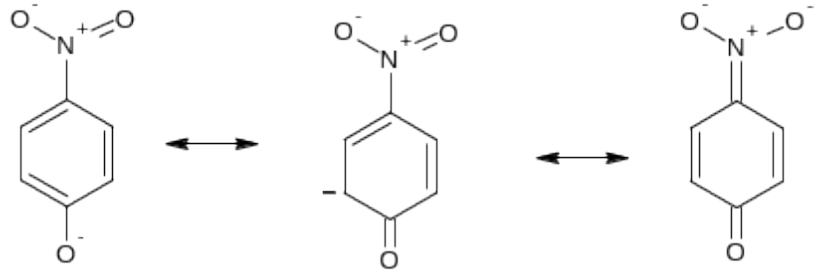
Sol: -SH is more acidic than -OH

Ans: (d)

7. The most unlikely resonating structure of $p^-$ nitrophenoxide ion is

(a)  (b)  (c)  (d) 

Sol:



Ans: (c)

8. The standard electrode potentials of $Zn^{2+}/Zn$, $Cu^{2+}/Cu$ and $Ag^+$/Ag are respectively $-0.76, 0.34$ and $0.8\ V$. The following cells were constructed

$I - Zn\left|Zn^{2+}\right\|Cu^{2+}\left|Cu\right.$

$II - Zn\left|Zn^{2+}\right\|Ag^{+}\left|Ag\right.$

$III - Cu\left|Cu^{2+}\right\|Ag^{+}\left|Ag\right.$

What is the correct order of $E^{o}_{cell}$ of these cells?

(a) $II > III > I$ (b) $II > I > III$ (c) $I > II > III$ (d) $III > I > II$

Sol:

(I) $E^{\circ} = 0.34 - (-0.76) = 1.1$

(II) $E^{\circ} = 0.8 - (-0.76) = 1.56$

(III) $E^{\circ} = 0.8 - 0.34 = 0.46$

II > I > III

Ans: (b)

9. For the reaction $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$, if $K_p = K_c(RT)^x$ where the symbols have usual meaning then the value of $x$ is (assuming ideality)

(a) $-1$ (b) $-\frac{1}{2}$ (c) $\frac{1}{2}$ (d) $1$

Sol: $x = \Delta n = 1 - 1 - \frac{1}{2} = -\frac{1}{2}$

Ans: (b)

10. Which one of the following undergoes reaction with $50\%$ sodium hydroxide solution to give the corresponding alcohol and salt of an acid?

(a) Phenol (b) Butanol (c) Benzoic acid (d) Benzaldehyde

Sol: Cannizzaro reaction / $C_6H_5CHO$

Ans: (d)

11. Rotation around bond is not restricted in:

(a) $C_2H_4$ (b) $C_2H_2$ (c) $C_2F_2$ (d) $C_2H_6$

Sol: Rotation of $e^{-}$ is restricted around $\pi$-bond.

Ans: (d)

12. The $\pi$ - bond between $Cl$ - $O$ in $ClO_4^-$ is formed by the overlapping of _____ orbitals:

(a) $sp^3$ - $2p$ (b) $2p$ - $3p$ (c) $2p$ - $3d$ (d) $3p$ - $3d$

Sol: Pure atomic orbitals used to form $\pi$ bond.

Ans: (c)

13. Which statements is incorrect:

(a) In alkali metals group, from top to bottom increase in size is maximum from $Na$ to $K$

(b) Addition of $e^-$ in P atom will be exothermic

(c) IP of F is greater than its EA value

(d) Reaction $O^-_{(g)} + S_{(g)} \longrightarrow O_{(g)} + S^-_{(g)}$ is endothermic.

Sol: $\Delta H_{eg}[O < S]$

Hence overall process will be exothermic $\Rightarrow O^- \rightarrow O$ : $IP = +41$ kJ/mol

$S \longrightarrow S^-$ $\Delta H_{eg} = -200$ kJ/mol

Ans: (d)

14. What is the lowest energy of the spectral line emitted by the hydrogen atom in the Lyman series? ($h$ =Planck's constant, $c$ =velocity of light, $R$ =Rydberg's constant).

(a) $\frac{5hcR}{36}$ (b) $\frac{4hcR}{3}$ (c) $\frac{3hcR}{4}$ (d) $\frac{7hcR}{144}$

Sol: $\frac{1}{\lambda} = R\left[\frac{1}{1^2} - \frac{1}{2^2}\right]$

$E = \frac{hc}{\lambda} = \frac{3Rch}{4}$

Ans: (c)

15. Stilbene $(PhCH = CHPh)$ can exist in two diastereomeric forms $(X)$ and $(Y)$ and $(X)$ is found to be more soluble in water than $(Y)$. Predict which of the following statement is correct?

(a) $X$ is cis isomer

(b) Stability of $X$ < stability of $Y$

(c) Melting point of $X$ <melting point of $Y$

(d) All of these

Sol: polarity of cis isomer > trans isomer. More the polarity higher the solubility and boiling point . More the symmetry higher the mp.

Both cis and trans stilbene are slightly soluble in water but for trans it is nil. So we can assume $X$ is cis isomer.cis isomer m.p. $278-279\ K$

Trans isomer m.p. $395-398\ K$

Stability of trans isomer is more than that of cis isomer

Ans: (d)

16. Observation of "Rhumann's purple" is a confirmatory test for the presence of:

(a) Starch (b) Reducing sugar (c) Protein (d) Cupric ion

Sol: Ninhydrin is a chemical used to detect ammonia, primary and secondary amine. When reacting with free amines (proteins) a deep blue or purple colour known as Rhumann's purple is produced

Ans: (c)

17. The gaseous reaction $A(g)\rightarrow 2B(g)+C(g)$ is found to be first order with respect to A. If the reaction is started with $P_A=90$ torr the pressure after $10\ \text{min}$ is found to be 180 torr. The rate constant of the reaction is

(a) $1.15\times10^{-3}\ s^{-1}$ (b) $2.30\times10^{-3}\ s^{-1}$ (c) $3.45\times10^{-3}\ s^{-1}$ (d) $4.60\times10^{-3}\ s^{-1}$

Sol:

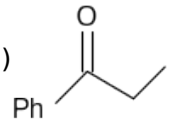
$$\underset{90-P}{A(g)} \longrightarrow \underset{2P}{2B(g)} + \underset{P}{C(g)}$$

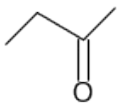
$$90+2P=180 \Rightarrow P=45$$

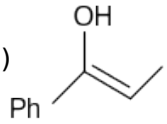
$$K=\frac{2.303}{10\times60}\log\frac{90}{90-45}=1.15\times10^{-3}\ s^{-1}$$

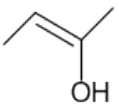
Ans: (a)

18. $Ph-C\equiv C-CH_3 \xrightarrow{Hg^{2+}+H_2SO_{4(aq)}} A$ . The major product $(A)$ formed is

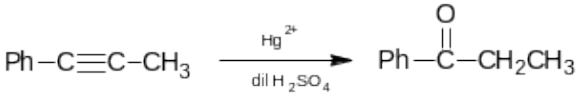
(a) 

(b) 

(c) 

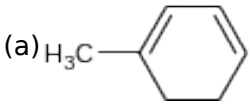
(d) 

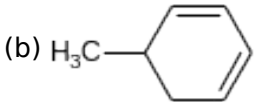

Sol:

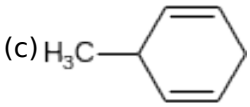


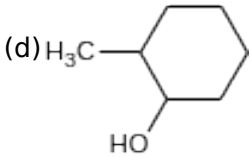

Ans: (a)

19. The major product of the following reaction is

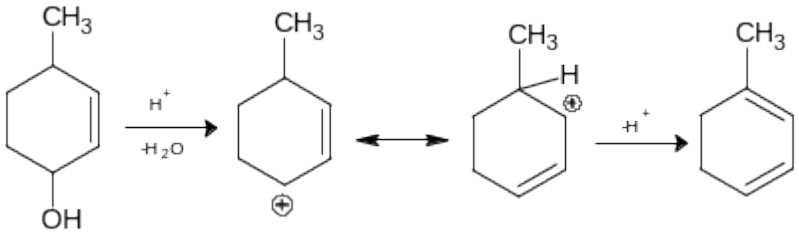

(a) 


(b) 


(c) 


(d) 


Sol:




Ans: (a)

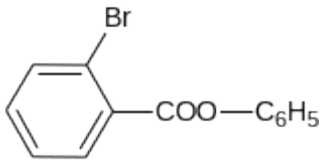
20. Which of the following configurations, forms an outer octahedral complex only?

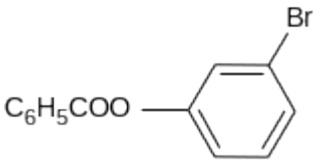
(a) $d^4$ (b) $d^8$ (c) $d^6$ (d) None of these

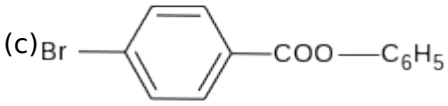
Sol: $d^4$ and $d^6$ also can form inner orbital complex if strong field ligand is used

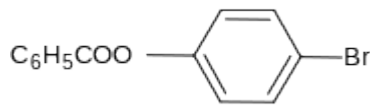
Ans: (b)

21. The major product form by the monobromination of phenyl benzoate is

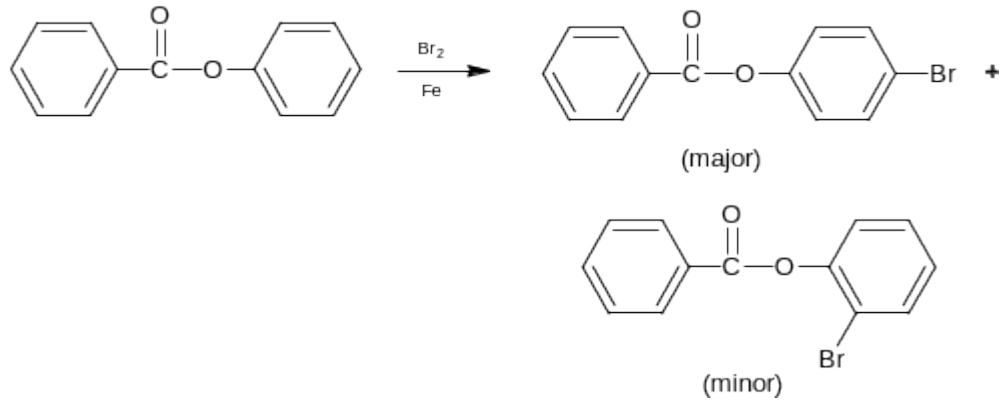
(a) 


(b) 


(c) 


(d) 


Sol:




Ans: (d)

22. In which of the following reactions there is a change in the oxidation number of nitrogen atom:

(a) $2NO_2 \longrightarrow N_2O_4$ (b) $NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$

(c) $N_2O_5 + H_2O \longrightarrow 2HNO_3$ (d) $N_2 + 3H_2 \longrightarrow 2NH_3$

Sol:

$N_2 + 3H_2 \longrightarrow 2NH_3$

There is change in ON of both N and H.

Ans: (d)

23. The equilibrium $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ is established in a container of 4 litre at a particular temperature. If number of moles of $SO_2, O_2$ and $SO_3$ at equilibrium are 2, 1 and 4 respectively. Then value of $K_C$ will be:

(a) 4 (b) 2 (c) 1 (d) $\frac{1}{4}$

Sol: $K_C = \frac{\frac{4}{4}}{\left(\frac{2}{4}\right) \times \left(\frac{1}{4}\right)^{1/2}} = 4$

Ans: (a)

24. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is $1:4$. The ratio of number of their molecule is

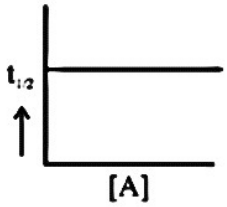
(a) $1:4$ (b) $7:32$ (c) $1:8$ (d) $3:16$

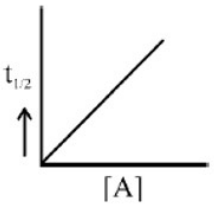
Sol: Mass of ratio of $O_2 : N_2 = \frac{x}{4x}$

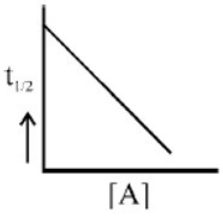
Mole or molecule ratio of $O_2 : N_2 = \frac{\left(\frac{x}{32}\right)}{\left(\frac{4x}{28}\right)} = 7 : 32$

Ans: (b)

25. Which of the following curve represents zero order reaction?

(a) 


(b) 


(c) 


(d) None of these

Sol: $t_{1/2} = \frac{[A]_0}{2k}$ or $t_{1/2} \propto [A]_0$

Ans: (b)

26. Which of the following is the wrong statement?

(a) All the actinoid elements are radioactive

(b) Alkali and alkaline earth metals are s-block elements

(c) Chalcogens and halogens are p-block elements

(d) The first member of the lanthanoid series is lanthanum

Sol: 1st member of lanthanoid series is Cerium

Ans: (d)

27. Sodium extract is heated with concentrated $HNO_3$ before testing for halogens because:

(a) $Ag_2S$ and $AgCN$ are soluble in acidic medium

(b) Silver halides are totally insoluble in nitric acid

(c) $S^{2-}$ and $CN^-$, if present, are decomposed by conc. $HNO_3$ and hence do not interfere in the test

(d) Ag reacts faster with halides in acidic medium

Sol: $S^{2-}$ and $CN^-$, if present, are decomposed by conc. $HNO_3$ and hence do not interfere in the test.

Ans: (c)

28. For the gaseous reaction, $C_2H_4 + H_2 \rightleftharpoons C_2H_6, \Delta H = -130\ kJ\ mol^{-1}$ carried in a closed vessel, the

equilibrium concentration of the $C_2H_6$ can definitely be increased by

(a) Increasing temperature and decreasing pressure

(b) Decreasing temperature and increasing pressure

(c) Increasing temperature and pressure both

(d) Decreasing temperature and pressure both

Sol: Reaction is exothermic and number of moles of product is less than that of reactant

Ans: (b)

29. At $80^{\circ}C$, the vapour pressure of pure liquid $'A'$ is $520\ \text{mm Hg}$ and that of pure liquid $'B'$ is 1000 mm Hg. If a mixture solution of $'A'$ and $'B'$ boils at $80^{\circ}C$ and $1\ \text{atm}$ pressure, the amount of $'A'$ in the mixture is $(1\ \text{atm} = 760\ \text{mm Hg})$

(a) $52\,\text{mole percent}$ (b) $34\,\text{mole percent}$ (c) $48\,\text{mole percent}$ (d) $50\,\text{mole percent}$

Sol: $520X_A + 1000(1 - X_A) = 760$

$480X_A = 240$

$X_A = 0.5 = 50$ mole percent

Ans: (d)

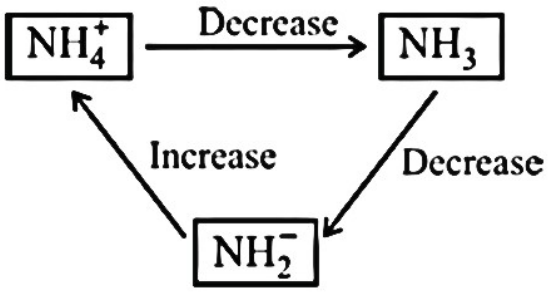
30. Which of the following would be the best (most reactive) nucleophile in the polar protic medium?

(a) $I^-$ (b) $Br^-$ (c) $Cl^-$ (d) $F^-$

Sol: In polar protic solvent $I^-$ is the best nucleophile

Ans: (a)

31. Which of the following properties show given change in $NH_4^+, NH_3$ and $NH_2^-$ ?




(a) Number of lone pair(s) at nitrogen

(b) Total number of electrons

(c) Number of p-orbitals in hybridisation of nitrogen

(d) Bond angle at nitrogen

Sol: Bond angle $\propto \frac{1}{\text{lone pair}}$

Ans: (d)

32. Urea can be detected by

(a) benedict test (b) molisch test (c) Seliwinoff's test (d) biuret test

Sol: Biuret test

Ans: (d)

33. Which of the following is an intensive property of the system?

(a) Density (b) Volume (c) Total heat capacity (d) Mass

Sol: Density

Ans: (a)

34. Consider the reaction $A \rightarrow 2B + C, \Delta H = -15 \text{ kcal.}$ The energy of activation of backward reaction is 20kcal/mol. In presence of catalyst, the energy of activation of forward reaction is $3 \text{ kcal mol}^{-1}$. At $400 \text{ K}$ the catalyst cause the rate of the forward reaction to increase by the number of times equal to

(a) $e^{3.5}$ (b) $e^{2.5}$ (c) $e^{-2.5}$ (d) $e^{2.303}$

Sol: Enthalpy change $= -15 \ kcal$

$E_{\text{backward}} = 20 \ kcal$

$E_{\text{forward}} = 20 - 15 = 5 \ kcal$

$E_{\text{forward}} (\text{catalyst}) = 3 \ kcal$

$$\frac{k_2}{k_1}=\frac{A.e^{-3/400R}}{A.e^{-5/400R}}$$

$$\frac{k_2}{k_1}=e^{(5-3)/400\times 0.002}$$

$$\frac{k_2}{k_1}=e^{2.5}$$

Ans: (b)

35. In how many of the following molecules, all atoms are in same place?

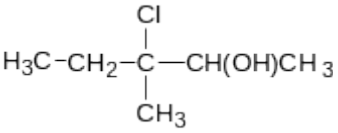
| | | | |
|---|---|---|---|
| $ClF_3$ | $H_2O$ | $PCl_3$ | $BF_3$ |
| $SF_4$ | $H_2S$ | $OCl_2$ | $SO_3$ |
| $XeF_6$ | $NH_3$ | $C_6H_6$ | $XeF_2$ |
| $XeF_4$ | $PCl_5$ | $I_2Cl_6$ | $PH_3$ |

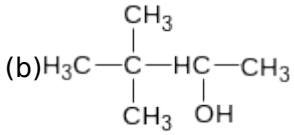
(a) 7 (b) 8 (c) 9 (d) 10

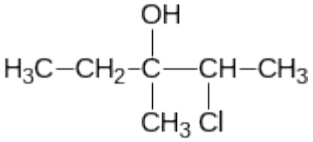
Sol: $ClF_3, H_2O, BF_3, H_2S, OCl_2, SO_3, C_6H_6, XeF_2, XeF_4$

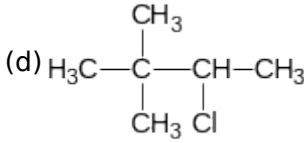
Ans: (c)

36. The major product formed when 3- methylpent-2- ene reacts with chlorine water is

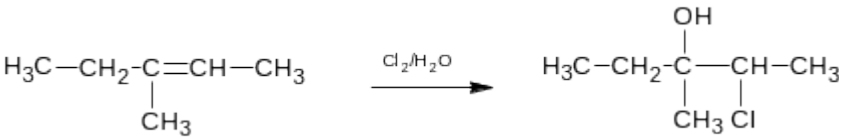
(a) 

(b) 

(c) 

(d) 

Sol:



Ans: (c)

37. The equilibrium constant of the reaction $A_2(g)+B_2(g)\rightleftharpoons 2AB(g)$ at $373\ K$ is $50$. If $1\ L$ of flask containing $1$ mole of $A_2(g)$ is connected to $2\ L$ flask containing $2$ moles $B_2(g)$ at $100^{\circ}C$, the amount of $AB$ produced at equilibrium at $100^{\circ}C$, would be

(a) $0.93\ mol$ (b) $1.87\ mol$ (c) $2.80\ mol$ (d) $3.74\ mol$

Sol:

$$A_2 + B_2 \rightleftharpoons 2AB$$

$$\frac{1-x}{3} \quad \frac{2-x}{3} \quad \frac{2x}{3}$$

$$50 = \frac{\left(\frac{2x}{3}\right)^2}{\left(\frac{1-x}{3}\right)\left(\frac{2-x}{3}\right)} = \frac{4x^2}{2-3x+x^2}$$

$$100-150x+50x^2 = 4x^2$$

$$46x^2-150x+100 = 0$$

$$x = 0.9347$$

$$2x = 1.87$$

Ans: (b)

38. What amount of bromine will be required to convert $2g$ of phenol into 2, 4, 6-tribromophenol?

(a) 4.00 (b) 6.00 (c) 10.2

(d) 20.4

Sol:

For $94\ g$ of phenol need $3\times160\ g\ Br_2$ to make 2, 4, 6-tribromo phenol 2 $\frac{3\times160\times2}{94} = 10.2127\ g$

Ans: (c)

39. The resistance of $1N$ solution of acetic acid is $250\ ohm$, when measured in a cell having a cell constant of $1.15\ cm^{-1}$. The equivalent conduction $\left(\text{in } \Omega^{-1}cm^2eq^{-1}\right)$ of $1N$ acetic acid is.....

(a) 18.4 (b) 9.2 (c) 4.6 (d) 2.3

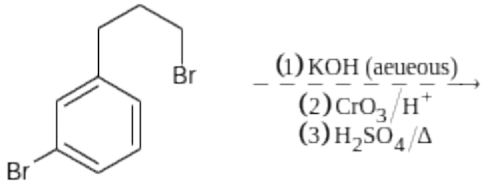
Sol: $250 = \left(\frac{1}{k}\right)\times1.15$

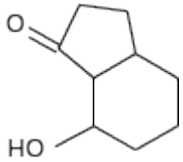
$$K = 4.6\times10^{-3}$$

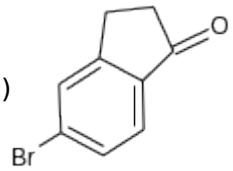
Equivalent conductance $= \frac{4.6\times10^{-3}\times1000}{1} = 4.6$

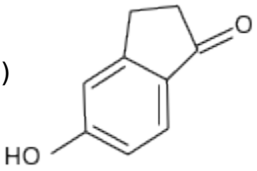
Ans: (c)

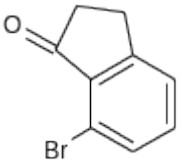
40. The major product of the following reaction is



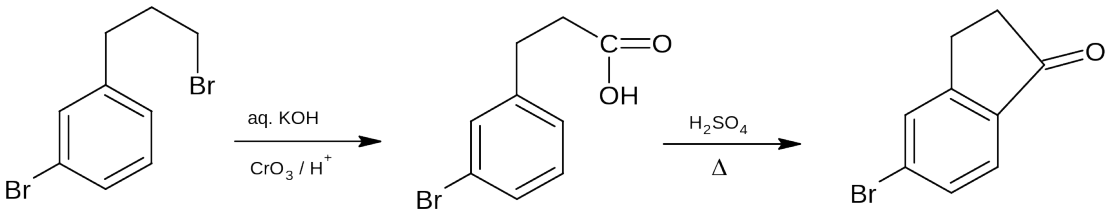

(a) 


(b) 


(c) 


(d) 


Sol:




Ans: (b)

41. Most basic hydroxide among the following is

(a) $Lu(OH)_3$ (b) $Eu(OH)_3$ (c) $Yb(OH)_3$ (d) $Ce(OH)_3$

Sol: Due to lanthanide contraction, the size of $M^{3+}$ ions [$Lu^{3+}$, $Eu^{3+}$, $Yb^{3+}$ and $Ce^{3+}$] decreases and thus, the basic strength of their hydroxides decreases.

The order of size of given $M^{3+}$ ions is $Ce^{3+} > Eu^{3+} > Yb^{3+} > Lu^{3+}$

$\therefore$ The order of basic strength of hydoxides is

$$\underset{(\text{most basic})}{Ce(OH)_3} > Eu(OH)_3 > Yb(OH)_3 > Lu(OH)_3$$

Ans: (d)

42. Which of the following represents incorrect match?

(a) $\left[Co(NH_3)_5(NO_2)\right](NO_3)_2$ : Linkage isomerism

(b) $\left[Pt(NH_3)(H_2O)Cl_2\right]$ : Geometrical isomerism

(c) $K\left[Cr(H_2O)_2(C_2O_4)_2\right]$ : Geometrical and optical

(d) $\left[Cr(H_2O)_5Cl\right]Cl_2H_2O$ : Hydrate and linkage isomerism

Sol: It exhibits only hydrate isomerism.

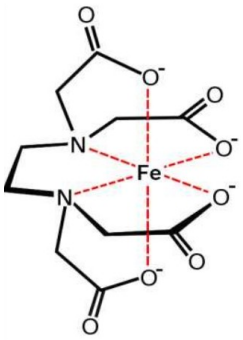
Ans: (d)

43. In the complex ion $\left[Fe(EDTA)\right]^-$, the coordination number and oxidation state of central metal ion is

(a) $CN = 6 \quad ON = +3$ (b) $CN = 4 \quad ON = -1$

(c) $CN = 4 \quad ON = +2$ (d) $CN = 3 \quad ON = +3$

Sol:




Ans: (a)

44. Which of the following can show oxidation state higher than +3?

(a) B (b) Al (c) Ce (d) Ga

Sol: Boron (B), aluminum (Al) and gallium (Ga) are present in IIIA group. They show +3 oxidation state. While cerium (Ce) is a lanthanoid. It is present in lanthanide series. It shows +3 and +4 oxidation states.

Ans: (c)

45. $N_2$ and $O_2$ are converted into monoanions $N_2^-$ and $O_2^-$ respectively, which of the following statement is wrong?

(a) In $N_2^-$, the $N-N$ bond weakens (b) In $O_2^-$, the $O-O$ bond order decrease

(c) In $O_2^-$ bond length increases (d) $N_2^-$ becomes diamagnetic

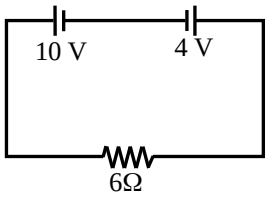
Sol: $N_2$ was diamagnetic $N_2^-$ becomes paramagnetic.

Ans: (d)

## Physics

**Multiple Choice Questions with one correct answer. A correct answer carries 4 marks. A wrong answer carries a penalty of 1 mark. 45 x 4 = 180**

46. The power consumed by the $4\ \text{V}$ battery is




(a) $4\ \text{W}$ (b) $8\ \text{W}$ (c) $7\ \text{W}$

(d) $2\ \text{W}$

Sol: Current in the circuit,

$$I = \frac{E_{\text{net}}}{R_{\text{net}}}$$

$$\Rightarrow I = \frac{10 - 4}{6} = 1\ \text{A}$$

$\therefore$ Power consumed by battery

$$P = V \times I$$

$$\Rightarrow P = 1 \times 4 = 4\ \text{W}$$

Ans: (a)

47. Intensities of the two light waves are $I$ and $4I$. The maximum intensity $I_{\max}$ of resultant wave after superposition is

(a) $5I$ (b) $9I$ (c) $16I$ (d) $25I$

Sol: Given: $I_1 = I, I_2 = 4I$

Resultant intensity $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

Resultant intensity $I$ will be maximum when $\phi = 0$

$$I_{\max} = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos 0^\circ = I + 4I + 2\sqrt{I.4I}.1$$

$$I_{\max} = 9I$$

Ans: (b)

48. The force required to row a boat over the sea is proportional to the square of the speed of the boat. It is found that it takes $24$ hp to row a certain boat at a speed of $8\ \text{km hr}^{-1}$. When speed is doubled, then required horse power is

(a) $12\,\text{hp}$ (b) $48\,\text{hp}$ (c) $96\ \text{hp}$ (d) $192\ \text{hp}$

Sol: Given,

$F \propto v^2$ ... (i)

As power is given by

$P = Fv$ ... (ii)

Therefore from (i) and (ii),

$P \propto v^3$

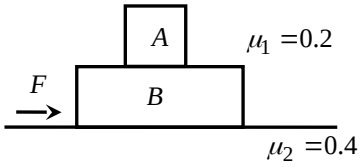
$\frac{P_2}{P_1} = \left(\frac{v_2}{v_1}\right)^3$; $\frac{P_2}{24} = \left(\frac{2v}{v}\right)^3$

$\frac{P_2}{24} = 8$

$P_2 = 192\ \text{hp}$

Ans: (d)

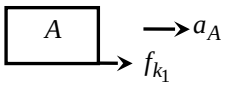
49. In the figure, mass of block $A$ is $m_A = 2\ \text{kg}$ and mass of block $B$ is $m_B = 4\ \text{kg}$. For what minimum value of force, $F$, block $A$ starts slipping over block $B$ $\left(g = 10\ \text{ms}^{-2}\right)$




(a) $24\ \text{N}$ (b) $36\ \text{N}$ (c) $12\ \text{N}$ (d) $20\ \text{N}$

Sol: Let $a_A$ be maximum accelerate of $A$. $f_{k_1}$ is maximum frictional force acting on $A$

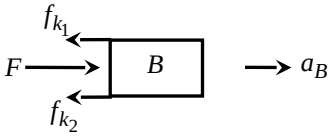
For $A$, $m_A a_A = f_{k_1}$




$m_A a_A = \mu_1 m_A g$

$a_A = \mu_1 g$ ... (i)

For $B$,




$F - \left(f_{k_1} + f_{k_2}\right) = m_B a_B$;

$$a_B = \frac{(F - \mu_1 m_A g - \mu_2 (m_A + m_B) g)}{m_B} \quad \text{... (ii)}$$

For slipping of $A$ over $B$; $a_B \geq a_A$

$$\frac{(F - \mu_1 m_A g - \mu_2 (m_A + m_B) g)}{m_B} \geq \mu_1 g \quad \Rightarrow \quad F \geq (\mu_1 m_A g + \mu_2 (m_A + m_B) g + \mu_1 m_B g)$$

$$F \geq (0.2 \times 2 \times 10) + (0.4 \times 6 \times 10) + (0.2 \times 4 \times 10)$$

$F \geq 36$ N; $F_{\min} = 36$ N

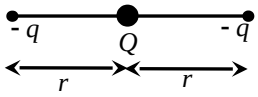
Ans: (b)

50. Which one of the following is a simple harmonic motion?
    (a) motion of particle in transverse wave moving through a string fixed at both ends
    (b) earth spinning about its own axis
    (c) ball bouncing between two rigid vertical walls
    (d) particle moving in a circle with uniform speed

    Sol:
    Simple harmonic motion of particles sets up wave in the string, fixed at both two ends, while
    earth spinning about its own axis, ball bouncing between two rigid vertical walls and particle moving in a circle with uniform speed, all these are periodic but not simple harmonic.
    Ans: (a)

51. Three charges $-q, Q$ and $-q$ are placed at equal distances on a straight line sequentially. If the potential energy of the system of charges is zero, then the ratio $Q:q$ is
    (a) $4:1$ (b) $1:2$ (c) $1:8$ (d) $1:4$

    Sol: $u = \frac{-2kQq}{r} + \frac{kq^2}{2r} = 0$




$$\frac{2kQq}{r} = \frac{kq^2}{2r}; \quad \frac{Q}{q} = \frac{1}{4}$$

    Ans: (d)

52. A particle of mass $m$ is located in a field such that its potential energy is given by $U(x) = U_0(1 - \cos ax)$ where $U_0$ and $a$ are positive constants. The period of small oscillations is

(a) $2\pi\sqrt{\frac{U_0}{ma^2}}$ (b) $2\pi\sqrt{\frac{mU_0}{a^2}}$ (c) $2\pi\sqrt{\frac{a}{mU_0}}$ (d) $2\pi\sqrt{\frac{m}{U_0a^2}}$

Sol: Given potential energy is

$U(x)=U_0(1-\cos ax)$

Therefore force on the particle is given by

$F=-\frac{dU(x)}{dx}=-U_0a\sin(ax)$

Using small angle approximation, $\sin(ax)\approx ax$

Therefore $F=-U_0a^2x$

$\frac{dv}{dt}=-\left(\frac{U_0a^2}{m}\right)x$ ... (i)

Comparing (i) with standard equation for SHM

$\frac{dv}{dt}=-(\omega^2)x$ ; $\omega^2=\frac{U_0a^2}{m}$ ; $T=2\pi\sqrt{\frac{m}{U_0a^2}}$

Ans: (d)

53. A uniform metal wire is used in a simple pendulum. If the room temperature rises by $10^\circ C$, and the coefficient of linear expansion of the metal of the wire is $2\times10^{-6}{}^\circ C^{-1}$, then the time period of the pendulum will have increase by

(a) $2\times10^{-5}\%$ (b) $0.5\times10^{-3}\%$ (c) $2\times10^{-3}\%$ (d) $1\times10^{-3}\%$

Sol: $T=2\pi\sqrt{\frac{l}{g}}$ ; $\frac{\Delta T}{T}=\frac{1}{2}\frac{\Delta l}{l}=\frac{1}{2}\alpha\Delta\theta$

% change in the time period $=\frac{\Delta T}{T}\times100=\frac{1}{2}\alpha\Delta\theta\times100=\frac{1}{2}\times2\times10^{-6}\times10\times100$ $=10^{-3}\%$

Ans: (d)

54. If an alpha particle and a proton are accelerated from rest by a potential difference of $1\text{ MeV}$, then the ratio of their kinetic energies will be

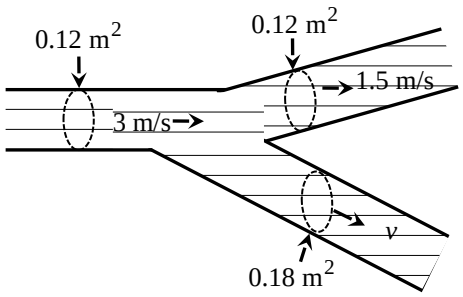
(a) $3:1$ (b) $1:1$ (c) $2:1$ (d) $4:1$

Sol: From conservation of mechanical energy

$\Delta KE=q(V_f-V_i)$ ; $\frac{K_\alpha}{K_p}=\frac{2e(V)}{e(V)}$ ; $\frac{K_\alpha}{K_p}=\frac{2}{1}$

Ans: (c)

55. An incompressible liquid flows in a tube, as shown in the figure. The speed of the liquid in the lower branch will be




(a) $1.0\ \text{ms}^{-1}$

(b) $1.5\ \text{ms}^{-1}$

(c) $2.5\ \text{ms}^{-1}$

(d) $3.0\ \text{ms}^{-1}$

Sol:

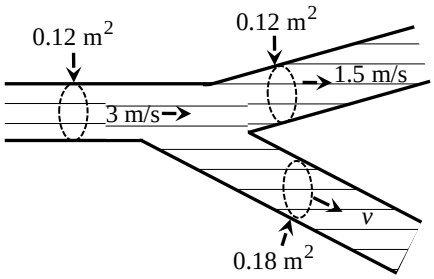
From equation of continuity

$$Av = A_1v_1 + A_2v_2$$

$$(0.12)(3) = (0.12)(1.5) + (0.18)v$$

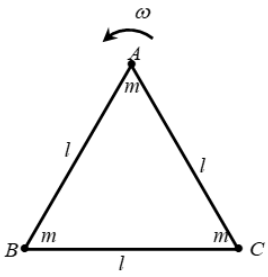
$$0.18 = (0.18)v$$

$$v = 1\ \text{m/s}$$




Ans: (a)

56. An equilateral triangular frame is made of three thin massless rods. Three point masses each of mass $m$ are fixed at vertices of the frame as shown in the figure. The system is rotated with uniform angular speed $\omega$ about a fixed axis passing through $A$ and normal to the plane of triangular frame. Neglect the effect of gravity. The tension in rod, connecting the masses $B$ and $C$, is




(a) $m\omega^2 l$

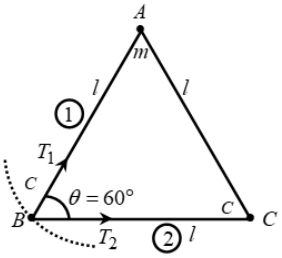
(b) $\frac{m\omega^2 l}{2}$

(c) $\frac{\sqrt{3}}{2}m\omega^2 l$

(d) zero

Sol: $B$ moves in a circle (shown by the dashed curve) of radius $l$ with uniform speed.

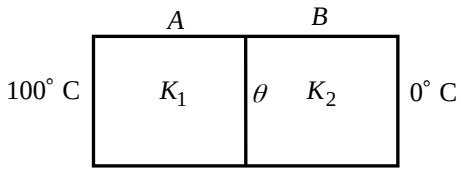
Massless rod $(1)$ can exert force $T_1$ on $B$ only along its length i.e. towards the centre of the circular path. Hence $T_1$ contributes only centripetal acceleration to $B$.



The tension in rod $(2)$, that is, $T_2$ can contribute both tangential and centripetal acceleration to $B$. As the angular speed is uniform, so tangential acceleration of $B$ is zero. $T_2 \sin\theta = 0 \Rightarrow T_2 = 0$ Hence the tension in rod, connecting the masses $B$ and $C$, is zero.

Ans: (d)

57. Two rectangular blocks, $A$ and $B$ of different metals, have the same length and same area of cross-section. They are kept in such a way that their cross-sectional areas are in contact. The temperature at one end of $A$ is $100^\circ C$ and that of $B$ at the other end is $0^\circ C$ as shown in the figure. If the ratio of their thermal conductivity is $1:3$, then under steady-state, the temperature $(\theta)$ of the junction in contact will be

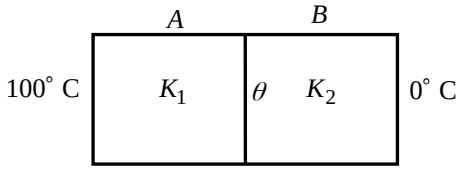



(a) $25^\circ C$ (b) $50^\circ C$ (c) $75^\circ C$ (d) $100^\circ C$

Sol: It is given that $\frac{K_1}{K_2} = \frac{1}{3}$; $A_1 = A_2 = A,\ l_1 = l_2 = l;\ \theta_1 = 100^\circ C,\ \theta_2 = 0^\circ C$

In steady state

$$\frac{AK_1(\theta_1 - \theta)}{l} = \frac{AK_2(\theta - \theta_2)}{l}$$




The temperature of the junction in contact

$$\theta = \frac{K_1\theta_1 + K_2\theta_2}{K_1 + K_2}$$

Let $K_1 = K$ and $K_2 = 3K$,

then $\theta = \frac{K \times 100 + 3K \times 0}{K + 3K} = 25^\circ C$

Ans: (a)

58. A Newtonian fluid fills the clearance between a shaft and a sleeve. When a force of $800\ N$ is applied to the shaft, parallel to the sleeve, the shaft attains a speed of $2\ cms^{-1}$. If a force of $2.4\ kN$ is applied instead, the shaft would move with a speed of

(a) $2\ cms^{-1}$ (b) $15\ cms^{-1}$ (c) $6\ cms^{-1}$ (d) $9\ cms^{-1}$

Sol: Viscous force is given by $F = -\eta A\frac{\partial V}{\partial x}$

$\frac{F_1}{F_2} = \frac{v_1}{v_2}$ ; $\frac{800}{2400} = \frac{2}{v_2}$

$v_2 = 6\ \text{cm/s}$

Ans: (c)

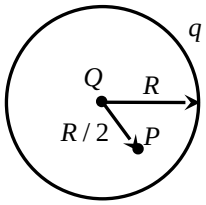
59. A thin spherical conducting shell of radius $R$ is given a charge $q$. Another charge $Q$ is placed at the centre of the shell. The electrostatic potential at the point $P$ at a distance $\frac{R}{2}$ from the centre of the shell is

(a) $\frac{2Q}{4\pi\varepsilon_0 R} - \frac{2q}{4\pi\varepsilon_0 R}$ (b) $\frac{2Q}{4\pi\varepsilon_0 R} + \frac{q}{4\pi\varepsilon_0 R}$ (c) $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$ (d) $\frac{2Q}{4\pi\varepsilon_0 R}$

Sol:

Potential at $P$ due to point charge $Q$

$V_1 = \frac{Q}{4\pi\varepsilon_0\left(\frac{R}{2}\right)}$ ... (i)




Potential due to charge $q$ on shell at a point $P$ inside shell

$V_2 = V_{\frac{R}{2}} = V_{\text{surface}}$

$V_2 = \frac{q}{4\pi\varepsilon_0 R}$ ... (ii)

$V_{\text{total}} = V_1 + V_2$

$V_{\text{total}} = \frac{2Q}{4\pi\varepsilon_0 R} + \frac{q}{4\pi\varepsilon_0 R}$

Ans: (b)

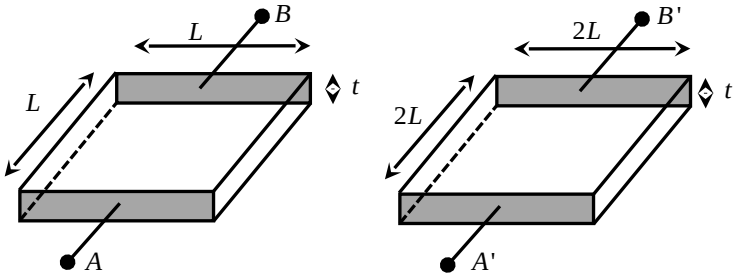
60. Equal number of molecules of two gases are in thermal equilibrium. If $P_a, P_b$ and $V_a, V_b$ are their respective pressures and volumes, then which of the following relations is true?

(a) $P_a \neq P_b; V_a \neq V_b$ (b) $P_a = P_b; V_a \neq V_b$ (c) $\frac{P_a}{V_a} = \frac{P_b}{V_b}$ (d) $P_a V_a = P_b V_b$

Sol: Thermal equilibrium implies that the temperature of gases is same and since number of molecules is also same, hence, using $PV = nRT$, $P_a V_a = P_b V_b$

Ans: (d)

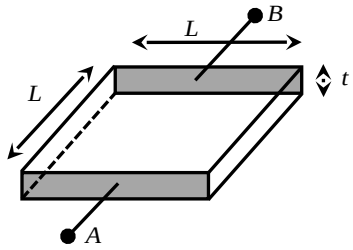
61. The resistance of metal sheet $1$ between points $A$ and $B$ is $R_1$ and the resistance of sheet $2$ between points $A'$ and $B'$ is $R_2$ as shown in the figure. Both sheets are made up of same metal. The value of the ratio $\frac{R_1}{R_2}$ is




Sheet 1 Sheet 2

(a) $1$ (b) $\frac{1}{2}$ (c) $2$ (d) $4$

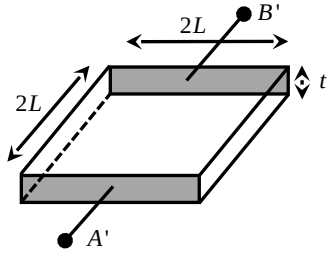
Sol:




Sheet 1

For sheet 1, resistance is,

$R_1 = \frac{\rho L}{Lt} = \frac{\rho}{t}$ ... (i) $\left(\text{Using } R = \rho\frac{l}{A}\right)$




Sheet 2

For sheet 2, resistance is, $R_2 = \frac{\rho 2L}{2L \times t} = \frac{\rho}{t}$ ... (ii)

From (i) and (ii), $\therefore \frac{R_1}{R_2}=1$

Ans: (a)

62. In the product $\vec{F}=q\left(\vec{v}\times\vec{B}\right)=\vec{v}\times\left(B\hat{i}+B\hat{j}+B_0\hat{k}\right)$, for $q=1$ and $\vec{v}=2\hat{i}+4\hat{j}+6\hat{k}$ and $\vec{F}=4\hat{i}-20\hat{j}+12\hat{k}$

What will be the complete expression for $\vec{B}$?

(a) $6\hat{i}+6\hat{j}-8\hat{k}$ (b) $-8\hat{i}-8\hat{j}-6\hat{k}$ (c) $-6\hat{i}-6\hat{j}-8\hat{k}$ (d) $8\hat{i}+8\hat{j}-6\hat{k}$

Sol: Given $q=1$ and $\vec{v}=2\hat{i}+4\hat{j}+6\hat{k}$ and $\vec{F}=4\hat{i}-20\hat{j}+12\hat{k}$

Also given, $\vec{F}=q\left(\vec{v}\times\vec{B}\right)$

$=q\vec{v}\times\left(B\hat{i}+B\hat{j}+B_0\hat{k}\right)$

$\Rightarrow\left(4\hat{i}-20\hat{j}+12\hat{k}\right)=-1\times\left[\left(2\hat{i}+4\hat{j}+6\hat{k}\right)\times\left(B\hat{i}+B\hat{j}+B_0\hat{k}\right)\right]$

Thus, calculating values of RHS,

$$\vec{v}\times\vec{B}=\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\2&4&6\\B&B&B_0\end{vmatrix}$$

$=\hat{i}(4B_0-6B)-\hat{j}(2B_0-6B)+\hat{k}(2B-4B)$

Comparing L.H.S and R.H.S,

$4B_0-6B=4$ ; $-(2B_0-6B)=-20$

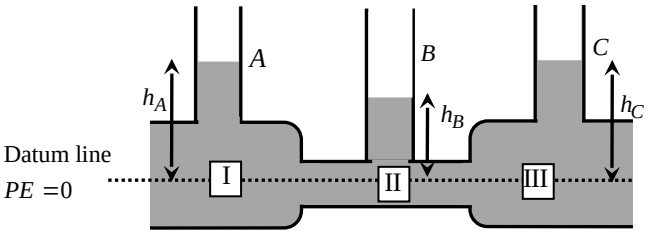
$2B-4B=12\Rightarrow B=-6$

From (2) and (3) $B=-6$ and $B_0=-8$

$\therefore\vec{B}=-6\hat{i}-6\hat{j}-8\hat{k}$

Ans: (c)

63. A non-viscous liquid is flowing through a horizontal pipe as shown in the figure. Three tubes $A, B$ and $C$ of same radius are connected to the pipe. The radii of the pipe segments I, II and III are $2\text{ cm}, 1\text{ cm}$ and $2\text{ cm}$ respectively. It can be said that the




(a) height of the liquid in the tube $A$ is maximum

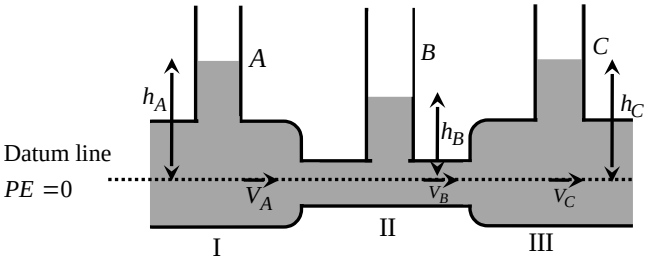
(b) height of the liquid in the tubes $A$ and $B$ is same

(c) height of the liquid in all the three tubes is same

(d) height of the liquid in the tubes $A$ and $C$ is same

Sol: Bernoulli's equation at datum line

$$P_A + \frac{1}{2}\rho V_A^2 + \rho gh = P_B + \frac{1}{2}\rho V_B^2 + \rho gh = P_C + \frac{1}{2}\rho V_C^2 + \rho gh$$




Since $h = 0$

$$P_A + \frac{1}{2}\rho V_A^2 = P_B + \frac{1}{2}\rho V_B^2 = P_C + \frac{1}{2}\rho V_C^2$$

$$\rho gh_A + \frac{1}{2}\rho V_A^2 = \rho gh_B + \frac{1}{2}\rho V_B^2 = \rho gh_C + \frac{1}{2}\rho V_C^2 \quad \ldots (i)$$

Using continuity equation, $AV$ =constant

$$A_A V_A = A_B V_B = A_C V_C; \quad \pi(2)^2 V_A = \pi(1)^2 V_B = \pi(2)^2 V_C$$

$$4V_A = V_B = 4V_C \quad \ldots (ii)$$

From (i) and (ii), $h_A = h_C > h_B$

Ans: (d)

64. An object will continue moving uniformly until

(a) the resultant fore acting on it begins to decrease

(b) the resultant force on it is zero

(c) the resultant force is at right angle to its rotation

(d) the resultant force on it is increased continuously

Sol: From Newton's first law an object will continue to move uniformly until the resultant force on it is zero. $F = \frac{mdv}{dt}$, If $F = 0$, then $\frac{dv}{dt} = 0 \Rightarrow v =$ constant

Ans: (b)

65. Equal masses of water (density of water $= 1\ g/cc$) and a liquid of density $2g/cc$ are mixed together, then the mixture has a density of

(a) $\frac{2}{3}\ g/cc$ (b) $\frac{4}{3}\ g/cc$ (c) $\frac{3}{2} g/cc$ (d) $3\ g/cc$

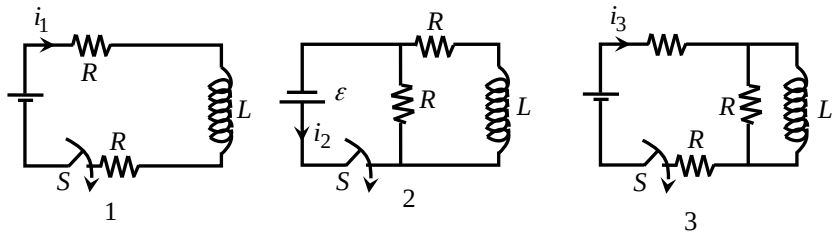
Sol: If two liquids of equal masses and different densities are mixed together, then the density of the mixture is

$$\rho = \frac{m_1 + m_2}{V_1 + V_2} = \frac{m + m}{\frac{m}{\rho_1} + \frac{m}{\rho_2}} = \frac{2}{\left(\frac{1}{\rho_1} + \frac{1}{\rho_2}\right)}$$

$\rho = \frac{2\rho_1\rho_2}{\rho_1 + \rho_2}$; $\rho = \frac{2 \times 1 \times 2}{1+2} = \frac{4}{3}$; $\rho = \frac{4}{3} g/cc$

Ans: (b)

66. The figure shows three circuits with identical batteries, inductors and resistances. Rank the circuits in decreasing order, according to the current through the battery just after the switch is closed.




(a) $i_2 > i_3 > i_1$ (b) $i_2 > i_1 > i_3$ (c) $i_1 > i_2 > i_3$ (d) $i_1 > i_3 > i_2$

Sol: Inductor behave like a infinite resistnce

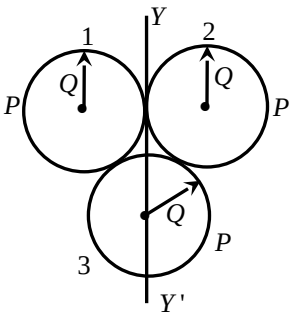
At $t = 0$, Current through inductor is zero, because of inductor behave like a infinite resistor.

At $t = \infty$, Inductor behave like a conductor

$\Rightarrow i_1 = \frac{E}{\infty} = 0,\ i_2 = \frac{E}{R}$ and $i_3 = \frac{E}{3R} \Rightarrow i_2 > i_3 > i_1$

Ans: (a)

67. Three rings, each of mass $P$ and radius $Q$ are arranged as shown in the figure. The moment of inertia of the arrangement about $YY'$ axis will be



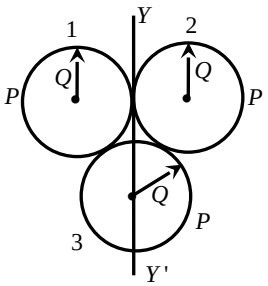

(a) $\frac{7}{2}PQ^2$

(b) $\frac{2}{7}PQ^2$

(c) $\frac{2}{5}PQ^2$

(d) $\frac{5}{2}PQ^2$

Sol: For ring $1$ and $2$ using parallel axis theorem,




$I_1 = I_2 = I_{cm} + Md^2$

$I_1 = I_2 = \frac{1}{2}PQ^2 + PQ^2$

$I_1 = I_2 = \frac{3}{2}PQ^2$

For ring $3$, $I_3 = \frac{1}{2}PQ^2$

Moment of inertia of the arrangement, about $YY'$ axis, $I = I_1 + I_2 + I_3$

$I = \frac{3}{2}PQ^2 + \frac{3}{2}PQ^2 + \frac{1}{2}PQ^2$; $I = \frac{7}{2}PQ^2$

Ans: (a)

68. A gas in airtight container is heated from $25^\circ C$ to $90^\circ C$. The density of the gas will

(a) increase slightly

(b) increase considerably

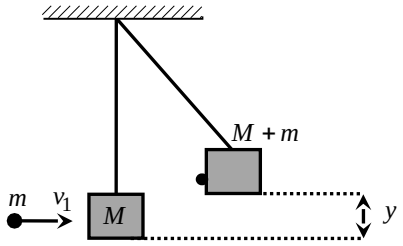
(c) remain the same

(d) decrease slightly

Sol: As mass and volume of the gas in an airtight container will remain same, so density will also remain same.

Ans: (c)

69. A bullet of mass $m$ moving with velocity $v_1$ strikes a suspended wooden block of mass $M$ as shown in the figure and sticks to it. If the block rises to a height $y$, the initial velocity $v_1$ of the bullet is




(a) $v_1 = \frac{m+M}{m}\sqrt{2gy}$

(b) $v_1 = \sqrt{2gy}$

(c) $v_1 = \frac{M+m}{M}\sqrt{2gy}$

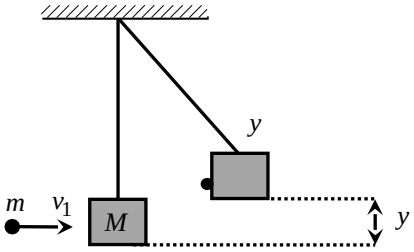
(d) $v_1 = \frac{m}{m+M}\sqrt{2gy}$

Sol: Let the speed of combined system (block + bullet) is $v_2$ just after collision

Using conservation of linear momentum

$mv_1 = (M+m)v_2$

$v_2 = \left(\frac{m}{M+m}\right)v_1$ ... (i)




As combined system (block + bullet) rises to a height $y$, then

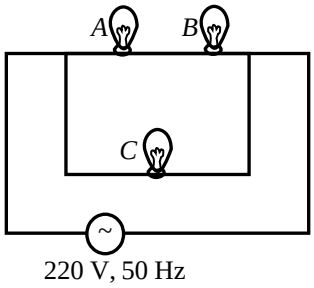
using conservation of mechanical energy

$0 + \frac{1}{2}(M+m)v_2^2 = (M+m)gy$ ... (ii)

From (i) and (ii), $\therefore v_1 = \left(\frac{m+M}{m}\right)\sqrt{2gy}$

Ans: (a)

70. In the arrangement of 3 bulbs $A, B$ and $C$, each of rating $220\text{ V}, 100\text{ W}$, as shown in the figure, the total power consumption will be

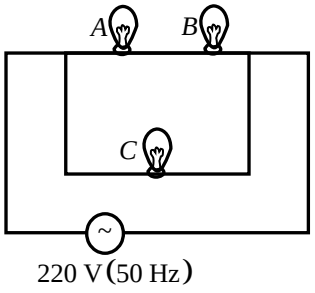



(a) $300\ \text{W}$ (b) $50\ \text{W}$ (c) $150\ \text{W}$ (d) $25\ \text{W}$

Sol: For the two bulbs in series, equivalent power is

$$P' = \frac{P_1 P_2}{P_1 + P_2} = \frac{PP}{P+P}; \quad P' = \frac{(100)(100)}{100+100}$$

$$P' = 50\ \text{W}$$




3rd bulb consumes $100\ \text{W}$ as it is connected to rated voltage

Therefore overall equivalent power is $P_{eq} = P' + 100\ \text{W}$

$$P_{eq} = 150\ \text{W}$$

Ans: (c)

71. A nucleus of mass number 189 splits into two nuclei having mass number 125 and 64 . The ratio of radius of two daughter nuclei respectively is

(a) $1:1$ (b) $4:5$ (c) $5:4$ (d) $25:16$

Sol:

Radius of nuclei with mass number $A$ varies as

$$R = R_0 A^{1/3}$$

$$\frac{R_1}{R_2} = \left(\frac{125}{64}\right)^{1/3} = \frac{5}{4} = 5:4$$

Ans: (c)

72. Which of the following statement is not true?

(a) Coefficient of viscosity is a scalar quantity (b) Surface tension is a scalar quantity

(c) Pressure is a vector quantity (d) Relative density is a scalar quantity

Sol: Pressure is a scalar quantity

Ans: (c)

73. Force necessary to pull a circular plate of radius $5\text{ cm}$ from water surface for which surface tension is $75\text{ dynes cm}^{-1}$, is

(a) $30\text{ dynes}$ (b) $60\text{ dynes}$ (c) $750\text{ dynes}$ (d) $750\pi\text{ dynes}$

Sol: The length of the circular plate on which the force will act $=2\pi R$

Force to pull $=$(surface tension) $\times$(length)

$F=75\times2\pi\times5$; $F=750\pi$ dynes

Ans: (d)

74. A flux of $10^{-3}\text{ Wb}$ passes through a strip having an area $A=0.02\text{ m}^2$. The plane of the strip is at an angle of $60^\circ$ to the direction of a uniform field $B$. The value of $B$ is

(a) $4.1\times10^{-2}\text{ T}$ (b) $5.8\times10^{-2}\text{ T}$ (c) $4.1\times10^{-3}\text{ T}$ (d) $5.8\times10^{-3}\text{ T}$

Sol:

As the ange between field and plane is $60^\circ$, therefore angle between area vector and magnetic field is, $\theta=30^\circ$

Magnetic flux through the strip is

$$\phi=BA\cos\theta$$

$$10^{-3}=B(0.02)\cos30^\circ$$

$$B=\frac{10^{-3}}{(0.02)\left(\frac{\sqrt{3}}{2}\right)}$$

$$B=0.058\text{ T}=5.8\times10^{-2}\text{ T}$$

Ans: (b)

75. A particle is moving along a circular path with a constant speed. The acceleration of the particle is constant in

(a) magnitude (b) direction

(c) both magnitude and direction (d) neither magnitude nor direction

Sol:

For constant speed along circular path, acceleration is centripetal, which is constant in magnitude $a_c=\frac{v^2}{r}$ and always directed towards the center, so the direction changes continuously.

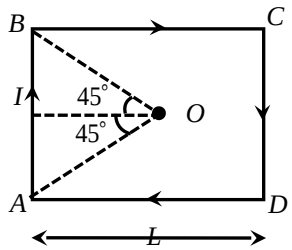
Ans: (a)

76. A square conducting loop of side length $L$ carries a current $I$. The magnetic field at the centre of the loop is

(a) $\frac{\mu_0 I}{\sqrt{2}\pi L}$ (b) $\frac{\mu_0 I}{\pi L}$ (c) $2\sqrt{2}\frac{\mu_0 I}{\pi L}$ (d) $\frac{\sqrt{2}\mu_0 I}{\pi L}$

Sol: Field due to wire $AB$ at the centre,

$$B_{AB} = \frac{\mu_0 I}{4\pi\left(\frac{L}{2}\right)}(\sin 45^\circ + \sin 45^\circ)$$




$$B_{center} = 4\frac{\mu_0 I}{4\pi\left(\frac{L}{2}\right)}\left(\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}}\right)$$

$B_{center} = 4B_{AB}$;

$$B_{center} = 2\sqrt{2}\frac{\mu_0 I}{\pi L}$$

Ans: (c)

77. The ground state energy of hydrogen atom is $-13.6\text{eV}$. The energy needed to ionize hydrogen atom from its second excited state will be:

(a) $13.6\text{eV}$ (b) $6.8\text{eV}$ (c) $1.51\text{eV}$ (d) $3.4\text{eV}$

Sol:

The energy levels of a hydrogen atom are given by the formula:

$E_n = -\frac{13.6\text{eV}}{n^2}$ where $E_n$ is the energy of the $n$-th energy level.

The ground state of hydrogen ( $n=1$ ) has an energy of $-13.6\text{eV}$ as mentioned, which means that it would take $+13.6\text{eV}$ to ionize it (remove the electron completely) from this state, since ionization implies moving the electron to a state of zero energy.

The second excited state of hydrogen is when $n=3$ (as $n=1$ is the ground state and $n=2$ is the first excited state). Thus, the energy of the second excited state is :

$$E_3 = -\frac{13.6\text{cV}}{3^2} = -\frac{13.6\text{cV}}{9} = -1.51\text{eV}$$

Since ionization implies moving the electron from its current energy level to 0 energy, the energy required to ionize the atom from this state is the absolute value of its current energy state. So, it will take $+1.51\text{eV}$ to ionize a hydrogen atom from its second excited state.

Ans: (c)

78. A force is acting on a $30\ g$ particle in such a way that the position of the particle as a function of time is given by $x = 3t - 4t^2 + t^3$, where $x$ is in meters and $t$ is in seconds. The work done during the first $4$ seconds is

(a) $5.28\ J$ (b) $4.50\ J$ (c) $3.48\ J$ (d) $9.26\ J$

Sol: $v = \frac{dx}{dt} = 3 - 8t + 3t^2$

Speed at $t = 0$ is

$v_0 = 3\ m/s$

Speed at $t = 4$ is

$v_4 = 19\ m/s$

According to work energy theorem

$W = \frac{1}{2}m\left(v_4^2 - v_0^2\right)$

$W = \frac{1}{2} \times 0.03 \times \left(19^2 - 3^2\right) = 5.28\ J$

Ans: (a)

79. If the de-Broglie wavelength is $\lambda_0$ for the protons accelerated through $100\ V$, then the de-Broglie wavelength for alpha particles accelerated through the same voltage will be

(a) $\lambda_0$ (b) $\frac{\lambda_0}{2}$ (c) $\frac{\lambda_0}{2\sqrt{2}}$ (d) $\frac{\lambda_0}{\sqrt{2}}$

Sol: De-Broglie wavelength is $\lambda = \frac{h}{\sqrt{2mK}} = \frac{h}{\sqrt{2mqV}}$

Therefore, de-Broglie wavelength for protons.

$\lambda_0 = \frac{h}{\sqrt{2(m_p)eV_0}}$ ... (i)

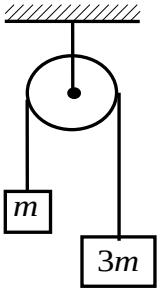
de-Broglie wavelength for alpha particles

$\lambda' = \frac{h}{\sqrt{2(4m_p)(2e)V_0}}$ ... (ii)

From (i) and (ii), $\frac{\lambda_0}{\lambda'} = \sqrt{8} = 2\sqrt{2}$ ; $\lambda' = \frac{\lambda_0}{2\sqrt{2}}$

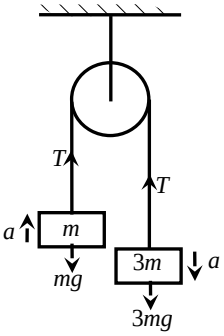
Ans: (c)

80. A pulley, fixed with ceiling, carries a string with blocks of masses $m$ and $3m$ attached to its ends as shown in the figure. The masses of string and pulley are negligible. When the system is released, its centre of mass moves with acceleration




(a) $g$ (b) $\frac{g}{5}$ (c) $\frac{g}{4}$ (d) zero

Sol:




$3mg - T = 3ma$ ... (i)

$T - mg = ma$ ... (ii)

From (i) and (ii), $a = \frac{3mg - mg}{(3m + m)} = \frac{g}{2}$, and $T = \frac{3mg}{2}$

Acceleration of centre of mass

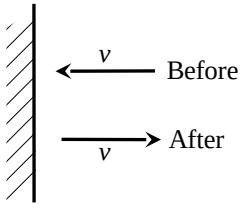
$$a_{cm} = \frac{3m\left(\frac{g}{2}\right) - m\left(\frac{g}{2}\right)}{(3m + m)} = \frac{g}{4}$$

Ans: (c)

81. A body of mass $m$ collides against a wall with the velocity $v$ and rebounds with the same speed. The magnitude of change of momentum of the body is

(a) $2\,mv$ (b) $mv$ (c) $\frac{1}{2}\,mv$ (d) $0$

Sol: Change in momentum




$\Delta p = p_f - p_i$; $\Delta p = mv - (-mv)$; $\Delta p = 2mv$

Ans: (a)

82. Two photons having

(a) equal wavelength have unequal linear momentum

(b) equal energy have equal linear momentum

(c) equal frequency have equal linear momentum

(d) equal linear momentum have equal wavelength

Sol: The magnitude of momentum and de-Broglie wavelength are related as $\lambda = \frac{h}{p}$

Therefore if linear momentum is same, then wavelength is equal but if wavelength is same, then only the magnitude of momentum is same while direction might be different.

Ans: (d)

83. Which of the following statements is correct?

(a) a body has a constant velocity and still it can have a varying speed

(b) a body has a constant speed but it can have a varying velocity

(c) a body having constant speed cannot have any acceleration

(d) a body in motion under a force acting upon it must always have work done upon it

Sol: If velocity is constant, then both magnitude of velocity i.e. speed and direction remain constant and acceleration is zero.

If speed is constant, then direction of velocity may change and therefore it may have acceleration.

For option (d): $dW = F \cdot ds$. If $F \perp ds$, then $dW = 0$

Ans: (b)

84. The temperature gradient in a $0.5\ \text{m}$ long rod is $80\ ^\circ\text{C m}^{-1}$. If the temperature of the hotter end of the rod is $30\ ^\circ\text{C}$, then the temperature of the cooler end is

(a) $40\ ^\circ\text{C}$ (b) $-10\ ^\circ\text{C}$ (c) $10\ ^\circ\text{C}$ (d) $0\ ^\circ\text{C}$

Sol:

$$\frac{dT}{dx} = 80$$

$$\Rightarrow \frac{T_2 - T_1}{l} = 80 \Rightarrow \frac{30 - T_1}{0.5} = 80$$

$$\Rightarrow 30 - T_1 = 40 \Rightarrow T_1 = -10\ ^\circ\text{C}$$

Ans: (b)

85. Heavy water is used as moderator in a nuclear reactor. The function of the moderator is

(a) to control the energy released in the reactor

(b) to absorb neutrons and stop chain reaction

(c) to start the chain reaction

(d) to slow down the neutrons to thermal energies

Sol: Heavy water is used in nuclear reactor as moderator to slow down the neutrons to thermal energies. Such neutrons have high probability of causing nuclear fission.

Ans: (d)

86. The mass and diameter of a planet have twice the value of the corresponding parameters of earth. Acceleration due to gravity on the surface of the planet is

(a) $9.8\ \text{ms}^{-2}$ (b) $4.9\ \text{ms}^{-2}$ (c) $980\ \text{ms}^{-2}$ (d) $19.6\ \text{ms}^{-2}$

Sol: $g = \frac{GM_e}{R_e^2}$ ... (i)

$g' = \frac{GM_P}{R_P{}^2}$ ... (ii)

From (i) and (ii), $\frac{g'}{g} = \frac{M_P}{M_e}\left(\frac{R_e}{R_P}\right)^2$ Given: $M_P = 2M_e$, and $R_P = 2R_e$

$\frac{g'}{g} = \left(\frac{2M_e}{M_e}\right)\left(\frac{R_e}{2R_e}\right)^2 = \frac{1}{2} \Rightarrow g' = \frac{g}{2} = \frac{9.8}{2} = 4.9\ \text{ms}^{-2}$

Ans: (b)

87. The magnitude of electric field intensity at point $B(2,0,0)$ due to a dipole of dipole moment $p = \hat{i} + \sqrt{3}\hat{j}$ kept at origin is (assume that the point $B$ is at a large distance from the dipole and $K = \frac{1}{4\pi\varepsilon_0}$)

(a) $\frac{\sqrt{13}K}{8}$ (b) $\frac{\sqrt{13}K}{4}$ (c) $\frac{\sqrt{7}K}{8}$ (d) $\frac{\sqrt{7}K}{4}$

Sol: Let $p = \hat{i} + \sqrt{3}\hat{j} = p_1 + p_2$

Therefore $p_1 = \hat{i}$ and $p_2 = \sqrt{3}\hat{j}$

Field due to $p_1$ at point $B$,

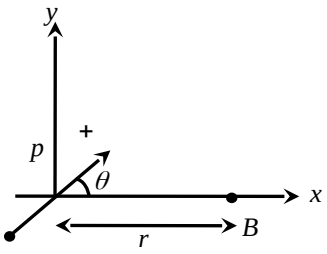
$E_1 = \frac{2 \times K}{2^3} = \frac{K}{4}$

Field due to $p_2$ at point $B$, $E_2 = \frac{K \times \sqrt{3}}{8}$

$E_{\text{net}} = \sqrt{E_1^2 + E_2^2}$; $E_{net} = \sqrt{\frac{K^2}{16} + \frac{K^2 \times 3}{64}}$; $E_{net} = \frac{\sqrt{7}K}{8}$

**Alternate sol:**

Given: $p = \hat{i} + \sqrt{3}\hat{j}$, $r = 2$ unit




Angle made by dipole from $x$-axis is $\theta$

$$\theta = \tan^{-1}\left(\frac{\sqrt{3}}{1}\right) = 60^\circ$$

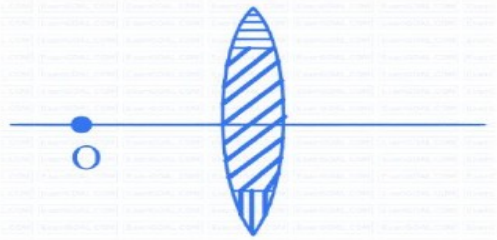
Now electric field due to dipole at point $B$

$$\left|\vec{E}\right| = \frac{|p|}{4\pi\varepsilon_0 r^3}\sqrt{3\cos^2\theta + 1} \quad \ldots \text{(i)}$$

$$= \frac{K\left|\hat{i} + \sqrt{3}\hat{j}\right|}{(2)^3}\sqrt{3\cos^2 60^\circ + 1} \quad = \frac{K\sqrt{7}}{8}$$

Ans: (c)

88. A lens is made up of 3 different transparent media as shown in figure. A point object $O$ is placed on its axis beyond $2f$. How many real images will be obtained on the other side?




(a) 2 (b) 1 (c) No images will be framed (d) 3

Sol: Since lens is made of three materials so three $\mu$ and hence three images.

Ans: (d)

89. When a certain weight is suspended from a uniform wire, its length increases by $1\text{ cm}$. If the same weight is suspended from another wire of the same material and length but having a diameter half of the first one, then the increase in length will be

(a) $0.5\text{ cm}$ (b) $2\text{ cm}$ (c) $4\text{ cm}$ (d) $8\text{ cm}$

Sol: Given $l_1 = 1\text{ cm}, r_2 = \frac{r_1}{2}$

Increase in length is given by, $l = \frac{FL}{AY} \Rightarrow l \propto \frac{1}{r^2}$ ;($F, L$ and $Y$ are constants)

$$\frac{l_2}{l_1} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{r_1}{\left(\frac{r_1}{2}\right)}\right)^2 = (2)^2 = 4$$

$$\Rightarrow l_2 = 4l_1 = 4\text{ cm}$$

Ans: (c)

90. $300\ g$ of water at $25^{\circ}C$ is added to $100\ g$ of ice at $0^{\circ}C$. The final temperature of mixture is

(a) $-\frac{5}{3}^{\circ}C$ (b) $5^{\circ}C$ (c) $-5^{\circ}C$ (d) $0^{\circ}C$

Sol: Heat required for $100\ g$ ice to melt is $Q_1 = mL = 100(80) = 8000\ cal$

Heat given by $300\ g$ water when it cools from $25^{\circ}C$ to $0^{\circ}C$

$Q_2 = ms\Delta\theta = 300(1)(25-0)$; $Q_2 = 7500\ cal$ As $Q_2 < Q_1$

Therefore ice cannot melt completely and final temperature of mixture is $0^{\circ}C$

Ans: (d)

## Biology

**Multiple Choice Questions with one correct answer. A correct answer carries 4 marks. A wrong answer carries a penalty of 1 mark.** **90 x 4 = 360**

91. Micropropagation is producing plants through

(a) growing plants in polluted soil or water

(b) exposed to gamma rays

(c) tissue culture

(d) transformed by recombinant DNA technology

Sol: tissue culture

Ans: (c)

92. Initiation of rooting in stem cuttings is by applying

(a) Auxins (b) ABA (c) $GA_3$ (d) Cytokinins

Sol: Auxins

Ans: (a)

93. Sucrose is converted into glucose and fructose by the enzyme

(a) RuBP (b) Hexokinase (c) Invertase (d) Pyruvate

Sol: Invertase

Ans: (c)

94. _____ serve as an important biofertilizer in rice fields.

(a) Salvinia (b) Cyanobacteria (c) Apergillus (d) Mucor

Sol: Cyanobacteria

Ans: (b)

95. The hydrogen donor for purple and green sulphur bacteria is

(a) $H_2O$ (b) $NH_4$ (c) $CO_2$ (d) $H_2S$

Sol: $H_2S$

Ans: (d)

96. Comon herbivores in the aquatic ecosystem are

(a) birds (b) mammals (c) molluscs (d) None of the above

Sol: molluscs

Ans: (c)

97.


Study the mRNA segment given above, which is to be completely translated into a polypeptide chain. The codons for 'a' and 'b' are:

(a) a-UAA b-UGA (b) a-AUG b-UUU (c) a-AUG b-UAG (d) a-UAG b-UGA

Sol: a-AUG

b-UAG

Ans: (c)

98. Match the organelles in column-I with their fucntion in column-II and choose the correct option

| Column I | Column II |
|---|---|

| | | | |
|---|---|---|---|
| (A) | Golgi bodies | (i) | Cytoskeleton |
| (B) | RER | (ii) | Storage of fats |
| (C) | Microtubules | (iii) | Protein sysnthesis |
| (D) | Elaioplasts | (iv) | Helps in pseudopodia formation |
| | | (v) | formation of glycoproteins and glycolipids. |

(a) A – (i), B - (ii), C – (iv), D – (v) (b) A – (v), B – (iii), C – (i), D – (ii)

(c) A – (v), B – (iii), C – (iv), D – (ii) (d) A – (iv), B – (iii), C – (v), D – (ii)

Sol: A – (v), B – (iii), C – (i), D – (ii)

Ans: (b)

99. Nodules on the roots of leguminous plants are formed by

(a) Rhizobium (b) Spirogyra (c) Mucor (d) Methanococcus

Sol: Rhizobium

Ans: (a)

100. The characteristic feature that can be exclusively seen in angiosperms is

(a) Double fertilization (b) Triploid endosperm

(c) Presence of vessels in xylem (d) Both (a) and (b)

Sol: Both (a) and (b)

Ans: (d)

101. Which of the following soil bacterium produces a protein/chemical that is toxic to insect pests?

(a) Proteobacteria (b) *Bacillus thuringiensis* (c) Spirochaetes (d) *Trichoderma*

Sol: *Bacillus thuringiensis*

Ans: (b)

102. What is the function of Cytochrome c?

(a) Act as donor of electron

(b) Passage for movement of electron

(c) Act as a receptor of e- between complex II and III

(d) Act as a mobile carrier for e- transfer between complex III and IV

Sol: Act as a mobile carrier for electron transfer between complex III and IV

Ans: (d)

103. Turnip and radish belong to the family

(a) Poaceae (b) Fabaceae (c) Solanaceae (d) Brassicaceae

Sol: Brassicaceae

Ans: (d)

104. In the TCA cycles, $FADH_2$ is formed during

(a) Consversion of succinyl co-A to succinate (b) Conversion of citrate to cis-aconitase

(c) Conversion of succinate to fumarate (d) Conversion of fumarate to malate

Sol: Conversion of succinate to fumarate

Ans: (c)

105. Identify the incorrect statement from the following with reference to lac operon.

(a) It is a unit of gene expression and regulation for lactose sugar metabolism in E.coli

(b) Lactose sugar enters the cell due to the activity of enzyme permease.

(c) Operators are present between promoters and structural genes.

(d) The structural genes $'z'$ code for $\beta$- galactosidase, $'y'$ for transacetylase, and $'a'$ for permease.

Sol: The structural genes $'z'$ code for $\beta$- galactosidase, $'y'$ for transacetylase, and $'a'$ for permease.

Ans: (d)

106. Read the following statements:

i. Membrane-bounded inclusion bodies are not found in prokaryotic cells.

ii. Ribosomes are the site of protein synthesis.

iii. Pili are the surface structure of the bacteria which may play a role in motility.

iv. Mesosomes help in cell wall formation

Choose the option with correct statements.

(a) i, ii, iii and iv (b) ii, iii and iv (c) i, ii and iv (d) i, iii and iv

Sol: i, ii and iv

Ans:(c)

107. Tallest tree species belongs to

(a) Bryophyte (b) Gymnosperm (c) Pteridophyte (d) Algae

Sol: Gymnosperm

Ans: (b)

108. Zygomorphic flowers, the ovary is superior, unilocular, with a single ovule with basal placentation, and fruit caryopsis are characteristic features of family

(a) Liliaceae (b) Asteraceae (c) Brassicaceae (d) Gramineae

Sol: Gramineae

Ans: (d)

109. Which among the following step in glycolysis yields energy?

(i) Conversion of BPGA to PGA

(ii) Conversion of fructose – 6 –phosphate to fructose 1, 6 –bisphosphate

(iii) Conversion of PEP to pyruvic acid

(iv) Conversion of glucose – 6 –phosphate to fructose – 6 – phosphate

(a) Both ii and iv (b) i, ii, iii (c) Both i and iii (d) All of the above

Sol: Both i and iii

Ans: (c)

110. Cry protein is produced by

(a) *Phytophthora palmivors* (b) *Bacillus thuringiensis*

(c) Nostoc (d) All of these

Sol: *Bacillus thuringiensis*

Ans: (b)

111. Which of the following tissue is absent in vascular bundles of monocot stem?

(a) Cambium (b) Xylem (c) Phloem (d) All of these

Sol: Cambium

Ans: (a)

112. Read the following four statements A to D:

(A) A typical anther of angiosperm is dithecous.

(B) Egg apparatus constists of two antipodals and one egg cell.

(C) Cleistogamous flowers are invariably autogamous.

(D) If a female parent produces unisexual flowers, there is no need for emasculation.

How many of the above statements are correct?

(a) Four (b) Two (c) Three (d) One

Sol: Three

Ans: (c)

113. The chemical released by *Penicillium notatum* inhibited the growth of which microbe?

(a) *Clostridium* (b) *Streptomyces* (c) *Staphylococci*

(d) *Saccharomyces*

Sol: *Staphylococci*

Ans: (c)

114. Certain species of wasps are seen to frequently visit flowering fig trees. The interaction between them is:

(a) Brood parasitism (b) Mutualism (c) Commensalism (d) Parasitism

Sol: Mutualism

Ans: (b)

115. The parenchymatous cells with small amount of cytoplasm lining the cell wall and a large vacuole can be seen in

(a) Epidermis (b) Hypodermis (c) Cambium (d) Bundle sheath

Sol:Epidermis

Ans: (a)

116. Which one of the following represents a palindromic sequence in DNA?

(a) 5'- GAATTC - 3' 3'- CTTAAG - 5' (b) 5'- CCAATTG - 3' 3'- GAATCC - 5'

(c) 5'- CATTG - 3' 3'- GATAAC - 5' (d) 5'- GATACC - 3' 3'- CCTAAG - 5'

Sol: 5'- GAATTC - 3' 3'- CTTAAG - 5'

Ans: (a)

117. Selaginella and salvinia belong to _____i_____ and are _____ii_____

(a) i – Petridophyte ii – Homosporous (b) i – Petridophyte ii - Heterosporous

(c) I – Bryophyte ii – homosporous (d) I – bryophyte ii - heterosporous

Sol: i – Petridophyte ii - Heterosporous

Ans: (b)

118. LAB

(a) convert milk ino curd

(b) increase vitamin-c

(c) check disease causing microbes in our stomach

(d) both (a) and (c)

Sol: both (a) and (c)

Ans: (d)

119. Fungi reproduce asexually by

(a) Sporangiospores (b) Oospores (c) Ascospores (d) Basidiospores

Sol: Sporangiospores

Ans: (a)

120. Which one of the following processes occurs inside the nucleus during protein synthesis in eukaryotic cells?

(a) Processing of hnRNA (b) Activation of amino acids

(c) Translation (d) Formation of polypeptide chain

Sol: Processing of hnRNA

Ans: (a)

121. Apomixis is –

(a) A form of sexual reproduction that mimics asexual reproduction

(b) A form of asexual reproduction that mimics sexual reproduction

(c) Both of the above

(d) None of these

Sol: A form of asexual reproduction that mimics sexual reproduction

Ans: (b)

122. Which of the following is not the application of PCR?

(a) Detection of very low concentration of bacterial or virus

(b) Detection of mutation in genes in suspected cancer patients

(c) Amplification of desired DNA segment

(d) Detection of antibodies synthesised against pathogens

Sol: Detection of antibodies synthesised against pathogens

Ans: (d)

123. In eukaryotes, RNA polymerase-I transcribes _____ rRNA

(a) 28S, 18S, 5.8S (b) 23S, 5.0S, 16S (c) 28S, 23S, 18S, 5.8S (d) 28S, 16S, 18S, 5.8S

Sol: 28S, 18S, 5.8S

Ans: (a)

124. ICBN stands for

(a) Internatinoal Congress of Biologial NAmes

(b) Indian Code of Botanical Nomenclature

(c) Indian Congress of Biological Names

(d) International Code for Botanical Nomenclature

Sol: International Code for Botanical Nomenclature

Ans: (d)

125. Gas vacuoles are found in

(a) Green photosynthetic bacteria (b) Blue-green algae

(c) Purple photosynthetic bacteria (d) All of these

Sol: All of these

Ans: (d)

126. The capacity of the environment in which a species can get enough resources to support maximum population and beyond which no further growth is possible is called as

(a) Bearing capacity (b) Limited capacity

(c) Environmental resistance (d) Carrying capacity

Sol: Carrying capacity

Ans: (d)

127. The reason for the population explosion in the world is

(a) Increase in birth rate (b) Decrease in death rate

(c) Both (a) and (b) (d) None of them

Sol: Both (a) and (b)

Ans: (c)

128. Viruses having _____ and having shorter life span mutate and evolve faster

(a) DNA (b) RNA genome (c) Both (a) and (b) (d) only protein

Sol: RNA genome

Ans: (b)

129. The starch which is similar to amylopectin and glycogen in structure is

(a) Mannitol (b) Laminarin (c) Glucose (d) Floridian

Sol: Floridian

Ans: (d)

130. The hormone which helps the seed to withstand dessication and other factors unfavourable for growth is

(a) Ethylene (b) ABA (c) $GA_3$ (d) IAA

Sol: ABA

Ans: (b)

131. In the chloroplast, stroma lamellae membranes lack

(a) PSI (b) NADP reductase enzyme

(c) PS II (d) Both (b) and (c)

Sol: Both (b) and (c)

Ans: (d)

132. In a field experiment, when all Pisaster starfish were removed from an enclosed intertidal area the result was

(a) Increase in diversity of invertebrates (b) Exctintion of invertebrate species

(c) Inability of pisaster to enter the area again. (d) Replacement of pisaster by other starfish

Sol: Exctintion of invertebrate species

Ans: (b)

133. Prions are viruses that have only

(a) protein coat (b) nucleic acid core (c) carbohydrate coat (d) none of these

Sol: protein coat

Ans: (a)

134. Kranz Anatomy can be observed in

(a) maize (b) rice (c) wheat (d) mango

Sol: maize

Ans: (a)

135. In _____growth, following mitotic division, only one daughter cell continuous to divide while the other differentiates and matures.

(a) Geometric growth(b) Arithmetic growth(c) Both (a) and (b) (d) None of the above

Sol: Arithmetic growth

Ans: (b)

136. **Assertion:** Each seminiferous tubule is lined on its inside by three type of cells

**Reason:** These cells are male germ cells, Sertoli cells and Leydig's cells

(a) Both assertion and reason are true and reason is the correct explanation of assertion

(b) Both assertion and reason are true but reason is not the correct explanation of assertion

(c) Assertion is true but reason is false

(d) Both assertion and reason are false

Sol: Both assertion and reason are false

Ans: (d)

137. Which of the following is not a mechanism of the action of IUDs in preventing unwanted pregnancies?

(a) Increased phagocytosis of sperm

(b) Suppression of motility of sperms

(c) Prevention of ovulation

(d) Prevention of implantation

Sol: Prevention of ovulation

Ans: (c)

138. Which one of the following options gives the correct match of a disease with its causative organism and mode of infection?

(a) Disease – Typhoid, Causative organism – *Salmonella typhi*, Mode of infection - with inspired air

(b) Disease – Pneumonia, Causative organism –*Streptococcus pneumonia*, Mode of infection - droplet infection

(c) Disease – Elephantiasis, Causative organism – *Wuchereria bancrofti*, Mode of infection - with infected water and food

(d) Disease – Malaria, Causative organism – *Plasmodium vivax*, Mode of infection - bite of male Anopheles mosquito

Sol: Disease – Pneumonia, Causative organism –*Streptococcus pneumonia*, Mode of infection - droplet infection

Ans: (b)

139. A population will not exist in Hardy-Weinberg equilibrium if

(a) there is no migration (b) the population is large

(c) individuals mate selectively (d) there are no mutations

Sol: individuals mate selectively

Ans: (c)

140. Select the total number of true statements from the following.

(1) There are two types of synapses, namely electrical synapses and chemical synapses.

(2) Electrical synapses are rare in our system.

(3) At chemical synapse, the membranes of pre- and post-synaptic neuron are in very close proximity.

(4) Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon.

(5) At a chemical synapse, the membrane of the pre- and post-synaptic neurons are separated by a fluid-filled space called synaptic cleft.

(a) 2 (b) 3 (c) 4 (d) 5

Sol: 4

Ans: (c)

141. Read the following statements and find out the incorrect statement about frogs.

(a) Frog respire on land and in water by two different methods

(b) Liver secretes bile that is stored in the gall bladder

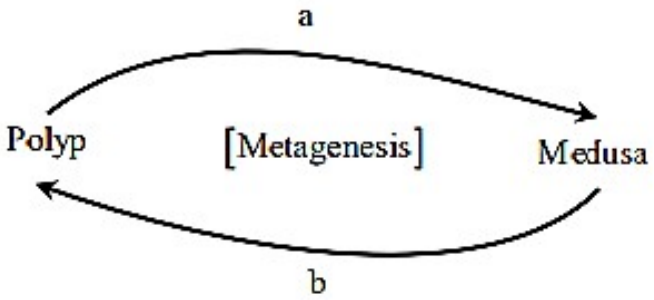
(c) Three chambered heart is situated in the upper part of body cavity

(d) RBCs are enucleated and contain red coloured pigment called haemoglobin

Sol: RBCs are enucleated and contain red coloured pigment called haemoglobin

Ans: (d)

142. Recognise the figure and find out the correct matching.




(a) a – sexually, b – asexually

(b) a – asexually, b – sexually

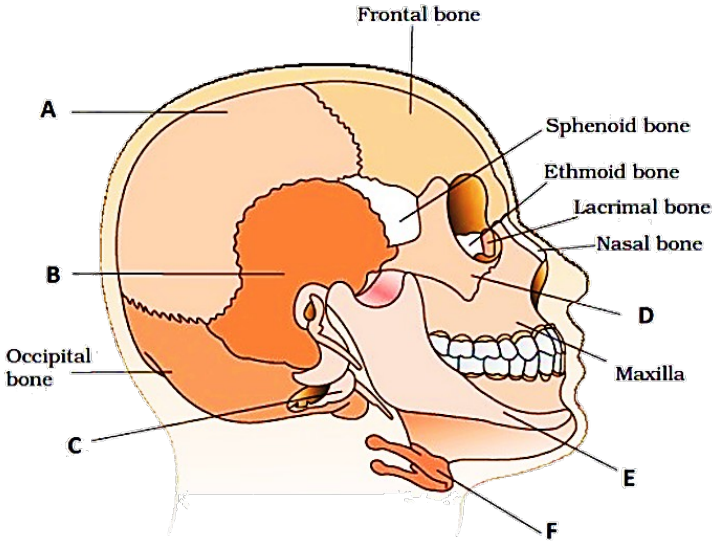
(c) a – asexually, b - parthenogenetically

(d) a – sexually, b – parthenogenetically

Sol: a – asexually, b – sexually

Ans: (b)

143. Select the option with the correct identification of the structures labelled by alphabets (A-F) in the given diagram of the human skull:




(a) A- Temporal bone, B-Parietal bone, C-Occipital condyle

(b) C-Occipital condyle, D-Zygomatic bone, E-Mandible

(c) A-Parietal bone, D-Vomer bone, F-Mandible

(d) B-Temporal bone, C-Hyoid bone, E-Mandible

Sol: C-Occipital condyle, D-Zygomatic bone, E-Mandible

Ans: (b)

144. Which of the following statements is/are true?

(A) Urine is hypertonic in ascending limb of Henle's loop.

(B) When the urine passes into the collecting tubule, it becomes hypotonic.

(C) Urine is isotonic in proximal convoluted tubule.

(D) Urine becomes more and more hypotonic as it descends down the descending limb of Henle's loop.

(a) A and C only (b) A, B and C only (c) B and C only (d) C only

Sol: C only

Ans: (d)

145. In human beings, the color of skin is controlled by

(a) Multiple alleles (b) Lethal genes (c) Polygenic effect (d) None of these

Sol: Polygenic effect

Ans: (c)

146. How many of the following elements have a greater percentage weight in the human body than percentage weight in the earth's crust?

(Sulphur, Sodium, Oxygen, Nitrogen, Carbon, Hydrogen, Magnesium, Silicon and Calcium)

(a) 3 (b) 5 (c) 6 (d) 7

Sol: 5

Ans: (b)

147. Meiosis involves

(a) Two nuclear divisions and one chromosomal division

(b) One nuclear division and one chromosomal division

(c) One nuclear division and two chromosomal divisions

(d) Two nuclear divisions and two chromosomal divisions

Sol: Two nuclear divisions and one chromosomal division

Ans: (a)

148. Hormones involved in carbohydrate metabolism are

(a) Insulin, glucagon, epinephrine and parathormone

(b) Insulin, glucagon, epinephrine and glucocorticoid

(c) Insulin, glucagon, glucocorticoid and calcitonin

(d) Insulin, glucagon, norepinephrine and melatonin

Sol: Insulin, glucagon, epinephrine and glucocorticoid

Ans: (b)

149. Which of the following statements is are true?

(a) Terrestrial biodiversity increases from poles to equator

(b) Latitudinal gradient does not influence biodiversity

(c) Terrestrial biodiversity increase from equator to poles

(d) Localities at higher altitudes have more species

Sol: Terrestrial biodiversity increases from poles to equator

Ans: (a)

150. False ribs are ventrally attached to

(a) Sternum through hyaline cartilage (b) Seventh rib through hyaline cartilage

(c) Seventh rib through fibrous cartilage (d) Sternum through fibrous cartilage

Sol: Seventh rib through hyaline cartilage

Ans: (b)

151. A normal-visioned man, whose father was colourblind, marries a woman whose father was also colourblind. They have their first child as a daughter. What is the chance that this child would be colourblind?

(a) 100% (b) Zero percent (c) 25% (d) 50%

Sol: Zero percent

Ans: (b)

152. Identify the incorrect information about erythroblastosis foetalis.

(a) Rh-ve blood of a pregnant mother

(b) Rh+ve blood of the foetus

(c) Foetus may suffer from severe anaemia and jaundice

(d) This condition can be avoided by administering anti-Rh antibodies to the foetus immediately after the delivery

Sol: This condition can be avoided by administering anti-Rh antibodies to the foetus immediately after the delivery

Ans: (d)

153. The process by which PTH increases blood $Ca^{2+}$ level except

(a) Acts on bones and stimulates the process of bone resorption.

(b) Reabsorption of $Ca^{2+}$ by the renal tubules.

(c) Increases $Ca^{2+}$ absorption from the digested food.

(d) Increases osteoblastic activity

Sol: Increases osteoblastic activity

Ans: (d)

154. After entry of sperm into cytoplasm of ovum which of the following event takes place?

(a) Mitotic division of secondary oocyte (b) Meiotic division of primary oocyte

(c) Mitotic division of primary oocyte (d) Meiotic division of secondary oocyte

Sol: Meiotic division of secondary oocyte

Ans: (d)

155. Read the following statements and find out the incorrect statements.

A. Glucocorticoids stimulate gluconeogenesis, lipolysis and proteolysis.

B. Glucocorticoids stimulate cellular uptake and utilisation of amino acids.

C. Cortisol is involved in the cardio-vascular system as well as kidney functions.

D. Cortisol stimulates the RBC production.

E. Aldosterone acts mainly at the renal tubules and stimulates the reabsorption of $Na^+$, $K^+$ and water and excretion of phosphate ions.

(a) B and E (b) A and D (c) B and C (d) D and E

Sol: B and E

Ans: (a)

156. Lysase catalyse _____ of groups from substrates by mechanism other than hydrolysis leaving _____ bond.

(a) Addition; double (b) Removal; double (c) Addition; single (d) Removal; triple

Sol: Removal; double

Ans: (b)

157. The tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if a regular dose of drugs/alcohols is abruptly discontinued is called as

(a) Habituation (b) Dependence (c) Psychotherapy (d) Tolerance

Sol: Dependence

Ans: (b)

158. Select the correct answer regarding the phase of meiosis and their respective events using the lists given below:

| | List I (Phase of meiosis) | List II (Event over occurs) |
|---|---|---|
| (1) | Prophase I | Crossing over occurs |
| (2) | Metaphase II | Sister chromatids migrate to opposite |
| (3) | Anaphase I | Homologous line up at equator in pairs |

(a) $^{1,2}$ and $^{3}$ are correct
(b) $^{1}$ and $^{2}$ are correct, $^{3}$ is false
(c) $^{1}$ is correct, $^{2}$ and $^{3}$ are false
(d) $^{1}$ and $^{3}$ are correct. $^{2}$ is false

Sol: $^{1}$ is correct, $^{2}$ and $^{3}$ are false.

Ans: (c)

159. **Assertion:** Aneuploidy is the gain or loss of chromosomes.

**Reason:** It is caused due to the failure of cytokinesis after telophase stage of cell division.

(a) Both assertion and reason are true and the reason is the correct explanation of assertion

(b) Both assertion and reason are true but the reason is not the correct explanation of assertion

(c) Assertion is true but reason is false

(d) Both assertion and reason are false

Sol: Assertion is true but reason is false

Ans: (c)

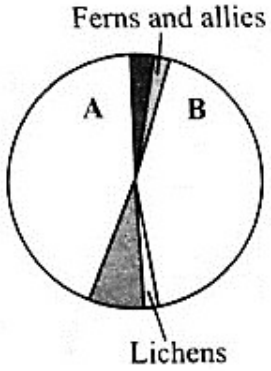
160. Refer to the given figure. This plant causes

(a) hallucinations (b) insomnia (c) depression (d) all of these

Sol: hallucinations

Ans: (a)

161. Name the unlabelled areas A and B of the pie chart representing the biodiversity showing their proportionate number of species of major taxa.



(a) A-Bryophytes, B-Gymnosperms (b) A-Fungi, B-Gymnosperms
(c) A-Pteridophytes, B-Angiosperms (d) A-Fungi, B-Angiosperms

Sol: A-Fungi, B-Angiosperms

Ans: (d)

162. Which of the following structures are supported by incomplete cartilaginous rings?

(A) Tracheae, (B) 1° bronchi, (C) 2° bronchi,
(D) 3° bronchi,
(E) initial bronchioles, (F) terminal bronchioles, (G) duct of alveoli, (H) alveoli

(a) A, B, C, D and E (b) A, B, C, D, E and F
(c) A, B, C, D, E, F and G (d) A, B, C, D, E, F, G and H

Sol: A, B, C, D and E

Ans: (a)

163. In the meiosis type of cell division, the centromeres divides during which stage?

(a) Never divides (b) Anaphase-I (c) Interkinesis (d) Anapahse-II

Sol: Anapahse-II

Ans:(d)

164. Bicuspid and tricuspid valves open to allow

(a) Blood from the pulmonary artery and vena cava to flow into the left and right ventricles, respectively

(b) Blood from the pulmonary vein and vena cava to flow into left and right ventricles, respectively

(c) Blood from the pulmonary vein and vena cava to flow into left and right atrium, respectively

(d) Oxygen from the pulmonary vein and vena cava to flow into left and right atrium, respectively

Sol: Blood from the pulmonary vein and vena cava to flow into left and right ventricles, respectively

Ans: (b)

165. How many diseases can be identified by karyotyping?

(Klinefelter’s syndrome, Phenylketonuria, Thalassemia, Alkaptonuria, Albinism, Colour blindness, Haemophilia, Down’s syndrome, Turner syndrome)

(a) 5 (b) 4 (c) 7 (d) 3

Sol: 3

Ans: (d)

166. In the alveoli, the factors favourable for the formation of oxyhaemoglobin are

A. Low $pO_2$ B. High $pO_2$. C. Low $pCO_2$ D. High $pCO_2$

E. Lower Temperature F. Higher Temperature G. Low pH H. High pH

(a) A, D, F, H (b) B, C, E, G (c) A, D, F, G (d) B, C, E, H

Sol: B, C, E, H

Ans: (d)

167. Antigen binding site is present on which terminal of peptide chain in antibodies

(a) N-terminal (b) C-terminal

(c) Either N-or C-terminal (d) In between N- and C-terminal

Sol: N-terminal

Ans: (a)

168. How many animals in the list given below are Oviparous

(*Macropus, Ornithorhynchus, Neophron, Delphinus, Pteropus, Aptenodytes, Equus, Hemidactylus, Struthio, Canis*)

(a) Six (b) Three (c) Four (d) Five

Sol: Five

Ans: (d)

169. The action of the vaginal diaphragm is

(a) To prevent the ova to come in the uterus

(b) To prevent the sperm to come in contact with ova

(c) Spermicidal

(d) Anti-implantational

Sol: To prevent the sperm to come in contact with ova

Ans: (b)

170. The disease sickle-cell anaemia is caused by the substitution of __(i)__ by __ (ii)___ at the __(iii)__ position of __(iv)___ globin chain of haemoglobin molecule.

Which of the following correctly fills the blanks in the above statement

(a) (i) valine, (ii) glutamic acid, (iii) sixth, (iv) beta

(b) (i) glutamic acid, (ii) valine, (iii) sixth, (iv) beta

(c) (i) glutamic acid, (ii) valine, (iii) fifth, (iv) beta

(d) (i) valine, (ii) glutamic acid, (iii) fifth, (iv) beta

Sol: (i) glutamic acid, (ii) valine, (iii) sixth, (iv) beta

Ans: (b)

171. The acellular forms of life could have originated around

(a) 1000 mya (b) 1500 mya (c) 2000 mya (d) 3000 mya

Sol: 3000 mya

Ans: (d)

172. Diabetes insipidus is caused due to deficiency of

(a) Aldosterone (b) ADH (c) ACTH (d) TSH

Sol: ADH

Ans: (b)

173. Which of the following does not belong the Palaeozoic era?

(a) Silurian (b) Cretaceous (c) Devonian (d) Carboniferous

Sol: Cretaceous

Ans: (b)

174. The partial pressure of oxygen is equal in

(a) Atmospheric air and Alveoli

(b) Alveoli and Oxygenated blood

(c) Alveoli and Deoxygenated blood

(d) Deoxygenated blood and Tissues

Sol: Deoxygenated blood and Tissues

Ans: (d)

175. Find out the name of the following:

(A) A chordate animal having flame cells as excretory structures

(B) Cortical portions projecting between the medullary pyramids in the human kidney

(C) A loop of capillary running parallel to the Henle's loop

(a) (A) - Πλαναρια, (B) - δυχτ οφ Βελλινι, (X) - Περιτυβυλαρ χαπιλλαρψ

(b) (A) - Αμπηιοξυσ, (B) - Χολλεχτινγ δυχτ, (X) - ςασα ρεχτα

(c) (A) - Λανχελετ, (B) - Χολυμνσ οφ Βερτινι, (X) - ςασα ρεχτα

(d) (A) - Αμπηιοξυσ, (B) - χολυμνσ οφ Βερτινι, (X) - Περιτυβυλαρ χαπιλλαρψ

Sol: (A) - Λανχελετ, (B) - Χολυμνσ οφ Βερτινι, (X) - ςασα ρεχτα

Ans: (c)

176. How much blood is pumped out by each ventricle of the heart in a minute goes to the kidney?

(a) $1/5^{th}$ (b) $1/3^{rd}$ (c) $1/4^{th}$ (d) $1/6^{th}$

Sol: $1/5^{th}$

Ans: (a)

177. DCT helps in

(A) Conditional reabsorption of $Na^+$ and water (B) $HCO_3^-$ absorption

(C) pH maintenance (D) Selective secretion of $H^+$ and $K^+$

(a) A, C and D only (b) B, C and D only (c) C and D only (d) A, B, C and D

Sol: A, B, C and D

Ans: (d)

178. During inspiration

(a) Diaphragm and external intercostal muscles relax

(b) Diaphragm and internal intercostal muscles relax

(c) Diaphragm and external intercostal muscles contract

(d) Diaphragm and internal intercostal muscles contract

Sol: Diaphragm and external intercostal muscles contract

Ans: (c)

179. Select the incorrect statement:

(a) Insulin and glucagon are peptide hormones.

(b) Insulin acts mainly on hepatocyte and adipocytes and enhance glucose uptake and utilization.

(c) Insulin stimulates glycogenesis.

(d) Glucagon inhibits the process of gluconeogenesis.

Sol: Glucagon inhibits the process of gluconeogenesis

Ans: (d)

180. Which of the following muscular disorders is inherited?

(a) Muscular dystrophy (b) Myasthenia gravis (c) Botulism (d) Tetany

Sol: Muscular dystrophy

Ans: (a)

**Key Answers:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. a | 2. b | 3. d | 4. b | 5. b | 6. d | 7. c | 8. b | 9. b | 10. d |
| 11. d | 12. c | 13. d | 14. c | 15. d | 16. c | 17. a | 18. a | 19. a | 20. b |
| 21. d | 22. d | 23. a | 24. b | 25. b | 26. d | 27. c | 28. b | 29. d | 30. a |
| 31. d | 32. d | 33. a | 34. b | 35. c | 36. c | 37. b | 38. c | 39. c | 40. b |
| 41. d | 42. d | 43. a | 44. c | 45. d | 46. a | 47. b | 48. d | 49. b | 50. a |
| 51. d | 52. d | 53. d | 54. c | 55. a | 56. d | 57. a | 58. c | 59. b | 60. d |
| 61. a | 62. c | 63. d | 64. b | 65. b | 66. a | 67. a | 68. c | 69. a | 70. c |
| 71. c | 72. c | 73. d | 74. b | 75. a | 76. c | 77. c | 78. a | 79. c | 80. c |
| 81. a | 82. d | 83. b | 84. b | 85. d | 86. b | 87. c | 88. d | 89. c | 90. d |
| 91. c | 92. a | 93. c | 94. b | 95. d | 96. c | 97. c | 98. b | 99. a | 100. d |
| 101. b | 102. d | 103. d | 104. c | 105. d | 106. c | 107. b | 108. d | 109. c | 110. b |
| 111. a | 112. c | 113. c | 114. b | 115. a | 116. a | 117. b | 118. d | 119. a | 120. a |
| 121. b | 122. d | 123. a | 124. d | 125. d | 126. d | 127. c | 128. b | 129. d | 130. b |
| 131. d | 132. b | 133. a | 134. a | 135. b | 136. d | 137. c | 138. b | 139. c | 140. c |
| 141. d | 142. b | 143. b | 144. d | 145. c | 146. b | 147. a | 148. b | 149. a | 150. b |
| 151. b | 152. d | 153. d | 154. d | 155. a | 156. b | 157. b | 158. c | 159. c | 160. a |
| 161. d | 162. a | 163. d | 164. b | 165. d | 166. d | 167. a | 168. d | 169. b | 170. b |
| 171. d | 172. b | 173. b | 174. d | 175. c | 176. a | 177. d | 178. c | 179. d | 180. a |