AIPMT(NEET)Exam 2016

(Paper & Solution)

Code – Q Date : 01-05-2016

Q.1 The addition of a catalyst during a chemical reaction alters which of the following quantities ?

(1) Internal energy (2) Enthalpy (3) Activation energy (4) Entropy

Students may find similar question in CP exercise sheet :

[*Chapter : Chemical kinetic, Exercise # 1, Page No.181, Q.6*]

Ans. **[3]**

Sol. Catalyst lowers the threshold point by making a short intermediate path so activation energy decreases

Q.2 Predict the correct order among the following:

(1) lone pair-lone pair > bond pair-bond pair > lone pair – bond pair

(2) bond pair – bond pair > lone pair – bond pair > lone pair – lone pair

(3) lone pair – bond pair > bond pair – bond pair > lone pair – lone pair

(4) lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

Students may find same question in CP exercise sheet :

[*Chapter : Chemical Bonding (VSEPRT) in Class notes*]

Ans. **[4]**

Sol. According to V.S.E.P.R.T lone-lone pair repulsion is maximum because lone pair electron held by nuclei of one atom there for occupy more space.

Repulsion $\Rightarrow$ lone pair-lone pair > lone pair-bond pair > bond pair-bond pair

Q.3 The correct statement regarding the basicity of arylamines is:

(1) Arylamines are generally more basis than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring π electron system.

(2) Arylamines are generally more basic than alkylamines because of aryl group.

(3) Arylamines are generally more basic than alkylamines, because the nitrogen atom in arylamines is sp-hybridized

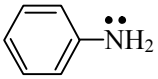
(4) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.

Students may find similar question in CP exercise sheet :

[*Chapter : Nitrogen Compounds, Exercise # 4, Q.23*]

Ans. **[4]**

Sol.

Aryl amine		Alkyl amine
	v/s	$R - \ddot{N}H_2$
delocalised ℓ.p.		localised ℓ.p.
due to resonance		⇓
⇓		more basic
less basic		

Q.4 When copper is heated with conc. HNO_3 it produces:

(1) $Cu(NO_3)_2$ and NO

(2) $Cu(NO_3)_2$,NO and NO_2

(3) $Cu(NO_3)_2$ and N_2O

4) $Cu(NO_3)_2$ and NO_2

Students may find same question in CP exercise sheet :

[*Chapter : p- block in Class notes*

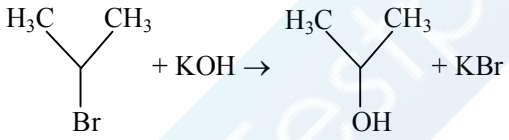
Ans. **[4]**

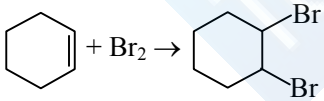
Sol. When copper react with conc. HNO_3 reddish brown gas NO_2 evolved

$Cu + 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$

Q.5 For the following reactions:

(a) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH = CH_2 + KBr + H_2O$

(b) 

(c) 

Which of the following statements is correct ?

(1) (a) is elimination, (b) is substitution and (c) addition reaction.

(2) (a) is elimination, (b) and (c) are substitution reactions.

(3) (a) is substitution, (b) and (c) are addition reactions.

(4) (a) and (b) are elimination reactions and (c) is addition reaction.

Students may find similar question in CP exercise sheet :

[*Chapter : GOC II in Class Notes*]

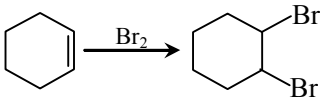
Ans. **[1]**

Sol. $CH_3–\underset{\underset{Br}{|}}{CH}–CH_2 \xrightarrow{KOH} CH_3–CH=CH_2 + KBr + H_2O$

It is elimination reaction

$CH_3–\underset{\underset{Br}{|}}{CH}–CH_3 \xrightarrow{KOH} CH_3–\underset{\underset{OH}{|}}{CH}–CH_3 + KBr$

It is substitution reaction



It is addition reaction

Q.6 Two electrons occupying the same orbital are distinguished by:

(1) Magnetic quantum number (2) Azimuthal quantum number

(3) Spin quantum number (4) Principal quantum number

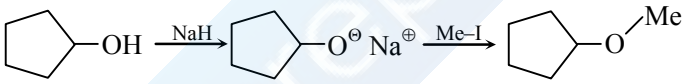
Students may find similar question in CP exercise sheet :

[*Chapter : Atomic Structure, Exercise # 3B, Page No.36, Q._19*]

Ans. **[3]**

Sol. If electron occupy same orbital it will differ in spin quantum no.

Q.7 The reaction



can be classified as:

(1) Alcohol formation reaction (2) Dehydration reaction

(3) Williamson alcohol synthesis reaction (4) Williamson ether synthesis reaction

Students may find same question in CP exercise sheet :

[*Chapter :Alcohol in Class Notes*]

Ans. **[4]**

Sol. It is williamson ether synthesis reaction

$R – X + R – ONa \rightarrow R – O – R + NaX$

Q.8 The electronic configurations of Eu (Atomic No. 63), Gd(Atomic No. 64) and Tb (Atomic No. 65) are:

(1) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(2) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

(3) $[Xe]4f^7 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(4) $[Xe]4f^7 6s^2$, $[Xe]4f^8 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

Students may find similar question in CP exercise sheet :
[Chapter : f-block, Exercise # 10, Page No.60, Q._8]

Ans. **[3]**

Sol. $_{63}Eu \Rightarrow [Xe]4f^7 5d^0 6s^2$

$_{64}Gd \Rightarrow [Xe]\ 4f^7 5d^1 6s^2$

half filled f subshell is more stable

$_{65}Tb \Rightarrow [Xe]\ 4f^9\ 5d^0\ 6s^2$

Q.9 At 100ºC the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be:

(1) 100ºC (2) 102ºC (3) 103ºC (4) 101ºC

Students may find same question in CP exercise sheet :
[Chapter : Liquid solution in class notes]

Ans. **[4]**

Sol. $$\frac{P_A^o - P_A}{P_A} = \frac{m \times M_A}{1000}$$

$$\frac{760 - 732}{732} = \frac{m \times 18}{1000}$$

$m = 2.125$

$\Delta T_b = K_b\, m$

$= 0.52 \times 2.125$

$= 1.10$

$T_s = 100 + 1.10$

$= 101.1$ºC

Q.10 The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is:

(1) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.

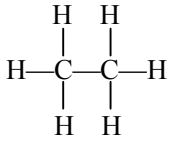
(2) The eclipsed conformation of ethane is more stable than staggered conformation, even though the eclipsed conformation has torsional strain.

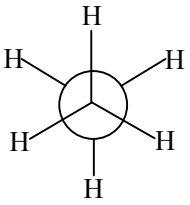
(3) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

(4) The staggered conformation of ethane is less stable the an eclipsed conformation, because staggered conformation has torsional strain.

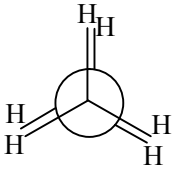
Students may find same question in CP exercise sheet :
[*Chapter : Alkane, Exercise # 1, Page No. 142, Q. 2*]

Ans. **[3]**

Sol.  (ethane)



V/s



staggered conformer

Eclipsed conformer

⇓

It is more stable than ellipsed conformer because no torsional strain.

Q.11 Which one of the following characteristics is associated with adsorption ?

(1) ΔG, ΔH and ΔS all are negative
(2) ΔG and ΔH are negative but ΔS is positive
(3) ΔG and ΔS are negative but ΔH is positive
(4) ΔG is negative but ΔH and ΔS are positive

Students may find same question in CP exercise sheet :
[*Chapter : Surface Chemistry, Exercise # 1, Page No.152, Q._31*]

Ans. **[1]**

Sol. in adsorption

ΔS = – ve

ΔH = – ve

ΔG = – ve

Q.12 Match the compounds given in **column I** with the hybridisation and shape given in **column II** and mark the correct option.

Column I	**Column II**
(a) XeF_6	(i) distorted octahedral
(b) XeO_3	(ii) square planar
(c) $XeOF_4$	(iii) pyramidal
(d) XeF_4	(iv) square pyramidal

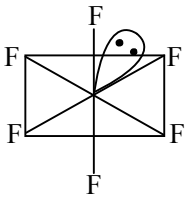
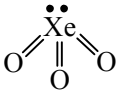
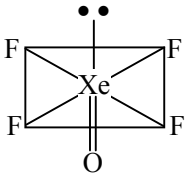
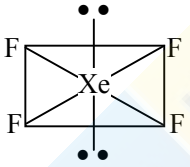
Code:

	(a)	**(b)**	**(c)**	**(d)**
(1)	(i)	(ii)	(iv)	(iii)
(2)	(iv)	(iii)	(i)	(ii)
(3)	(iv)	(i)	(ii)	(iii)
(4)	(i)	(iii)	(iv)	(ii)

Students may find same question in CP exercise sheet :
[*Chapter : p-block_, Exercise # 1, Page No.35, Q._14*]

Ans. **[4]**

Sol.

$:XeF_6$	sp^3d^3	distorted octahedral	
$:XeO_3$	sp^3	pyramid	
$\ddot{X}eOF_4$	sp^3d^2	square pyramid	
$\ddot{X}eF_4$	sp^3d^2	square planar	

Q.13 The **correct** statement regarding a carbonyl compound with a hydrogen atom on its alpha-carbon, is:

(1) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.

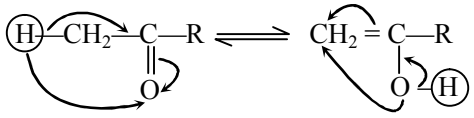
(2) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation

(3) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

(4) a carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.

Ans. **[3]**

Sol.



(Keto) (Enol)

This process is called as keto enol tautomerism.

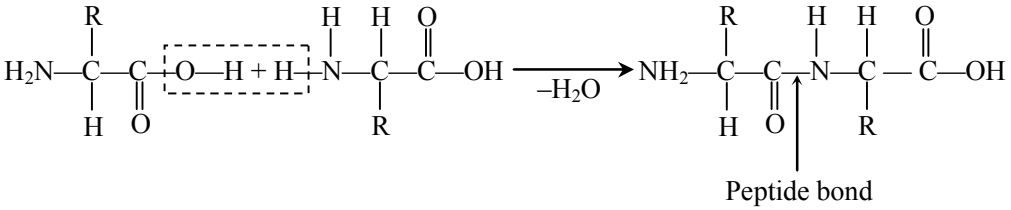
Q.14 In a protein molecule various amino acids are linked together by:

(1) β-glycosidic bond (2) peptide bond

(3) dative bond (4) α-glycosidic bond

Ans. **[2]**

Sol. The peptide bond is an amide bond which links amino acids together to form proteins.



Q.15 Match items of **Column I** with the items of **Column II** and assign the correct code:

Column I	**Column II**
(a) Cyanide process	(i) Ultrapure Ge
(b) Froth floatation process	(ii) Dressing of Zns
(c) Electrolytic reduction	(iii) Extraction of Al
(d) Zone refining	(iv) Extraction of Au
	(v) Purification of Ni

Code:

	(a)	**(b)**	**(c)**	**(d)**
(1)	(ii)	(iii)	(i)	(v)
(2)	(i)	(ii)	(iii)	(iv)
(3)	(iii)	(iv)	(v)	(i)
(4)	(iv)	(ii)	(iii)	(i)

Ans. **[4]**

Sol. **Cyanide process:**

$4Au + 8NaCN + O_2 + 2H_2O \rightarrow 4Na[Au(CN)_2] + 4NaOH$

Impure

$2Na[Au(CN)_2] \xrightarrow{Zn} \underset{ppt}{2\,Au} + Na_2[Zn(CN)_4]$

froth floatation process → all sulphide ore's concentrated by froth floatation method.

Electrolytic reduction → Bauxite reduced by electrolytic reduction in the presence of cryolite by Hall herault process

Zone refining → semi conducter's (Ge, Si)are purified by zone refining

Q.16 Which of the following is an analgesic ?

(1) Penicillin (2) Streptomycin

(3) Chloromycetin (4) Novalgin

Students may find same question in CP exercise sheet :
[Chapter : Chemistry in every day life in sheet]

Ans. **[4]**

Sol. Novalgin is an analgesic

Q.17 Which is the correct statement for the given acids ?

(1) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid

(2) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid

(3) Both are triprotic acids

(4) Both are diprotic acids

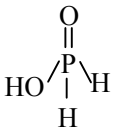
Students may find same question in CP exercise sheet :

[*Chapter : Redox reaction, Page No.81*]

Ans. **[1]**

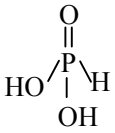
Sol. Phosphinic acid is monoprotic as it contain one – OH group.

H_3PO_2



Phosphonic acid (H_3PO_3) is diprotic as it contain two – OH group.

H_3PO_3



Q.18 The pair of electron in the given carbanion, $CH_3C \equiv C^{\ominus}$, is present in which of the following orbitals ?

(1) sp^3 (2) sp^2 (3) sp (4) 2p

Students may find similar question in CP exercise sheet :

[*Chapter : GOC I , Exercise # 1, Page No. 25*]

Ans. **[3]**

Sol. $CH_3 - \underset{sp}{C} \overset{\sigma}{\underset{2\pi}{\equiv}} \underset{sp}{C^-}$

– ve charge of carbon present in sp - hybridised orbitals because both carbon has sp hybridisation in propyne.

Q.19 Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false?

(1) The H – O – H bond angle in H_2O is larger than the H – C – H bond angle in CH_4

(2) The H – O – H bond angle in H_2O is smaller than the H – N – H bond angle in NH_3

(3) The H – C – H bond angle in CH_4 is larger than the H – C – H bond angle in NH_3

(4) The H – C – H bond angle in CH_4, the H – N – H bond angle in NH_3, and the H – O – H bond angle in H_2O are all greater than 90º

Students may find same question in CP exercise sheet :

[*Chapter : Chemical bonding in Class notes*]

Ans. **[1]**

Sol.

Bond angle	CH_4 >	$\ddot{N}H_3$ >	$H_2\ddot{\underset{\cdot\cdot}{O}}$
	sp^3	sp^3	sp^3
Shape	tetrahedral	pyramidal	bent/V
Bond angle	109°28"	107°	105°
Repulsion	bp-bp	lp-bp	lp-lp

Repulsion ↑ Bond angle ↓

Q.20 Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution ?

(1) The solution is decolourized (2) SO_2 is reduced

(3) Green $Cr_2(SO_4)_3$ is formed (4) The solution turns blue

Students may find similar question in CP exercise sheet :

[*Chapter : Coordination compounds, Exercise # 11(A), Page No._68*]

Ans. **[3]**

Sol. Acidified $K_2Cr_2O_7$ oxidizes SO_2 to green colour $Cr_2(SO_4)_3$

$$K_2Cr_2O_7 + 3SO_2 + H_2SO_4 \longrightarrow K_2SO_4 + \underset{\text{green}}{Cr_2(SO_4)_3} + H_2O$$

Q.21 The correct thermodynamic conditions for the spontaneous reaction at all temperatures is :

(1) $\Delta H > 0$ and $\Delta S < 0$ (2) $\Delta H < 0$ and $\Delta S > 0$

(3) $\Delta H < 0$ and $\Delta S < 0$ (4) $\Delta H < 0$ and $\Delta S = 0$

Students may find same question in CP exercise sheet :

[*Chapter : Chemical Thermodynamic, Exercise # 1, Page No.140*]

Ans. **[2]**

Sol. $\Delta G = \Delta H - T\Delta S$

For spontaneous process

ΔS = +ve

ΔH = – ve

Q.22 Natural rubber has :

(1) All trans-configuration

(2) Alternate cis - and trans-configuration

(3) Random cis- and trans-configuration

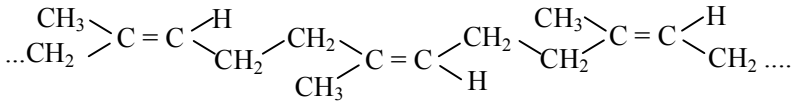
(4) All cis-configuration

Students may find same question in CP exercise sheet :

[*Chapter : Polymer, Page No.192*]

Ans. **[4]**

Sol. Natural rubber has all cis-configuration



cis cis cis

Natural Rubber

Q.23 In Which of the following options the order of arrangement does not agree with the variation of property indicate against it ?

(1) B < C < N < O (increasing first ionisation enthalpy)

(2) I < Br < Cl < F (increasing electron gain enthalpy)

(3) Li < Na < K < Rb (increasing metallic radius)

(4) $Al^{3+} + < Mg^{2} + < Na^{+} + < F^{-}$ (increasing ionic size)

Students may find similar question in CP exercise sheet :

[*Chapter : Periodic table, Exercise # 3B, Page No._195 Q._99*]

Ans. **[1, 2]**

Sol. Ionisation enthalpy of N is greater than O because N has half filled p subshell.

B < C < O < N (I^{st} ionization enthalpy)

$2p^1$ $2p^2$ $2p^4$ $2p^3$

Electron gain enthalpy of F is less than Cl because in F small size of 2p orbital result in high electron density so inter electronic repulsion is high.

I < Br < F < Cl (electron gain enthalpy)

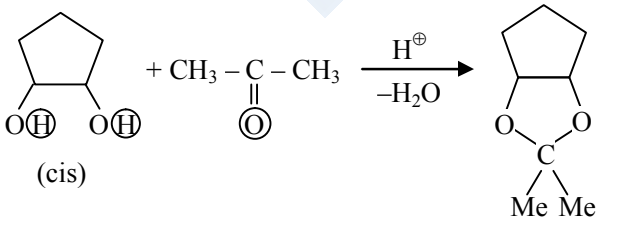
Q.24 Which of the following reagents would distinguish cis-cyclopenta-1, 2-diol from the trans-isomer ?

(1) Ozone (2) MnO_2

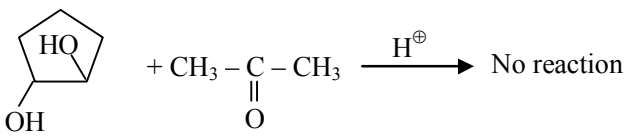
(3) Aluminium isopropoxide (4) Acetone

Ans. **[4]**

Sol.



(cis)



(trans)

Q.25 The product obtained as a result of a reaction of nitrogen with CaC_2 is

(1) CaCN (2) $CaCN_3$ (3) Ca_2CN (4) $Ca(CN)_2$

Students may find similar question in CP exercise sheet :
[Chapter : p-block in class notes]

Ans. **[Bonus]**

Sol. When nitorgen react with CaC_2 than Calcium cyanide $CaCN_2$ form

$CaC_2 + N_2 \longrightarrow CaCN_2 + C$

Q.26 Fog is a colloidal solution of :

(1) Gas in liquid (2) Solid in gas (3) Gas in gas (4) Liquid in gas

Ans. **[4]**

Sol. Fog (liquid in gas)

Q.27 Which one of the following orders in correct for the bond dissociation enthalpy of halogen molecules ?

(1) $Cl_2 > Br_2 > F_2 > I_2$ (2) $Br_2 > I_2 > F_2 > Cl_2$

(3) $F_2 > Cl_2 > Br_2 > I_2$ (4) $I_2 > Br_2 > Cl_2 > F_2$

Students may find similar question in CP exercise sheet :
[Chapter : Periodic table, Exercise # 1, Page No.__, Q.43]

Ans. **[1]**

Sol. $Cl_2 > Br_2 > F_2 > I_2$

Bond dissociation energy of F_2 less than Cl_2 and Br_2 because small size of f atom result in strong lone pair repulsion.

Q.28 Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape ?

(1) 1/4 (2) 3/8 (3) 1/2 (4) 1/8

Students may find similar question in CP exercise sheet :
[Chapter : Gaseous State, Exercise # 3B, Page No.120, Q._11]

Ans. **[4]**

Sol. $\frac{r_{O_2}}{r_{H_2}} = \sqrt{\frac{M_{H_2}}{M_{O_2}}}$

$$\frac{\frac{n_{O_2}}{t}}{\frac{n_{H_2}}{t}} = \sqrt{\frac{2}{32}} = \sqrt{\frac{1}{16}} = \frac{1}{4}$$

$$\therefore \frac{n_{O_2}}{n_{H_2}} = \frac{1}{4}$$

as $\frac{1}{2}$ moles of H_2 are diffused, moles of O_2 diffused in same time.

$$\frac{n_{O_2}}{1/2} = \frac{1}{4} \Rightarrow n_{O_2} = \frac{1}{8}$$

Q.29 Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1}. Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23}$ mol^{-1})

(1) 352 pm (2) 527 pm (3) 264 pm (4) 154 pm

Students may find same question in CP exercise sheet :

[*Chapter : Solid State_, Exercise # 1, Page No.116, Q._23*]

Ans. **[1]**

Sol. For BCC

$$d = \frac{Z \times M}{N_A \times a^3}$$

$$530 = \frac{2 \times 6.94 \times 10^{-3}}{6.02 \times 10^{23} \times a^3}$$

$$a^3 = \frac{2 \times 694}{530 \times 6.023 \times 10^{28}}$$

$a^3 = 0.435 \times 10^{-28}$ m

$= 43.5 \times 10^{-30}$ m

$= 43500000$ pm

$\therefore \quad a = 352$ pm

Q.30 Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct ? Assume that the temperature is constant at 25ºC. (Given, Vapour Pressure Data at 25ºC, benzene = 12.8 kPa, toluene = 3.85 kPa)

(1) The vapour will contain a higher percentage of toluene

(2) The vapour will contain equal amounts of benzene and toluene

(3) Not enough information is given to make a prediction

(4) The vapour will contain a higher percentage of benzene

Ans. **[4]**

Sol. V.P. of C_6H_6 > V.P. of $C_6H_5CH_3$

$\because Y_A = \frac{P_A^o X_A}{P}$, $Y_B = \frac{P_B^o X_B}{P}$

X_A and X_B are same so mole fraction in vapour phase is directly proportional to the vapour pressure.

Q.31 Which of the following has longest C – O bond length ? (Free C – O bond length in CO is 1.128 Å)

(1) $[Co(CO)_4]^{\Theta}$ (2) $[Fe(CO)_4]^{2-}$ (3) $[Mn(CO)_6]^{+}$ (4) $Ni(CO)_4$

Students may find same question in CP exercise sheet :

[*Chapter : Coordination Chemistry in class notes*]

Ans. **[2]**

Sol. $Ni(CO)_4$ Ni^{0}

$[Mn(CO)_6]^{+}$ Mn^{+}

$[Co(CO)_4]^{\ominus}$ Co^{-1}

$[Fe(CO)_4]^{2-}$ Fe^{-2}

Due to negative charge electron density of Fe is maximum these for back donation from metal to vacant π^* abmo of CO ligand is high, so C–O bond order minimum therefore C – O bond length maximum.

Q.32 Among the following the correct order of acidity is :

(1) $HClO < HClO_2 < HClO_3 < HClO_4$ (2) $HClO_4 < HClO < HClO_3 < HClO_4$

(3) $HClO_4 < HClO_2 < HClO < HClO_3$ (4) $HClO_3 < HClO_4 < HClO_2 < HClO$

Students may find similar question in CP exercise sheet :

[*Chapter : Redox reaction, Exercise # 3A, Page No._97, Q._23*]

Ans. **[1]**

Sol. $HClO < HClO_2 < HClO_3 < HClO_4$

O.S. +1 +3 +5 +7

Acidic nature $\propto$ O.S.

Q.33 In the correct

$$X - C \equiv CH \xrightarrow[(2)\,CH_3CH_2Br]{(1)\,NaNH_2\,/\,liq.NH_3} X \xrightarrow[(2)\,CH_3CH_2Br]{(1)\,NaNH_2\,/\,liq.NH_3}$$

X and Y are :

(1) X = 2-Butyne ; Y=3-Hexyne (2) X = 2-Butyne ; y=2-Hexyne

(3) X = 1-Butyne; y = 2-Hexyne (4) X = 1-Butyne ; Y = 3-Hexyne

Students may find same question in CP exercise sheet :

[*Chapter : Alkyne, Exercise # _3, Page No. 169*]

Ans. **[4]**

Sol.

$$H–C\equiv C–H \xrightarrow[liq.\ NH_3]{Na\ NH_2/} HC\equiv C\ Na \xrightarrow[-NaBr]{CH_3\ CH_2–Br} CH\equiv C–CH_2–CH_3$$

$$CH_3–CH_2–C\equiv CH \xrightarrow[liq.\ NH_3]{Na\ NH_2/} CH_3–CH_2–C\equiv C\ Na \xrightarrow[-NaBr]{CH_3\ CH_2–Br} CH_3–CH_2–C\equiv C–CH_2–CH_3$$

3-Hexyne

Q.34 MY and NY_3, two nearly insoluble salts, have the same K_{SP} values of 6.2×10^{-13} at room temperature. Which statement would be true in regard to MY and NY_3 ?

(1) The molar solubility of MY in water is less than that of NY_3

(2) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water

(3) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities

(4) The molar solubilities of MY and NY_3 in water are identical

Students may find similar question in CP exercise sheet :

[*Chapter : Ionic equilibrium, Exercise # 1, Page No._142, Q._61*]

Ans. **[1]**

Sol. For MY,

$K_{SP} = S^2$

$S = \sqrt{K_{SP}}$

$= \sqrt{6.2 \times 10^{-13}}$

$= \sqrt{62 \times 10^{-14}}$

$\approx 8 \times 10^{-7}$

for NY_3,

$NY_3 \rightleftharpoons \underset{S}{N^{+3}} + \underset{3S}{3Y^-}$

$K_{SP} = 27S^4$

$S = \left(\frac{6.2 \times 10^{-13}}{27}\right)^{1/4} = (0.2296 \times 10^{-13})^{1/4}$

$S = 3.89 \times 10^{-4}$

Q.35 Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of nitration will be :

(1) slower (2) uncharged (3) doubled (4) faster

Students may find similar question in CP exercise sheet :
[Chapter : Benzene in class notes]

Ans. **[1]**

Sol. $H_2SO_4 + HNO_3 \rightarrow \overset{\oplus}{N}O_2 + H\overset{\ominus}{S}O_4 + H_2O$

$KHSO_4 \rightarrow K^{\oplus} + \overset{\ominus}{H}SO_4$

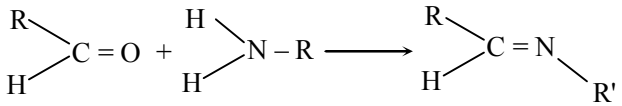
Due to common ion effect backward reaction will take place so the formation NO_2^+ decrease so nitration process will become slower.

Q.36 The product formed by the reaction of an aldehyde with a primary amine is :

(1) Ketone (2) Carboxylic acid (3) Aromatic acid (4) Schiff base

Ans. **[4]**

Sol. Aldehyde + Primary amines ⟶ Schiff base



Aldehyde Primary amines General structure or Schiff base

Schiff bases can be synthesized from an aliphatic or aromatic amine and a carbonyl compounds by nucleophilic addition-elimination reaction

Q.37 The pressure of H_2 required to make the potential of H_2-electrode zero in pure water at 298 K is :

(1) 10^{-12} atm (2) 10^{-10} atm (3) 10^{-4} atm (4) 10^{-14} atm

Students may find similar question in CP exercise sheet :

[*Chapter : Electrochemistry, Exercise # 3B, Page No._36, Q._30*]

Ans. **[4]**

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

$$E_{H^+/H_2} = -\frac{0.0591}{2}\log\frac{P_{H_2}}{[H^+]^2}$$

$$\log\frac{P_{H_2}}{[H^+]^2} = 0,\ \frac{P_{H_2}}{[H^+]^2} = 10^0 = 1$$

$$P_{H_2} = [H^+]^2$$

For pure H_2O ; $H^+ = 10^{-7}$ M

$$P_{H_2} = (10^{-7})^2 = 10^{-14} \text{ atm}$$

Q.38 The correct statement regarding RNA and DNA respectively is :

(1) The sugar component in RNA is ribose and the sugar component in DNA is 2-dexyribose

(2) The sugar component in RNA is arabinose and the sugar component in DNA is ribose

(3) The sugar component in RNA is 2'-dexyribose and the sugar component in DNA is arabinose

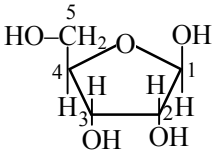
(4) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose

Students may find similar question in CP exercise sheet :

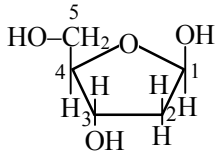
[*Chapter : Biomolecule in class notes*]

Ans. **[1]**

Sol. Sugar component in RNA is ribose



Sugar component in DNA is 2'-deoxyribose



Q.39 Which one given below is a non-reducing sugar ?

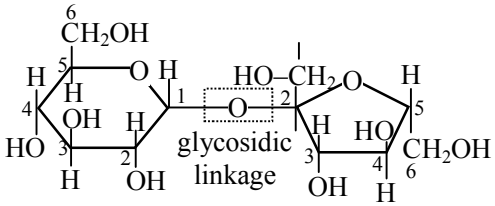
(1) Lactose (2) Glucose (3) Sucrose (4) Maltose

Students may find same question in CP exercise sheet :

[*Chapter : Biomolecule in class notes*]

Ans. **[3]**

Sol. Sucrose is non reducing sugar because of glucose and fructose are involved in glycosidic bond formation



Q.40 Which of the following statement about hydrogen is incorrect ?

(1) Hydrogen never acts as cation in ionic salts

(2) Hydronium ion, H_3O^+ exists freely in solution

(3) Dihydrogen does not act as a reducing agent

(4) Hydrogen has three isotopes of which tritium is the most common

Ans. **[3,4]**

Sol. Hydrogen exist as a hydride (H^-) in ionic salt.

Most abundant form of hydrogen is protium.

Dihydrogen reduces some metal ions in aqueous solution and oxides of metals (less active than iron) into corresponding metals.

$H_2(g) + Pd^{2+}(aq) \rightarrow Pd(s) + 2H^+(aq)$

$yH_2(g) + M_xO_y(s) \rightarrow xM(s) + yH_2O(\ell)$

Q.41 Consider the following liquid-vapour equilibrium

$$\text{Liquid} \rightleftharpoons \text{Vapour}$$

Which of the following relations is correct ?

(1) $\frac{d \ln P}{dT} = \frac{-\Delta H_v}{RT}$ (2) $\frac{d \ln P}{dT^2} = \frac{-\Delta H_v}{T^2}$ (3) $\frac{d \ln P}{dT} = \frac{\Delta H_v}{RT^2}$ (4) $\frac{d \ln G}{dT^2} = \frac{\Delta H_v}{RT^2}$

Students may find similar question in CP exercise sheet :

[*Chapter : Chemical equilibrium, Exercise # 1, Page No._113, Q._23*]

Ans. **[3]**

Sol. Acc. To Clausius Claperon equation

$$P = A\,e^{\frac{-\Delta H}{RT}}$$

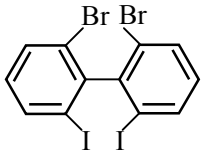
$$ln\,P = ln\,A + ln\,e^{\frac{-\Delta H}{RT}} \Rightarrow lnp = lnA - \frac{\Delta H}{RT} lne$$

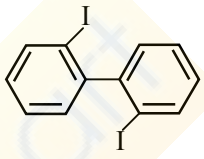
or $$lnp = lnA - \frac{\Delta H}{RT}$$

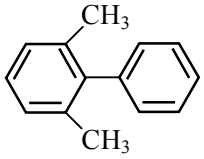
$$\frac{d}{dT}(ln\,P) = 0 + \frac{-\Delta H}{R}\frac{d}{dT}(T^{-1})$$

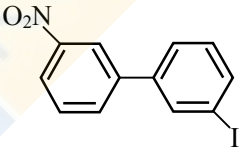
$$\frac{d}{dT} lnP = \frac{\Delta H_v}{RT^2}$$

Q.42 Which of the following biphenyls is optically active ?

(1) 

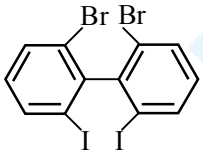
(2) 

(3) 

(4) 

Students may find similar question in CP exercise sheet :
[*Chapter : GOC-I (Isomerism), Exercise # 6, Page No.70, Q._24*]

Ans. **[1]**

Sol. 

Both phenyl ring placed in different plane so plane of symmetry absent result in it is optically active

Q.43 Which of the following statements is false ?

(1) Ca^{2+} ions are important blood in clotting

(2) Ca^{2+} ions are not important in maintaining the regular beating of heart

(3) Mg^{2+} ions are important in the green parts of plants

(4) Mg^{2+} ions form a complex with ATP

Students may find similar question in CP exercise sheet :
[*Chapter : in class notes*]

Ans. **[2]**

Sol. Blood calcium plays a major role in the regulation of heart rate and rhythm because it is involved in the generation and transmission of current from pace makers to the heart muscle. low blood calcium increase the risk for ventricular tachycardia.

Q.44 The ionic radii of A^+ and B^- ions are 0.98×10^{-10} m and 1.81×10^{-10} m. The coordination number of each ion in AB is :

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

Students may find similar question in CP exercise sheet :
[Chapter : Solid state, Exercise # 1, Page No.118, Q.56]

Ans. **[4]**

Sol. Radius ratio $= \dfrac{0.98\times10^{-10}}{1.81\times10^{-10}} = 0.541$

it is in between 0.414 – 0.732

$\therefore$ C.N. is 6.

Q.45 The rate of a first order reaction is 0.04 mol l^{-1} s^{-1} at 10 seconds and 0.03 mol l^{-1} s^{-1} at 20 seconds after initiation of the reaction. The half-life period of the reaction is :

(1) 34.1 s (2) 44.1 s (3) 54.1 s (4) 24.1 s

Students may find same question in CP exercise sheet :
[Chapter : Chemical kinetic in full syllabus Major Test 2]

Ans. **[4]**

Sol. $K = \dfrac{2.303}{10}\log\dfrac{0.04}{0.03}$

$K = \dfrac{2.303}{10}\log\dfrac{4}{3}$

$K = \dfrac{2.303\times0.123}{10}$

$K = 0.0285$

$t_{1/2} = \dfrac{0.693}{K}$

$t_{1/2} = \dfrac{0.693}{0.0285} = 24.1\text{s}.$

Q.46 The two polypeptides of human insulin are linked together by

(1) Phosphodiester bond (2) Covalent bond

(3) Disulphide bridges (4) Hydrogen bonds

Students may find it in CP sheet "Endocrine system"
Page No.170

Ans. **[3]**

Sol. Disulphide bond is present in A and B polypeptide chain in, human insulin

Q.47 The coconut water from tender coconut represents :

(1) Fleshy mesocarp (2) Free nuclear proembryo

(3) Free nuclear endosperm (4) Endocarp

Students may find in CP sheet "Reproduction in flowering plant"
Page No.33

Ans. **[3]**

Sol. Coconut water is free nuclear endosperm of coconut

Q.48 Which of the following is not a feature of the plasmids ?

(1) Circular structure (2) Transferable

(3) Single-stranded (4) Independent replication

Students may find it in CP sheet "Genetics"
Page No.44

Ans. **[3]**

Sol. Plasmid is double strand circular DNA

Q.49 Which is the National Aquatic Animal of India ?

(1) River dolphin (2) Blue whale (3) Sea-horse (4) Gangetic shark

Ans. **[1]**

Sol. River dolphin or gangetic dolphine is national aquatic animal of India

Q.50 The Avena curvature is used for bioassay of

(1) GA_3 (2) IAA (3) Ethylene (4) ABA

Students may find similar question in CP exercise sheet : Plant physiology
[Chapter : Plant growth physiology, Page No.144

Ans. **[2]**

Sol. *Avena* convature test is bioassay of plant hormone Auxin / IAA

Q.51 Which of the following is the most important cause of animals and plants being driven to extinction ?

(1) Alien species invasion (2) Habitat loss and fragmentation

(3) Co-extinctions (4) Over-exploitation

Students may find similar question in CP exercise sheet : Ecology
[Chapter :Biodiversity, Page No.140

Ans. **[2]**

Sol. Habitat loss & fragmentation is most common cause of species extinction across the globe.

Q.52 which of the following approaches does not give the defined action of contraceptive ?

(1)	Intra uterine devices	Increase phagocytosis of sperms, suppress sperm motility and fertilizing capacity of sperm
(2)	Hormonal contraceptives	Prevent/retard entry of sperm, prevent ovulation and fertilization
(3)	Vasectomy	Prevents spermatogenesis
(4)	Barrier methods	Prevent fertilization

Ans. **[3]**

Sol. Vasectomy prevents sperms from reaching the seminal secretion but it has no direct effect on stopping spermatogenesis.

Q.53 In a testcross involving F1 dihybrid flies, more parental-type offspring were produced than the recombinant-type-offspring. This indicates -

(1) Chromosomes failed to separate during meiosis

(2) The two genes are linked and present on the same chromosome

(3) Both of the characters are controlled by more than one gene

(4) The two genes are located on two different chromosomes

Students may find it in CP sheet "Genetics"
Page No.17

Ans. **[2]**

Sol. More parental less recombinant appear in phenomenon of incomplete linkage so the gene are linked and present an some chromosome

Q.54 A typical fat molecule is made up of -

(1) One glycerol and three fatty acid molecules

(2) One glycerol and one fatty acid molecule

(3) Three glycerol and three fatty acid molecules

(4) Three glycerol molecules and one fatty acid molecule

Students may find in CP sheet "Cell Biology & Protoplasm"
Page No.108

Ans. **[1]**

Sol. A typical fat molecule is a triglycerides & it is made up of one glycerol & three fatty acid molecules.

Q.55 Match the terms in Column-I with their description in Column-II and choose the correct option :

	Column-I		Column-II
(a)	Dominance	(i)	Many genes govern a single character
(b)	Codominance	(ii)	In a heterozygous organism only one allele expresses itself
(c)	Pleiotropy	(iii)	In a heterozygous organism both alleles express themselves fully
(d)	Polygenic inheritance	(iv)	A single gene influences many characters

Code :

	(a)	(b)	(c)	(d)
(1)	ii	iii	iv	i
(2)	iv	i	ii	iii
(3)	iv	iii	I	ii
(4)	ii	i	iv	iii

Students may find it in CP sheet "Genetics"
Page No.7,14,24

Ans. **[1]**

Sol. In heterozygous only one allele is express

Q.56 Which of the following statements is not correct ?

(1) Insects that consume pollen or nectar without bringing about pollination are called pollen / nector robbers.

(2) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil

(3) Some reptiles have also been reported as pollinators in some plant species

(4) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style

Students may find this in CP exercise sheet :
[Chapter :Reproduction in flowering plant, Page No.29

Ans. **[4]**

Sol. Many pollen tubes of same species can also grow into the style.

Q.57 Which of the following features is not present in *Periplaneta americana* ?

(1) Indeterminate and radial cleavage during embryonic development

(2) Exoskeleton composed of N-acetylglucosamine

(3) Metamerically segmented body

(4) Schizocoelom as body cavity

Students may find it in CP class notes :

Ans. **[1]**

Sol. Periplanata americana shows spiral and determinate types of cleavage during embryonic development

Q.58 Water soluble pigments found in plant cell vacuoles are -

(1) Chlorophylls (2) Carotenoids

(3) Anthocyanine (4) Xanthophylls

Students may find it in CP sheet "Cell biology & Protoplasm"
Page No.32

Ans. **[3]**

Sol. Anthocynine is water soluble pigment present in sap vacuole of plant.

Q.59 A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is contaning more number of chromosomes as compared to other dividing cells. This would results in -

(1) Polyploidy (2) Somaclonal variation

(3) Polyteny (4) Aneuploidy

Students may find it in CP sheet "Cell biology & Protoplasm"
Page No.53

Ans. **[1]**

Sol. When Nuclear membrane & cell plate is not formed in a cell during telophase of mitosis than polyploid cell is formed.

Q.60 A plant in your garden avoids photorespiratory losses, has improved water use efficiency, shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilization. In which of the following physiological groups would you assign this plant ? ;

(1) C_4 (2) CAM (3) Nitrogen fixer (4) C_3

Students may find similar question in CP exercise sheet : Plant Physiology
[Chapter : Photosynthesis, Page No.20

Ans. **[1]**

Sol. C_4 plants are adapted to hot & dry climate and no photorespiration due to Kranz anatomy.

Q.61 In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormally and it attacks self-cells, then it leads to

(1) Graft rejection (2) Auto-immune disease

(3) Active immunity (4) Allergic response

Students may find similar question in CP exercise sheet : Immune and disease
Page No.128

Ans. **[2]**

Sol. Due to genetic and some unknown reason immune cell can not distinguish self and non-self cells

Q.62 Emerson's enhancement effect and Red drop have been instrumental in the discovery of

(1) Two photosystems operating simultaneously

(2) Photophosphorylation and cyclic electron transport

(3) Oxidative phosphorylation

(4) Photophosphorylation and non-cyclic electron transport

Students may find similar question in CP exercise sheet : Plant physiology
[Chapter :Photosynthesis, Page No.11

Ans. **[1]**

Sol. Emerson's enhancement effect and Red drop effect leads to discovery of participation of two types of photosystem in light reaction of photosynthesis

Q.63 Select the correct statement

(1) *Salvinia, Ginkgo* and *Pinus* all are gymnosperms

(2) *Sequoia* is one of the tallest trees

(3) The leaves of gymnosperms are not well adapted to extremes of climate

(4) Gymnosperms are both homosporous and heterosporous

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.139

Ans. **[2]**

Sol. *Sequoia semepervirans* is one of the tallest tree (tallest in gymnosperm).

Q.64 Which of the following is not a characteristic feature during mitosis in somatic cells ?

(1) Disappearance of nucleolus (2) Chromosome movement

(3) Synapsis (4) Spindle fibres

Students may find it in CP sheet "Cell biology & Protoplasm"
Page No.57

Ans. **[3]**

Sol. Synapsis or pairing of homologous chromosome occurs in zygotene stage of meiosis. It does not occur in mitosis.

Q.65 Blood pressure in the pulmonary artery is -

(1) More than that in the carotid (2) More than that in the pulmonary vein

(3) Less than that in the venae cavae (4) Same as that in the aorta

Students may find it in CP sheet "Circulatory system"

Ans. **[2]**

Sol. Arteries have higher blood pressure than vein because blood is forced inside them from heart and also their lumen is narrow.

Q.66 Which of the following structures is homologus to the wing of the birds ?

(1) Wing of a Moth (2) Hind limb of Rabbit

(3) Flippers of Whale (4) Dorsal fin of a Shark

Students may find it in CP sheet "Origin & evolution"

Ans. **[3]**

Sol. Wings of a bird & flippers of a whale are modified forelimbs.

Q.67 Seed formation without fertilization in following plants involves the process of

(1) Budding (2) Somatic hybridization

(3) Apomixis (4) Sporulation

Students may find this in CP exercise sheet :
Chapter : Reproduction in flowering plant, Page No.38

Ans. **[3]**

Sol. Seed formation without fertilization in flowering plant is termed as agamospermy which comes under apomixis.

Q.68 Name the chronic respiratory disorder caused mainly by cigarette smoking

(1) Asthma (2) Respiratory acidosis (3) Respiratory alkalosis (4) Emphysema

Students may find it in CP sheet "Respiratory system, Animal physiology-II"

Ans. **[4]**

Sol. Emphysema is called smoker's disease

Q.69 Spindle fibres attach on to

(1) Kinetochore of the chromosomes (2) Centromere of the chromosomes

(3) Kinetosome of the chromosomes (4) Telomere of the chromosomes

Students may find it in CP sheet "Cell biology & Protoplasm"
Page No.40

Ans. **[1]**

Sol. Spindle fiber during mitosis & meiosis are attached to kinetochore of the chromosome.

Q.70 In context of Amniocentesis, which of the following statement is incorrect ?

(1) It is used for prenatal sex determination

(2) It can be used for detection of Down syndrome

(3) It can be used for detection of Cleft palate.

(4) It is usually done when a woman is between 14-16 weeks pregnant

Ans. **[3]**

Sol. Cleft palate can not detect by amniocentesis.
(Refer : Class notes)

Q.71 Stems modified into flat green organs performing the functions of leaves are known as
(1) Phyllodes (2) Phylloclades (3) Scales (4) Cladodes

Students may find it in CP sheet "Structural organization of flowering plant" Page No.88

Ans. **[2]**

Sol. In phylloclade complete stem is modified in flat leaf like photosynthetic organ.

Q.72 In a chloroplast the highest number of protons are found in
(1) Lumen of thylakoids (2) Inter membrane space
(3) Antennae complex (4) Stroma

Students may find similar question in CP exercise sheet : Plant physiology [Chapter : Photosynthesis, Page No.79

Ans. **[1]**

Sol. Highest number of protons found in lumen of thylakoid of chloroplast during day time due to photolysis of water and active transport of protons by plastoquinone from stroma to lumen of thylakoid.

Q.73 Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature ?
(1) The first word in a biological name represents the genus name, and the second is a specific epithet
(2) The names are written in Latin and are italicised
(3) When written by hand, the names are to be underlined
(4) Biological names can be written in any language

Students may find this in CP exercise sheet : [Chapter : Plant diversity, Page No.9

Ans. **[4]**

Sol. Biological names are written in latin only so as to follow single universal norm.

Q.74 In meiosis crossing over is initiated at :
(1) Leptotene (2) Zygotene (3) Diplotene (4) Pachetene

Students may find it in CP sheet "Cell biology & Protoplasm" Page No.54

Ans. **[4]**

Sol. Initiation of crossing over occurs in pachytene stage of prophase I of meiosis.

Q.75 Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain -
(1) Harvested antibodies (2) Gamma globulin
(3) Attenuated pathogens (4) Activated pathogens

Students may find similar question in CP exercise sheet : Immunity and disease Page No.127

Ans. **[3]**

Sol. O.P.V. is live attenuated pathogen vaccine

Q.76 The taq polymerase enzyme is obtained from
(1) *Thiobacillus ferroxidans* (2) *Bacillus subtilis*
(3) *Pseudomonas putida* (4) *Thermus aquaticus*

Students may find similar question in CP exercise sheet : Genetics Page No.57

Ans. **[4]**

Sol. Taq is obtain from thermus aquaticus

Q.77 Which of the following most appropriately describes haemophilia ?

(1) X-linked recessive gene disorder (2) Chromosomal disorder

(3) Dominant gene disorder (4) Recessive gene disorder

Students may find similar question in CP exercise sheet : Genetics
Page No.19

Ans. **[1]**

Sol. Hemophilia is x-linked recessive disorder

Q.78 The standard petal of a papilionaceous corolla is also called -

(1) Pappus (2) Vexillum (3) Corona (4) Carina

Students may find it in CP sheet "Structural organization of flowering plant"
Page No.100

Ans. **[2]**

Sol. Standard petal or posterior petal in papilionaceous corolla is known as vaxillum.

Q.79 Which part of the tobacco plant is infected by *Meloidogyne incognita* ?

(1) Leaf (2) Stem (3) Root (4) Flower

Ans. **[3]**

Sol. Meloidogyne incognita cause root node disease
NCERT XII page 209

Q.80 Which of the following statements is wrong for viroids ?

(1) They are smaller than viruses (2) They cause infections

(3) Their RNA is of high molecular weight (4) They lack a protein coat

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.189

Ans. **[3]**

Sol. Viroids consist of low molecular weight RNA

Q.81 Which of the following statements is not true for cancer cells in relation to mutations ?

(1) Mutations destroy telomerase inhibitor

(2) Mutations inactivate the cell control

(3) Mutations inhibit production of telomerase

(4) Mutations in proto-oncogenes accelerate the cell cycle

Students may it in CP class notes

Ans. **[3]**

Sol. Telomerase production is increased in cancer by mutation.

Q.82 Which type of tissue correctly matches with its locations ?

	Tissue	**Location**
(1)	Areolar tissue	Tendons
(2)	Transitional epithelium	Tip of nose
(3)	Cuboidal epithelium	Lining of stomach
(4)	Smooth muscle	Wall of intestine

Students may find it in CP sheet "Animal tissue"
Page No.44

Ans. **[4]**

Sol. In this match the column correct matching is smooth muscle –Wall of intestine

Q.83 Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other ?

(1)	Insulin	Glucagon
(2)	Aldosterone	Atrial Natriuretic Factor
(3)	Relaxin	Inhibin
(4)	Parathormone	Calcitonin

Students may find it in CP sheet "Endocrine system"
Page No.175

Ans. **[3]**

Sol. In this match the column which pairing of hormones are not antagonistic (having opposite effects) to each other is Relaxin-Inhibin

Q.84 Specialised epidermal cells surrounding the guard cells are called -

(1) Subsidiary cells (2) Bulliform cells

(3) Lenticels (4) Complementary cells

Students may find it in CP sheet "Structural organization of flowering plant"
Page No.23

Ans. **[1]**

Sol. Specialized epidermal cells surrounding the guard cells are known as Subsidiary or accessory cell.

Q.85 Fertilization in humans is practically feasible only if -

(1) The ovum and sperms are transported simultaneously to ampullary-isthmic junction of the fallopian tube

(2) The ovum and sperms are transported simultaneously to ampullary-isthmic junction of the cervix

(3) The sperm are transported into cervix within 48 hrs of release of ovum in uterus

(4) The sperm are transported into vagina just after the release of ovum in fallopian tube

Students may find it in CP sheet "Reproduction system"
Page No.91

Ans. **[1]**

Sol. Sperm and egg can lead to formation of zygote only when both of them are viable

Life of sperm after insemination – 4 to 5 days

Life of egg after ovulation – 2 days

Q.86 Which one of the following is the starter codon ?

(1) UGA (2) UAA (3) UAG (4) AUG

Students may find it in CP sheet "Cell biology & Protoplasm"
Page No.134

Ans. **[3]**

Sol. AUG is initiation codon during protein synthesis.

Q.87 A river with an inflow of domestic sewage rich in organic waste may result in -
(1) Increased population of aquatic food web organisms
(2) An increased production of fish due to biodegradable nutrients
(3) Death of fish due to lack of oxygen
(4) Drying of the river very soon due to algal bloom

Students may find similar question in CP exercise sheet : Ecology
[Chapter : Environmental issue, Page No.179

Ans. **[3]**
Sol. Domestic sewage rich in organic waste leads to increase in B.O.D, which leads to decrease D.O. (dissolved oxygen) Which leads to death of fishes.

Q.88 Following are the two statements regarding the origin of life -
(a) The earliest organisms that appeared on the earth were non-green and presumably anaerobes
(b) The first autotrophic organisms were the chemoautotrophs that never released oxygen
Of the above statements which one of the following options is correct ?
(1) (b) is correct but (a) is false
(2) Both (a) and (b) are correct
(3) Both (a) and (b) are false
(4) (a) is correct but (b) is false

Ans. **[2]**
Sol. Both statements are correct because primitive atmosphere was reducing and chlorophyll appeared later on.

Q.89 A system of rotating crops with legume or grass pasture to improve soil structure and fertility is called -
(1) Contour farming (2) Strip farming (3) Shifting agriculture (4) Ley farming

Ans. **[4]**
Sol. Rotating crops with legume or grass pasture to improve soil fertility is called as lay farming

Q.90 Gause's principle of competitive exclusion states that -
(1) Competition for the same resources excludes species having different food preferences
(2) No two species can occupy the same niche indefinitely for the same limiting resources
(3) Larger organisms exclude smaller ones through competition
(4) More abundant species will exclude the less abundant species through competition

Students may find similar question in CP exercise sheet : Ecology
[Chapter : Community, population , Page No.65

Ans. **[2]**
Sol. Gause's competitive exclusion principle starts that no two species can occupy the same niche indefinitely in a habitat.

Q.91 Which of the following characteristic features always holds true for the corresponding group of animals?

(1)	Viviparous	Mammalia
(2)	Possess a mouth with an upper and a lower jaw	Chordata
(3)	3-chambered heart with one incompletely divided ventricle	Reptilia
(4)	Cartilaginous endoskeleton	Chondrichthyes

Students may find it CP Sheet Animal diversity I & II Page No. 108

Ans. **[4]**
Sol. Chondrichthyse always have cartilagenous endoskeleton

Q.92 Change in GnRH pulse frequency in females is controlled by circulating levels of -

(1) estrogen and inhibin
(2) progesterone only
(3) progesterone and inhibin
(4) estrogen and progesterone

Students may find it in CP class notes

Ans. **[4]**

Sol. Changes in GnRH pulse frequency in female is controlled by circulating level of estrogen and progesteron hormone .

Q.93 Microtubules are the constituents of -

(1) Spindle fibres, Centrioles and Cilia
(2) Centrioles, spindle fibres and chromatin
(3) Centrosome, Nucleosome and Centrioles
(4) Cilia, Flagella and Peroxisomes

Students may find it in CP Sheet "Cell biology & protoplasm"
Page No. 33

Ans. **[1]**

Sol. Microtubule is structural component of spindle fiber, cilia, flagella, centriole etc.

Q.94 Mitochondria and chloroplast are-

(a) semi-autonomous organelles
(b) formed by division of pre existing organelles and they contain DNA but lack protein synthesising machinery

Which one of the following options is correct?

(1) (b) is true but (a) is false
(2) (a) is true but (b) is false
(3) Both (a) and (b) are false
(4) Both (a) and (b) are correct

Students may find it in CP Sheet "Cell biology & protoplasm"
Page No. 17, 20

Ans. **[2]**

Sol. Mitochondria & chloroplast is semi autonomous cell organelle which formed by division of pre existing organelle & contain DNA but they also contain protein synthesizing mechinary, thus A is true & B is false.

Q.95 Photosensitive compound in human eye is made up of -
(1) Opsin and Retinal (2) Opsin and Retinol
(3) Transducin and Retinene (4) Guanosine and Retinol

Students may find it in CP Sheet "Sensory system"
Page No. 274

Ans. **[1]**
Sol. Photosensitive compound Rhodopsin is made up of opsin and retinal

Q.96 Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the kingdom
(1) Protista (2) Fungi (3) Animalia (4) Monera

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.61

Ans. **[1]**
Sol. All unicellular eukaryotic organism like diatoms, desmids (chrysophytes), euglenoids, dinoflagellates and slime mould are included in Protista.

Q.97 The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals include the -
(1) Thermoacidophiles (2) Methanogens (3) Eubacteria (4) Halophiles

Students may find it in CP Sheet
[Chapter : Plant diversity, Page No.24

Ans. **[2]**
Sol. Methanogens are methane producing organism.

Q.98 Identify the correct statement on 'inhibin' -
(1) Is produced by granulose cells in ovary and inhibits the secretion of FSH
(2) Is produced by granulose cells in ovary and inhibits the secretion of LH
(3) Is produced by nurse cells in testes and inhibits the secretion of LH
(4) Inhibits the secretion of LH, FSH and Prolactin

Ans. **[1]**
Sol. Inhibin hormone secreted by granulosa cell of ovary and inhibits the secretion of FSH from pituitary in female while in male it also secreted by sertoli cells of testis and inhibits the secretion of FSH of pituitary in male.

Q.99 It is much easier for a small animals to run uphill than for a large animal, because -
(1) Smaller animals have a higher metabolic rate
(2) Small animals have a lower O2 requirement
(3) The efficiency of muscles in large animals is less than in the small animals
(4) It is easier to carry a small body weight

Students may find it in CP class notes

Ans. **[1]**
Sol. Small animal have high metabolic rate so they can easily run uphill than for a large animal

Q.100 A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F_1 plants were selfed the resulting genotypes were in the ratio of -
(1) 1 : 2 : 1 :: Tall heterozygous : Tall homozygous : Dwarf
(2) 3 : 1 :: Tall : Dwarf
(3) 3 : 1 :: Dwarf : Tall
(4) 1 : 2 : 1 :: Tall homozygous : Tall heterozygous : Dwarf

Students may find similar question in CP exercise sheet: Genetic
Page No.7

Ans. **[4]**

Sol. Tt × Tt

	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio

1 : 2 : 1

Q.101 Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancers -

(1) Ozone (2) Ammonia (3) Methane (4) Nitrous oxide

Students may find similar question in CP exercise sheet :
[Chapter : Ecology, Environmental issue , Page No 176

Ans. **[1]**

Sol. Ozone depletion is stratosphere leads to reaching of harmfull U.V. rays on earth which cause skin cancer

Q.102 Which one of the following is a characteristic feature of cropland ecosystem ?

(1) Least genetic diversity (2) Absence of weeds

(3) Ecological succession (4) Absence of soil organisms

Students may find similar question in CP exercise sheet :
[Chapter : Ecology, Biodivesity_, Page No. 132

Ans. **[1]**

Sol. Cropland ecosystem posses least genetic diversity

Q.103 Tricarpellary, syncarpous gynoecium is found in flowers of -

(1) Solanaceae (2) Fabaceae (3) Poaceae (4) Liliaceae

Students may find it in CP Sheet "Structural organisation of flowering plant"
Page No. 151

Ans. **[4]**

Sol. Tricarpellary syncarpous gyanoecium is a characteristic feature of flowers of liliaceae family.

Q.104 In which of the following, all three are macronutrients ?

(1) Iron, copper, molybdenum

(2) Molybdenum, magnesium, manganese

(3) Nitrogen, nickel, phosphorus

(4) Boron, zinc, manganese

Students may find similar question in CP exercise sheet :
[Chapter : Plant Physiology, Mineral Nutrition, Page No.212

Ans. **[Bonus]**

Sol. Mis question should be bonus as all 4 options are incorrect.

3rd option is more correct which includes N, Ni & P, but Ni (Nickel) is a micronutrient.

Q.105 Reduction in pH of blood will-
(1) reduce the blood supply to the brain
(2) decrease the affinity of hemoglobin with oxygen
(3) release bicarbonate ions by the liver
(4) reduce the rate of heart beat

Students may find it in CP sheet "Respiratory system"

Ans. **[2]**

Sol. Fall in pH or Rise in acidity of blood decreases the O_2 – Hb affinity.

Q.106 Lack of relaxation between successive stimuli in sustained muscle contraction is known as -
(1) Fatigue (2) Tetanus (3) Tonus (4) Spasm

Students may find it in CP Sheet "Muscle"
Page No. 201

Ans. **[2]**

Sol. Lack of relaxation between successive stimuli in sustain muscle contraction in known as tetanus.

Q.107 Which one of the following statements is wrong ?
(1) Golden algae are also called desmids
(2) Eubacteria are also called false bacteria
(3) Phycomycetes are also called algal fungi
(4) Cyanobacteria are also called blue-green algae

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.25

Ans. **[2]**

Sol. Eubacteria are true bacteria.

Q.108 Which of the following is a restriction endonuclease ?
(1) Protease (2) DNase I (3) RNase I (4) Hind II

Students may find similar question in CP exercise sheet :
[Chapter : Genetic , Page No.43

Ans. **[4]**

Sol. Hind II is first discovered restriction enzyme by Warner Arber.

Q.109 Which of the following would appear as the pioneer organisms on bare rocks?
(1) Liverworts (2) Mosses (3) Green algae (4) Lichens

Students may find similar question in CP exercise sheet :
[Chapter Ecology, Community, Population, Page No.60

Ans. **[4]**

Sol. On bare rock, Lichens are pioneer as they secretes carbonic acid which leads to rock weathering and creation of soil.

Q.110 Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using one of following options :
(1) Both processes can happen together because the diffusion coefficient of water and CO_2 is different.
(2) The above processes happen only during night time.
(3) One process occurs during day time, and the other at night.
(4) Both processes cannot happen simultaneously.

Students may find similar question in CP exercise sheet :
[Chapter : Plant Physiology, Plant water relation, Page No.204

Ans. **[1]**

Sol. Transpirational loss of water occurs through stomata & gaseous exchange also occurs through stomata in terrestrial plants. Simultaneously as both are the process of simple diffusion occurs in order of diffusion pressure gradient or diffusion coefficient.

Q.111 Cotyledon of maize grain is called :

(1) Coleorhiza (2) Coleoptile (3) Scutellum (4) Plumule

Students may find it in CP Sheet "Reproduction in flowering plant"
Page No. 41

Ans. **[3]**

Sol. Single shield shape cotyledon of maize grain is known as scutellum.

Q.112 Which of the following guards the opening of hepatopancreatic duct into the duodenum?

(1) Ileocaecal valve (2) Pyloric sphincter (3) Sphincter of Oddi (4) Semilunar valve

Students may find it in CP Sheet "Digestive system"
Page No. 145

Ans. **[3]**

Sol. Opening of hepatopancreatic duct in the duodenum is guarded by sphincter of oddi

Q.113 In the stomach, gastric acid is secreted by the :

(1) Parietal cells (2) Peptic cells
(3) Acidic cells (4) Gastrin secreting cells

Students may find it in CP Sheet "Digestive system"
Page No. 137

Ans. **[1]**

Sol. In stomach, gastric acid (HCl) is secreted by parietal cells of gastric gland.

Q.114 In mammals, which blood vessel would normally carry largest amount of urea?

(1) Dorsal Aorta (2) Hepatic Vein (3) Hepatic Portal Vein (4) Renal Vein

Ans. **[2]**

Sol. Urea synthesis occurs in liver.

Q.115 The term ecosystem was coined by :

(1) A.G. Tansley (2) E. Haeckel (3) E. Warming (4) E.P. Odum

Students may find similar question in CP exercise sheet :
[Chapter : Ecology, Ecosystem, Page No.86

Ans. **[1]**

Sol. Term Ecosystem was coined by A.G. Tansley.

Q.116 Which of the following is required as inducer(s) for the expression of Lac operon?

(1) galactose (2) lactose (3) lactose and galactose (4) glucose

Students may find similar question in CP exercise sheet :
[Chapter : Genetic, Page No.36

Ans. **[2]**

Sol. Lactose is inducer of lac operon.

Q.117 Which of the following is wrongly matched in the given table?

	Microbe	**Product**	**Application**
(1)	*Monascus purpureus*	Statins	Lowering of blood cholesterol
(2)	*Streptococcus*	Streptokinase	Removal of clot from blood vessel
(3)	*Clostridium butylicum*	Lipase	Removal of oil stains
(4)	*Trichoderma polysporum*	Cyclosporin A	Immunosuppressive drug

Students may find it in CP sheet "Biotechnology & its application"
Page no. 117

Ans. **[3]**

Sol. Clostridium butylicum ils used for butyric acid production
NCERT-XII page 183

Q.118 When does the growth rate of a population following the logistic model equal zero? The logistic model is given as $dN/dt = rN(1-N/K)$:
(1) When N nears the carrying capacity of the habitat.
(2) When N/K equals zero.
(3) When death rate is greater than birth rate.
(4) When N/K is exactly one.

Ans. **[4]**

Sol. $\frac{dN}{dt} = rN\left(1-\frac{N}{K}\right)$

when $\frac{N}{K} = 1$

then $\frac{dN}{dt} = rN\,(1-1)$

$\Rightarrow \frac{dN}{dt} = rN \times 0 \Rightarrow \frac{dN}{dt} = 0$

Q.119 Which one of the following statements is **not** true?
(1) Exine of pollen grains is made up of sporopollenin
(2) Pollen grains of many species cause severe allergies
(3) Stored pollen in liquid nitrogen can be used in the crop breeding programmes
(4) Tapetum helps in the dehiscence of anther

Students may find this in CP exercise sheet :
[Chapter : Reproduction in flowering plant, Page No.11

Ans. **[4]**

Sol. Endothecium helps in dehiscence of anther.

Q.120 In bryophytes and pteridophytes, transport of male gametes requires :
(1) Insects (2) Birds (3) Water (4) Wind

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.112

Ans. **[3]**

Sol. Bryophytes and Pteridophytes require water for fertilization and have motile male gametes.

Q.121 Which of the following is **not** a stem modification?

(1) Thorns of citrus (2) Tendrils of cucumber

(3) Flattened structures of *Opuntia* (4) Pitcher of *Nepenthes*

Students may find it in CP Sheet "Structural organisation of flowering plant" Page No. 89

Ans. **[4]**

Sol. Pitcher of Nepentheis or pitcher plant is modification of leaf not stem

Q.122 Which one of the following cell organelles is enclosed by a single membrane?

(1) Chloroplasts (2) Lysosomes (3) Nuclei (4) Mitochondria

Students may find it in CP Sheet "Cell biology and protoplasm"

Ans. **[2]**

Sol. Lysosome → Single membrane bound, Chloroplast, nucleus & mitochondria → Double membrane bound

Q.123 Analogous structures are a result of :

(1) Convergent evolution (2) Shared ancestry

(3) Stabilizing selection (4) Divergent evolution

Ans. **[1]**

Sol. Development of similar adaptive functional structure in organs of different origin is due to convergent evolution.

Q.124 Which one of the following statements is **wrong**?

(1) Cellulose is a polysaccharide. (2) Uracil is a pyrimidine.

(3) Glycine is a sulphur containing amino acid. (4) Sucrose is a disaccharide.

Ans. **[3]**

Sol. Glycins is simplest amino acid and does not contain sulphur

Q.125 Proximal end of the filament of stamen is attached to the :

(1) Connective (2) Placenta (3) Thalamus or petal (4) Anther

Ans. **[3]**

Sol. Proximal or basal end of a stamen is attached on thalamus or petal

Q.126 Which of the following is **not** required for any of the techniques of DNA fingerprinting available at present?

(1) Zinc finger analysis (2) Restriction enzymes

(3) DNA – DNA hybridization (4) Polymerase chain reaction

Students may it in CP exercise sheet : Genetics Page No.53

Ans. **[1]**

Sol Zinc-finger analysis is for protein analysis

Q.127 Which one of the following characteristics is not shared by birds and mammals?

(1) Breathing using lungs (2) Viviparity

(3) Warm blooded nature (4) Ossified endoskeleton

Students may find it CP Sheet Animal diversity I & II Page No. 127 & 133

Ans. **[2]**

Sol. Birds are always oviparous where as prototherian mammals are oviparous while rest of the mammals are viviparous.

Q.128 Select the **incorrect** statement :
(1) LH triggers ovulation in ovary.
(2) LH and FSH decrease gradually during the follicular phase.
(3) LH triggers secretion of androgens from the Leydig cells.
(4) FSH stimulates the sertoli cells which help in spermiogenesis.

Students may find it in CP Sheet "Reproductive System"

Ans. **[2]**

Sol. In this question select the incorrect statement which is LH and FSH decrease gradually during the follicular phase. While LH is decrease and FSH is gradually increase.
(Second statement is wrong because LH & FSH gradually rise during follicular phase.)

Q.129 The amino acid Tryptophan is the precursor for the synthesis of :
(1) Thyroxine and Triiodothyronine (2) Estrogen and Progesterone
(3) Cortisol and Cortisone (4) Melatonin and Serotonin

Students may find it in CP class notes

Ans. **[4]**

Sol. Tryptaphan is the precursor of synthesis of melatonin and serotonin.

Q.130 Joint Forest Management Concept was introduced in India during :
(1) 1970s (2) 1980s (3) 1990s (4) 1960s

Students may find similar question in CP exercise sheet :
[Chapter : Ecology, Environmental issue, Page No.189

Ans. **[2]**

Sol. Joint Forest Management Concept was introduced in India during 1980s.

Q.131 One of the major components of cell wall of most fungi is :
(1) Peptidoglycan (2) Cellulose (3) Hemicellulose (4) Chitin

Students may find this in CP exercise sheet :
[Chapter : Plant diversity, Page No.73

Ans. **[4]**

Sol. Most of the fungi have chitin in their cell wall [Oomycetes have cellulosic cell wall]

Q.132 A complex of ribosomes attached to a single strand of RNA is known as :
(1) Polymer (2) Polypeptide
(3) Okazaki fragment (4) Polysome

Students may find it in CP Sheet "Cell biology and protoplasm"
Page No. 25

Ans. **[4]**

Sol. String of ribosome on mRNA molecule during translation is known as polysome

Q.133 Which of the following features is **not** present in the Phylum – Arthropoda?
(1) Metameric segmentation (2) Parapodia
(3) Jointed appendages (4) Chitinous exoskeleton

Students may find it CP Sheet Animal diversity I & II Page No. 31

Ans. **[2]**

Sol. Presence of parapodia is a feature of polychaete annelids [eg. Neries] not of arthropods

Q.134 Asthma may be attributed to :

(1) allergic reaction of the mast cells in the lungs

(2) inflammation of the trachea

(3) accumulation of fluid in the lungs

(4) bacterial infection of the lungs

Students may find similar question in CP exercise sheet : Immunity and disease
Page No.123

Ans. **[1]**

Sol. Asthma is allergic disorder

Q.135 Pick out the **correct** statements :

(a) Haemophilia is a sex-linked recessive disease.

(b) Down's syndrome is due to aneuploidy.

(c) Phenylketonuria is an autosomal recessive gene disorder.

(d) Sickle cell anaemia is an X – linked recessive gene disorder.

(1) (b) and (d) are correct.

(2) (a), (c) and (d) are correct.

(3) (a), (b) and (c) are correct.

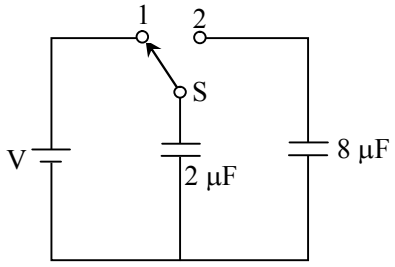
(4) (a) and (d) are correct.

Students may find similar question in CP exercise sheet : Immunity and disease
Page No.146

Ans. **[3]**

Sol. Sickle cell anemia is autosomal recessive gene disorder

Q.136 A capacitor of 2 μF is charged as shown in the diagram. When the switch S is turned to position 2, the percentage of its stored energy dissipated is :



(1) 20 % (2) 75 % (3) 80 % (4) 0 %

Students may find similar question in CP exercise sheet :
[*Chapter : Capacitor, Exercise # 3(B), Page No.125, Q.26*]

Ans. **[3]**

Sol. $U_{2\,\mu F} = \frac{1}{2}(2)\,V^2 = V^2$

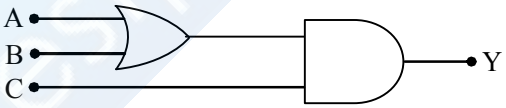
$$\Delta U = \frac{C_1C_2}{2(C_1+C_2)}(V_1 - V_2)^2$$

$$= \frac{2\times 8}{2(2+8)}(V-0)^2$$

$$= \frac{4}{5}V^2$$

$$\% \text{ dissipated} = \frac{\frac{4}{5}V^2}{V^2} \times 100 = 80\ \%$$

Q.137 To get output 1 for the following circuit, the correct choice for the input is :



(1) A = 1, B = 0, C = 0 (2) A = 1, B = 1, C = 0
(3) A = 1, B = 0, C = 1 (4) A = 0, B = 1, C = 0

Students may find similar question in CP exercise sheet :
[*Chapter : Electronics, Exercise #3(A), Page No.193, Q.56*]

Ans. **[3]**

Sol. A = 1, B = 0, C = 1

Q.138 A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is :

(1) 5 : 4 (2) 3 : 4 (3) 3 : 2 (4) 5 : 1

Students may find similar question in CP exercise sheet :
[*Chapter : Current Electricity, Exam., Page No.183, Q.33*]

Ans. **[3]**

Sol. $E_1 + E_2 = x(50)$ ....(i)

$E_1 - E_2 = x(10)$ ....(ii)

(i)/(ii); $\frac{E_1 + E_2}{E_1 - E_2} = \frac{5}{1}$

$\frac{E_1}{E_2} = \frac{3}{2}$

Q.139 When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is :

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

Students may find similar question in CP exercise sheet :
[*Chapter : Photoelectric Effect, Exercise #1, Page No.75, Q.39*]

Ans. **[3]**

Sol. $eV = \frac{hc}{\lambda} - w$ ....(i)

$\frac{eV}{4} = \frac{hc}{2\lambda} - w$ ....(ii)

(i) – 4 × (ii)

$0 = -\frac{hc}{\lambda} + 3w$

$3w = \frac{hc}{\lambda}$

$3\left(\frac{hc}{\lambda_0}\right) = \frac{hc}{\lambda}$

$\lambda_0 = 3\lambda$

Q.140 Two non-mixing liquids of densities ρ and nρ (n > 1) are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length pL (p < 1) in the denser liquid. The density d is equal to :

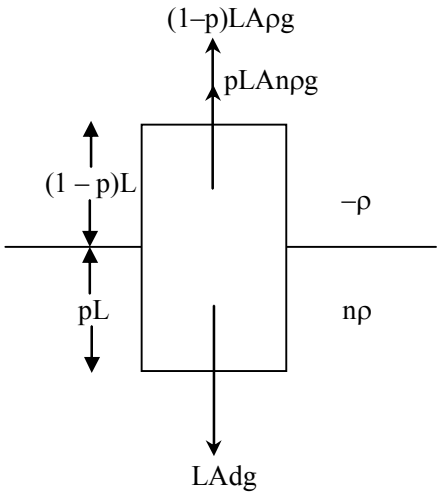
(1) {2 + (n + 1) p} ρ (2) {2 + (n – 1) p} ρ

(3) {1 + (n – 1) p} ρ (4) {1 + (n + 1) p} ρ

Students may find similar question in CP exercise sheet :
[*Chapter : Fluid Statics, Same as Class room notes*]

Ans. **[3]**

Sol.



$LAdg = (1 - p)\, LA\rho g + pLAn\rho g$

$d = (1 - p)\, \rho + np\rho$

$d = \rho\, [L - p + np)$

$d = \rho\, \{1 + (n - 1)\, p\}$

Q.141 Out of the following options which one can be used to produce a propagating electromagnetic wave ?

(1) A stationary charge

(2) A chargeless particle

(3) An accelerating charges

(4) A charge moving at constant velocity

Students may find similar question in CP exercise sheet :

[*Chapter : Electrostatics, Exercise # 1, Page No.35, Q.6*]

Ans. **[3]**

Q.142 The charge flowing through a resistance R varies with time t as $Q = at - bt^2$, where a and b are positive constants, The total heat produced in R is :

(1) $\frac{a^3R}{3b}$ (2) $\frac{a^3R}{2b}$ (3) $\frac{a^3R}{b}$ (4) $\frac{a^3R}{6b}$

Students may find similar question in CP exercise sheet :

[*Discussed in CP notes*]

Ans. **[4]**

Sol. $Q = at - bt^2$

$I = \frac{dQ}{dt} = a - 2bt$

for $I = 0 \quad \Rightarrow t = \frac{a}{2b}$

Heat in time $dt = I^2Rdt$

Total heat $= \int_0^{a/2b} I^2R\,dt$

$= \int_0^{a/2b} (a - 2bt)^2 R\,dt$

$= \int_0^{a/2b} (a^2 + 4b^2t^2 - 4abt)R\,dt$

$= R\left[a^2t + \frac{4b^2t^3}{3} - 2abt^2\right]_0^{a/2b}$

$= R\left[\frac{a^3}{2b} + \frac{a^3}{6b} - \frac{a^3}{2b} - 0\right]$

$= \frac{a^3R}{6b}$

Q.143 At what height from the surface of earth the gravitation potential and the value of g are -5.4×10^7 J kg^{-2} and 6.0 ms^{-2} respectively ? Take the radius of earth as 6400 km :

(1) 1600 km (2) 1400 km (3) 2000 km (4) 2600 km

Students may find similar question in CP exercise sheet :

[*Chapter : Gravitation, Same as Class room notes*]

Ans. **[4]**

Sol. $V_h = -\dfrac{GM}{R+h} = -5.4 \times 10^7$ J/k gm

$g_h = \dfrac{GM}{(R+h)^2} = 6$ m/s^2

$\dfrac{V_h}{g_h} = R + h = \dfrac{5.4 \times 10^7}{6}$

$h = 0.9 \times 10^7 - R$

$= 0.9 \times 10^4$ km $- 6400$ km

$= 9000 - 6400 = 2600$ km

Q.144 Coefficient of linear expansion of brass and steel rods are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good ?

(1) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (2) $\alpha_1^2 l_2 = \alpha_2^2 l_1$ (3) $\alpha_1 l_1 = \alpha_2 l_2$ (4) $\alpha_1 l_2 = \alpha_2 l_1$

Students may find similar question in CP exercise sheet :

[Chapter :Thermal Expansion, Exercise # 2, Page No.236, Q.8]

Ans. **[3]**

Sol. $T_1 \Rightarrow \Delta L_1 = L_2 - L_1$

$T_2 \Rightarrow \Delta L_2 = L'_2 - L'_1$

$= L_2 (1 + \alpha_2 \Delta T) - L_1 (1 + \alpha_1 \Delta T)$

$\Delta L_2 = L_2 - L_1 + (L_2\alpha_2 - L_1\alpha_1)\,\Delta T$

$\Delta L_1 = \Delta L_2$

$L_2 - L_1 = L_2 - L_1 + (L_2\alpha_2 - L_1\alpha_1)\,\Delta T$

$\Delta T \neq 0$

$L_1\alpha_1 = L_2\alpha_2$

Q.145 The intensity at the maximum in a Young's double slit experiment is I_0. Distance between two slits is $d = 5\lambda$, where λ is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen placed at a distance $D = 10\ d$?

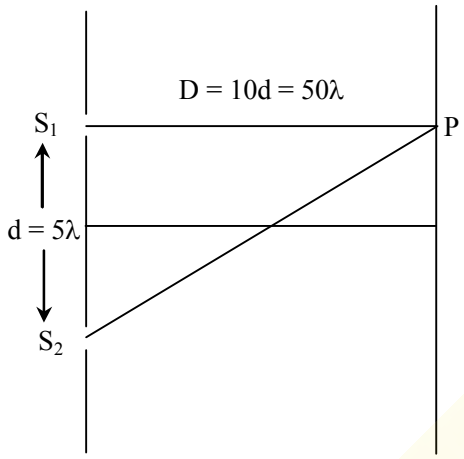
(1) $\dfrac{I_0}{4}$ (2) $\dfrac{3}{4} I_0$ (3) $\dfrac{I_0}{2}$ (4) I_0

Students may find similar question in CP exercise sheet :

[Chapter :Interference of Light, Exercise # 1(A), Page No.88, Q.8]

Ans. **[3]**

Sol.



Path difference $S_2P - S_1P = \sqrt{(50\lambda)^2 + (5\lambda)^2} - 50\,\lambda = 0.25\,\lambda$

$S_2P - S_1P = \dfrac{\lambda}{4}$

or phase difference = $\dfrac{\pi}{2}$

when $I_1 = I_2$

$I = I_{max} \cos^2 \dfrac{\phi}{2}$ (given $I_{max} = I_0$ and $\phi = \dfrac{\pi}{2}$)

$I = I_0 \cos^2 \dfrac{\pi/2}{2}$

$= I_0 \cos^2 \dfrac{\pi}{4}$

$= \dfrac{I_0}{2}$

Q.146 Given the value of Rydberg constant is 10^7 m^{-1}, the wave number of the last line of the Balmer series in hydrogen spectrum will be :

(1) 0.5×10^7 m^{-1} (2) 0.25×10^7 m^{-1} (3) 2.5×10^7 m^{-1} (4) 0.025×10^4 m^{-1}

Students may find similar question in CP exercise sheet :

[*Chapter :Atomic Structure, Same as Class room notes*]

Ans. **[2]**

Sol. $\frac{1}{\lambda} = Rz^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$\frac{1}{\lambda} = R(1)^2\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right)$

$\lambda = \frac{4}{R}$

$\overline{\nu} = \frac{1}{\lambda} = \frac{R}{4} = 0.25 \times 10^7\ m^{-1}$

Q.147 The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p) whose radius and mean density are twice as that of earth is :

(1) $1 : 2\sqrt{2}$ (2) 1 : 4 (3) $1 : \sqrt{2}$ (4) 1 : 2

Students may find similar question in CP exercise sheet :

[*Chapter :Gravitation, Exercise # 2, Page No.208, Q.2*]

Ans. **[1]**

Sol. $v_{escape} = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{8}{3}\pi GR^2\rho}$

$\frac{v_{earth}}{v_{planet}} = \sqrt{\left(\frac{R_e}{R_p}\right)^2\left(\frac{\rho_e}{\rho_p}\right)}$

$= \sqrt{\left(\frac{R_e}{2R_e}\right)^2\left(\frac{\rho_e}{2\rho_e}\right)} = \sqrt{\frac{1}{8}} = 1 : 2\sqrt{2}$

Q.148 A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb. The self-inductance of the solenoid is :

(1) 3 H (2) 2 H (3) 1 H (4) 4 H

Students may find similar question in CP exercise sheet :

[*Chapter : EMI, Exercise # 1, Page No.163, Q.47*]

Ans. **[3]**

Sol. $L = \frac{N\phi}{I}$

$L = \frac{1000 \times 4 \times 10^{-3}}{4} = 1\ H$

Q.149 A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is :

(1) $\sqrt{gR\dfrac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$ (2) $\sqrt{\dfrac{g}{R}\dfrac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

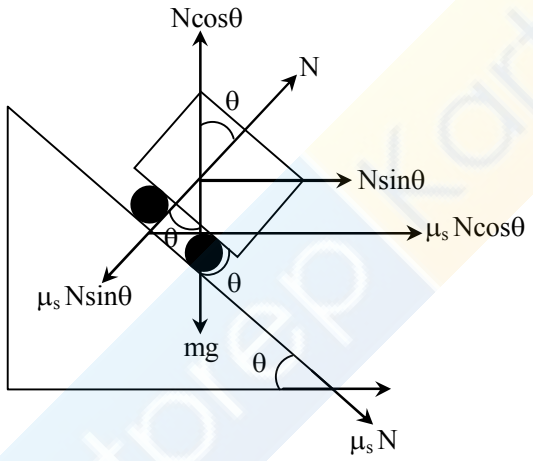
(3) $\sqrt{\dfrac{g}{R^2}\dfrac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$ (4) $\sqrt{gR^2\dfrac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

Students may find similar question in CP exercise sheet :

[*Chapter : Circular Motion, Same as Class room notes*]

Ans. **[1]**

Sol.



$\mu_s N\cos\theta + N\sin\theta = \dfrac{mv_{max}^2}{R}$ ….(i)

$N\cos\theta = \mu_s N\sin\theta + mg$

$N\cos\theta - \mu_s N\sin\theta = mg$ ….(ii)

(i)/(ii);

$$\frac{\mu_s\cos\theta+\sin\theta}{\cos\theta-\mu_s\sin\theta} = \frac{V^2}{Rg}$$

$$V = \sqrt{gR\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$$

Q.150 The magnetic susceptibility is negative for :

(1) paramagnetic material only (2) ferromagnetic material only

(3) paramagnetic and ferromagnetic materials (4) diamagnetic material only

Students may find similar question in CP exercise sheet :

[*Chapter :Magnetic Material, Exercise # 1, Page No.116, Q.13*]

Ans. **[4]**

Sol. χ is –ve for diamagnetic material only.

Q.151 A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of $15 ms^{-1}$. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is :

(Take velocity of sound in air = 330 ms^{-1})

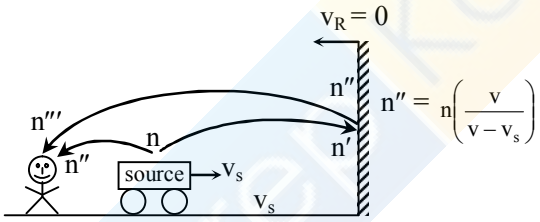
(1) 800 Hz (2) 838 Hz (3) 885 Hz (4) 765 Hz

Students may find similar question in CP exercise sheet :

[*Chapter : Doppler Effect (Wave Theory) , Exercise # 3(A), Page No.80, Q.11*]

Ans. **[2]**

Sol.



$$n''' = n'' = n\left(\frac{v}{v - v_s}\right)$$

$$= 800\left(\frac{330}{330 - 15}\right)$$

$$= 800 \times \frac{330}{315} = 838 \text{ Hz}$$

Q.152 A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = (2t\hat{i} + 3t^2\hat{j})$N, where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. What power will be developed by the force at the time t ?

(1) $(2t^2 + 4t^4)$W (2) $(2t^3 + 3t^4)$W (3) $(2t^3 + 3t^5)$W (4) $(2t^2 + 3t^3)$W

Students may find similar question in CP exercise sheet :

[*Chapter :Work, Power, Energy, Exercise #3(A), Page No.97, Q.2*]

Ans. **[3]**

Sol. $P = \vec{F} \cdot \vec{V}$

$P = (2t\hat{i} + 3t^2\hat{j}) \cdot (t^2\hat{i} + t^3\hat{j})$

$P = (2t^3 + 3t^5)W$

$\vec{F} = 2t\hat{i} + 3t^2\hat{j}$

$\vec{a} = \dfrac{\vec{F}}{m} = 2t\hat{i} + 3t^2\hat{j}$

$\int dV = \int \vec{a}\, dt$

$\vec{V} = t^2\hat{i} + t^3\hat{j}$

Q.153 From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre ?

(1) 13 $MR^2/32$ (2) 11 $MR^2/32$ (3) 9 $MR^2/32$ (4) 15 $MR^2/32$

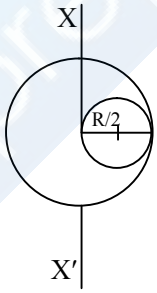
Students may find similar question in CP exercise sheet :

[Chapter : Rotational Motion, Exercise # 3(A), Page No.159, Q.30]

Ans. **[1]**

Sol. Mass of the removed part

$$M' = \frac{M}{\pi R^2} \times \pi\left(\frac{R}{2}\right)^2 = \frac{M}{4}$$



Moment of inertia of the disc $I = \dfrac{MR^2}{2}$

Moment of inertia of the removed part

$$I' = I_{CM} + \frac{Md^2}{4}$$

$$= \frac{\frac{M}{4}\left(\frac{R}{2}\right)^2}{2} + \frac{M}{4}\left(\frac{R}{2}\right)^2$$

$$= \frac{MR^2}{32} + \frac{MR^2}{16}$$

$= \frac{3MR^2}{32}$

So moment of inertia of the remaining part

$= I - I' = \frac{MR^2}{2} - \frac{3MR^2}{32}$

$= \frac{16MR^2 - 3MR^2}{32} = \frac{13MR^2}{32}$

Q.154 In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle 30º when light of wavelength 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of :

(1) $\sin^{-1}\left(\frac{2}{3}\right)$ (2) $\sin^{-1}\left(\frac{1}{2}\right)$ (3) $\sin^{-1}\left(\frac{3}{4}\right)$ (4) $\sin^{-1}\left(\frac{1}{4}\right)$

Students may find similar question in CP exercise sheet :
[Chapter : Diffraction, Exercise # 1, Page No.104, Q.3]

Ans. **[3]**

Sol. For first minimum

$\sin 30^o = \frac{\lambda}{a}$

$\frac{\lambda}{a} = \frac{1}{2}$ … (1)

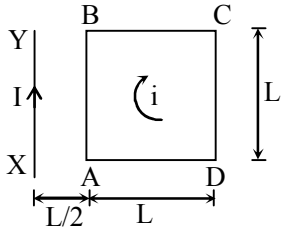
For first secondary maximum

$\sin\theta = \frac{3\lambda}{2a}$ $\frac{\lambda}{a} = \frac{1}{2}$

$\sin\theta = \frac{3}{2} \times \frac{1}{2}$

$\theta = \sin^{-1}\left(\frac{3}{4}\right)$

Q.155 A square loop ABCD carrying a current i is placed near and coplanar with a long straight conductor XY carrying a current I, the net force on the loop will be :



(1) $\frac{\mu_0 Ii}{2\pi}$ (2) $\frac{2\mu_0 IiL}{3\pi}$ (3) $\frac{\mu_0 IiL}{2\pi}$ (4) $\frac{2\mu_0 Ii}{3\pi}$

Students may find same question in CP exercise sheet :

[*Chapter : Magnetic Field, Exercise #3(A), Page No. 89, Q.92*]

Ans. **[4]**

Sol. $F_{AB} = \dfrac{\mu_0 Ii}{2\pi\left(\dfrac{L}{2}\right)} \times L$ (Attraction)

$F_{CD} = \dfrac{\mu_0 Ii}{2\pi\left(\dfrac{3L}{2}\right)} L$ (Repulsion)

$\vec{F}_{BC} = -\vec{F}_{AD}$

$\therefore$ Net force on loop

$F_{net} = F_{AB} - F_{CD}$

$= \dfrac{\mu_0 Ii}{\pi} - \dfrac{\mu_0 Ii}{3\pi}$

$= \dfrac{2\mu_0 Ii}{3\pi}$

Q.156 A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, b = 2.88×10^6 nmK. Which of the following is correct ?

(1) $U_3 = 0$ (2) $U_1 > U_2$ (3) $U_2 > U_1$ (4) $U_1 = 0$

Students may find similar question in CP exercise sheet :

[*Chapter :Radiation, Exercise #3(B), Page No.220, Q.25*]

Ans. **[3]**

Sol. $\lambda_m \times 5760 = 2.88 \times 10^{-3}$

$\lambda_m = \dfrac{10^{-3}}{2000} = 5 \times 10^{-7}$ m

$\lambda_m = 500$ nm

$\therefore$ U_2 is greatest

Q.157 An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is :

(1) 100 cm (2) 150 cm (3) 200 cm (4) 66.7 cm

Students may find similar question in CP exercise sheet :

[*Chapter : Wave Theory, Exercise # 1, Page No. 45, Q.157*]

Ans. **[2]**

Sol. $\ell_2 = 3\ell_1$

$= 3 \times 50 = 150$ cm

Q.158 The molecules of a given mass of a gas have r.m.s velocity of 200 ms^{-1} at 27ºC and 1.0×10^5 Nm^{-2} pressure. When the temperature and pressure of the gas are respectively, 127ºC and 0.05×10^5 Nm^{-2}, the r.m.s. velocity of its molecules in ms^{-1} is :

(1) $\frac{400}{\sqrt{3}}$ (2) $\frac{100\sqrt{2}}{3}$ (3) $\frac{100}{3}$ (4) $100\sqrt{2}$

Students may find similar question in CP exercise sheet :

[*Chapter : K.T.G., Exercise # 1, Page No.126, Q.12*]

Ans. **[1]**

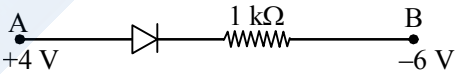
Sol. $V_{R.M.S.} \propto \sqrt{T}$

$$\frac{V_2}{V_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{400}{300}} = \frac{2}{\sqrt{3}}$$

$$V_2 = \frac{2V_1}{\sqrt{3}} = \frac{2 \times 200}{\sqrt{3}}$$

$$= \frac{400}{\sqrt{3}} \text{ m/sec}$$

Q.159 Consider the junction diode as ideal. The value of current flowing through AB is :



(1) 10^{-2} A (2) 10^{-1} A (3) 10^{-3} A (4) 0 A

Students may find similar question in CP exercise sheet :

[*Chapter : Electronics, Exercise # 2, Page No.184, Q.16*]

Ans. **[1]**

Sol. Diode is forward bias

$\Rightarrow$ Short circuit

$$I = \frac{PD}{\text{Resistance}} = \frac{10 \text{ volt}}{1 \times 10^3}$$

$= 10^{-2}$ A

Q.160 If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is :

(1) 90º (2) 45º (3) 180º (4) 0º

Students may find similar question in CP exercise sheet :

[*Chapter : Vector, Exercise # 1, Page No.64, Q.13*]

Ans. **[1]**

Sol. $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$

$\sqrt{A^2+B^2+2AB\cos\theta} = \sqrt{A^2+B^2-2AB\cos\theta}$

$\Rightarrow 4AB\cos\theta = 0$

$\Rightarrow \theta = 90^\circ$

Q.161 An astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance :

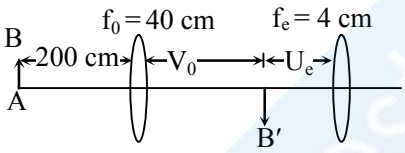
(1) 46.0 cm (2) 50.0 cm (3) 54.0 cm (4) 37.3 cm

Students may find similar question in CP exercise sheet :

[*Chapter : Ray Optics, Same as Class room notes*]

Ans. **[3]**

Sol.



$\frac{1}{V_0} - \frac{1}{U_0} = \frac{1}{f_0}$

$\frac{1}{V_0} - \frac{1}{-200} = \frac{1}{40}$

$\frac{1}{V_0} = \frac{1}{40} - \frac{1}{200}$

$\frac{1}{V_0} = \frac{5-1}{200} = \frac{4}{200} = \frac{1}{50}$

$V_0 = 50$ cm

If image is at infinite $\frac{1}{V_e} - \frac{1}{U_e} = \frac{1}{f_e}$

$$\frac{1}{\infty} - \frac{1}{U_e} = \frac{1}{4}$$

$U_e = 4$ cm

So separation between the lenses

$L = |V_0| + |U_e| = 50 + 4 = 54$ cm

Q.162 A npn transistor is connected to common emitter configuration in a given amplifier. A load resistance of 800 Ω is connected in the collector circuit and the voltage drop across it is 0.8 V. If the current amplification factor is 0.96 and the input resistance of the circuit is 192Ω, the voltage gain and the power gain of the amplifier will respectively be :

(1) 3.69, 3.84 (2) 4, 4 (3) 4, 3.69 (4) 4, 3.84

Students may find similar question in CP exercise sheet :

[*Same as Class room notes*]

Ans. **[4#]**

Sol. $\alpha = 0.96$

$R_L = 800\Omega$

$V_0 = 0.8$ volt

$R_i = 192\ \Omega$

$$A_R = \frac{800}{192}$$

$$A_V = \beta A_R = \frac{800}{192} \times 0.96$$

$A_V = 4$

$A_P = 0.96 \times 4 = 3.84$

(Answer is upto given data but given data is incorrect as in CE amplifier. Current amplification factor can't be less than 1.)

Q.163 A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then :

(1) Compressing the gas through adiabatic process will require more work to be done.

(2) Compressing the gas isothermally or adiabatically will require the same amount of work.

(3) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

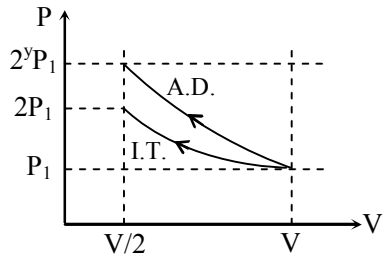
(4) Compressing the gas isothermally will require more work to be done.

Students may find similar question in CP exercise sheet :
[Chapter : Thermodynamics, Exercise # 2, Page No.167, Q.10]

Ans. **[1]**

Sol. $V \xrightarrow{I.T.C} \frac{V}{2} \Rightarrow P_2 = 2P_1$

$V \xrightarrow{A.D.C} \frac{V}{2} \Rightarrow P_2 = (2)^y P_1$



$W_{A.O.C.} > W_{I.T.C.}$

Q.164 A long straight wire of radius a carries a steady current I. The current uniformly distributed over its cross-section. The ratio of the magnetic fields B and B′, at radial distance $\frac{a}{2}$ and 2a respectively, from the axis of the wire is :

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

Students may find similar question in CP exercise sheet :
[Chapter : Magnetic Field, Exercise # 3(B), Page No.101, Q.125]

Ans. **[2]**

Sol. $B_{inside} = \frac{\mu_0 I(a/2)}{2\pi(a)^2} = \frac{\mu_0 I}{4\pi a}$

$B'_{outside} = \frac{\mu_0 I}{2\pi(2a)} = \frac{\mu_0 I}{4\pi a}$

$\therefore \frac{B}{B'} = 1 : 1$

Q.165 Match the corresponding entries of **column 1** with **column 2**. [Where m is the magnification produced by the mirror] :

Column 1	**Column 2**
(A) $m = -2$	(a) Convex mirror
(B) $m = -\frac{1}{2}$	(b) Concave mirror
(C) $m = +2$	(c) Real image
(D) $m = +\frac{1}{2}$	(d) Virtual image

(1) A → a and c; B → a and d; C → a and b; D → c and d

(2) A → a and d; B → b and c; C → b and d; D → b and c

(3) A → c and d; B → b and d; C → b and c; D → a and d

(4) A → b and c; B → b and c; C → b and d; D → a and d

Students may find similar question in CP exercise sheet :

[*Chapter : Ray Optics*]

Ans. **[4]**

Sol. A → b and c; B → b and c; C → b and d; D → a and d

Q.166 If the velocity of a particle is $v = At + Bt^2$, where A and B are constants, then the distance travelled by it between 1s and 2s is :

(1) 3A + 7B (2) $\frac{3}{2}A + \frac{7}{3}B$ (3) $\frac{A}{2} + \frac{B}{3}$ (4) $\frac{3}{2}A + 4B$

Students may find similar question in CP exercise sheet :

[*Chapter : Motion in One dimension*]

Ans. **[2]**

Sol. $v = At + Bt^2$

$$\frac{dx}{dt} = At + Bt^2$$

$$\int_0^x dx = \int_1^2 (At + Bt^2)\, dt$$

$$x = \left[\frac{At^2}{2} + \frac{Bt^3}{3}\right]_1^2$$

$$= \left[\frac{A(2)^2}{2} + \frac{B(2)^3}{3}\right] - \left[\frac{A(1)^2}{2} + \frac{B(1)^3}{3}\right]$$

$$= \frac{3}{2}A + \frac{7}{3}B$$

Q.167 A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first ?

(1) Sphere

(2) Both reach at the same time

(3) Depends on their masses

(4) Disk

Students may find same question in CP sheet :

[*Chapter : Rotational Motion, Page No.132, Q.1*]

Ans. **[1]**

Sol. $t = \frac{1}{\sin\theta}\sqrt{\frac{2L}{g}\left(1+\frac{k^2}{R^2}\right)}$

$\left(\frac{k^2}{R^2}\right)_{disk} = \frac{1}{2} = 0.5$

$\left(\frac{k^2}{R^2}\right)_{sphere} = \frac{2}{5} = 0.4$

$t_{disk} > t_{sphere}$

Q.168 Two identical charged spheres suspended from a common point by two massless strings of length *l*, are initially at a distance d (d << *l*) apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then v varies as a function of the distance x between the spheres, as :

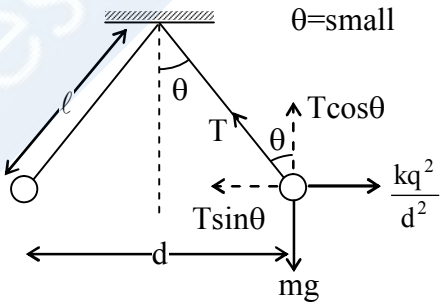
(1) $v \propto x$ (2) $v \propto x^{-\frac{1}{2}}$ (3) $v \propto x^{-1}$ (4) $v \propto x^{\frac{1}{2}}$

Students may find similar question in CP exercise sheet :

[*Chapter : Electrostatics, Exercise # 2, Page No.47, Q.13*]

Ans. **[2]**

Sol.



At balance $T\sin\theta = \frac{kq^2}{d^2}$

$T\cos\theta = mg$

$\tan\theta = \frac{kq^2}{d^2 mg} = \frac{d/2}{\ell}$

$\therefore \quad d^3 = \dfrac{2kq^2\ell}{mg}$

$d^3 \propto q^2$

if separation is x at instant t

$\Rightarrow \quad x^3 \propto q^2$

$\Rightarrow \quad q \propto x^{3/2}$

$\therefore \quad \dfrac{dq}{dt} \propto \dfrac{3}{2} x^{1/2} \cdot \dfrac{dx}{dt}$

$\therefore \quad \dfrac{dq}{dt}$ is given constant

$\therefore \quad x^{1/2} v = \text{constant}$

$\therefore \quad v \propto x^{-\frac{1}{2}}$

Q.169 A particle moves so that its position vector is given by $\vec{r} = \cos\omega t\,\hat{x} + \sin\omega t\,\hat{y}$. Where ω is a constant.

Which of the following is true ?

(1) Velocity and acceleration both are parallel to $\vec{r}$

(2) Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin.

(3) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.

(4) Velocity and acceleration both are perpendicular to $\vec{r}$

Students may find similar question in CP exercise sheet :

[*Chapter : Motion in One dimension*]

Ans. **[2]**

Sol. $\vec{r} = (\cos\omega t)\hat{i} + (\sin\omega t)\hat{j}$

$\vec{v} = \dfrac{d\vec{r}}{dt} = -\omega(\sin\omega t)\hat{i} + \omega(\cos\omega t)\hat{j}$

$\vec{a} = \dfrac{d\vec{v}}{dt} = -\omega^2(\cos\omega t)\hat{i} - \omega^2(\sin\omega t)\hat{j}$

$\vec{a} = -\omega^2(\cos\omega t\hat{i} + \sin\omega t\hat{j})$

$\boxed{\vec{a} = -\omega^2\vec{r}} \Rightarrow$ direction towards origin

$\boxed{\vec{r} \cdot \vec{v} = 0} \Rightarrow \vec{r} \perp \vec{v}$

Q.170 A piece of ice falls from a height h so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is : [Latent heat of ice is 3.4×10^5 J/kg and g = 10 N/kg]

(1) 544 km (2) 136 km (3) 68 km (4) 34 km

Students may find similar question in CP exercise sheet :

[*Chapter : Thermodynamics, Exercise # 2, Page No.169, Q.23*]

Ans. **[2]**

Sol. heat loss = mgh

$$\frac{1}{4}(mgh) = mL_f$$

$$h = \frac{4L_f}{g}$$

$$= \frac{4 \times 3.4 \times 10^5}{10}$$

$$= 13.6 \times 10^4 \text{ m}$$

$$= 136 \text{ km}$$

Q.171 A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad s^{-2}. Its net acceleration in ms^{-2} at the end of 2.0 s is approximately :

(1) 7.0 (2) 6.0 (3) 3.0 (4) 8.0

Students may find similar question in CP exercise sheet :

[*Chapter : Rotational Motion, Exercise # 1, Page No.140, Q.6*]

Ans. **[4]**

Sol. $\alpha = 2 \text{ rad/s}^2$

$R = 0.5$ m

$t = 2$ sec

$\omega_0 = 0$

$\omega = \omega_0 + \alpha t = 4$ rad/sec

$a_R = R\omega^2 = 0.5 \times 16 = 8 \text{ m/s}^2$

$a_t = \alpha = 1 \text{ m/s}^2$

$a = \sqrt{a_t^2 + a_R^2} \approx 8 \text{ m/s}^2$

Q.172 What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop ?

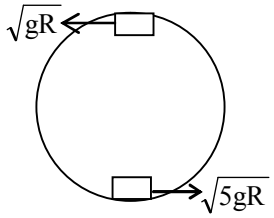
(1) $\sqrt{2gR}$ (2) $\sqrt{3gR}$ (3) $\sqrt{5gR}$ (4) $\sqrt{gR}$

Students may find similar question in CP exercise sheet :

[*Chapter : Circular Motion, Exercise # 2(B), Page No.186, Q.32*]

Ans. **[4]**

Sol.



But answer is $\sqrt{gR}$.

Q.173 A small signal voltage $V(t) = V_0 \sin \omega t$ is applied across an ideal capacitor C :

(1) Over a full cycle the capacitor C does not consume any energy from the voltage source

(2) Current I (t) is in phase with voltage V(t)

(3) Current I(t) leads voltage V(t) by 180º

(4) Current I(t), lags voltage V(t) by 90º

Students may find similar question in CP exercise sheet :

[*Chapter : Alternating Current , Exercise # 1, Page No.225, Q.83*]

Ans. **[1]**

Sol. In ideal capacitor, I leads from voltage by 90º and capacitor does not consume energy.

Q.174 A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ratio λ_2/λ_1 is :

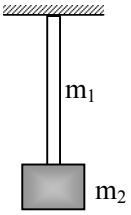
(1) $\sqrt{\frac{m_1 + m_2}{m_2}}$ (2) $\sqrt{\frac{m_2}{m_1}}$ (3) $\sqrt{\frac{m_1 + m_2}{m_1}}$ (4) $\sqrt{\frac{m_1}{m_2}}$

Students may find similar question in CP exercise sheet :

[*Chapter : Wave Theory, Exercise # 1, Page No.37, Q.48*]

Ans. **[1]**

Sol.



$T_1 = m_2 g$ | $T_2 = (m_1 + m_2)g$

$\lambda_1 = \lambda_1$ | $\lambda_2 = ?$

$$v = f\lambda = \sqrt{\frac{T}{\mu}}$$

$$\lambda \propto \sqrt{T}$$

$$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{T_1}{T_2}}$$

$$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{(m_1 + m_2)}{m_2}}$$

$$\lambda_2 = \sqrt{\frac{m_1 + m_2}{m_2}}\,\lambda_1$$

Q.175 An inductor 20 mH, a capacitor 50 μF and a resistor 40 Ω are connected in series across a source of emf V = 10 sin 340t. The power loss in A.C. circuit is :

(1) 0.67 W (2) 0.76 W (3) 0.89 W (4) 0.51 W

Students may find similar question in CP exercise sheet :

[Chapter : Alternating Current, Exercise # 2, Page No.228, Q.14]

Ans. **[4]**

Sol. $\omega = 340$

$$X_L = \omega L = 340 \times 20 \times 10^{-3} = 6.8\ \Omega$$

$$X_C = \frac{1}{\omega C} = \frac{1}{340 \times 50 \times 10^{-6}} = 58.8\ \Omega$$

$R = 40\ \Omega$

$$\therefore Z = \sqrt{(40)^2 + (52)^2} = \sqrt{1600 + 2704}$$

$$= \sqrt{4304}$$

$$= 65.6\ \Omega$$

$$P = V_{rms}\, I_{rms} \cos\phi$$

$$= \left(\frac{10}{\sqrt{2}}\right)\left(\frac{\frac{10}{\sqrt{2}}}{65.6}\right)\left(\frac{40}{65.6}\right) = 0.46\ \text{W} \approx 0.51\ \text{W}$$

Q.176 An electron of mass m and a photon have same energy E. The ratio of de-Broglie wavelengths associated with them is :

(1) $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$ (2) $c(2mE)^{\frac{1}{2}}$ (3) $\frac{1}{c}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$ (4) $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

(c being velocity of light)

Students may find similar question in CP exercise sheet :

[*Chapter : Matter Waves, Exercise # 1, Page No.103, Q.21*]

Ans. **[4]**

Sol. $\lambda_e = \frac{h}{P} = \frac{h}{\sqrt{2mE}}$

$\lambda_{ph} = \frac{hc}{E}$

$\therefore \frac{\lambda_e}{\lambda_{ph}} = \frac{h}{\sqrt{2mE}} \times \frac{E}{hc} = \frac{1}{c}\sqrt{\frac{E}{2m}} = \frac{1}{c}\left(\frac{E}{2m}\right)^{1/2}$

Q.177 When an α-particle of mass 'm' moving with velocity 'v' bombards on a heavy nucleus of charge 'Ze', its distance of closest approach from the nucleus depends on m as :

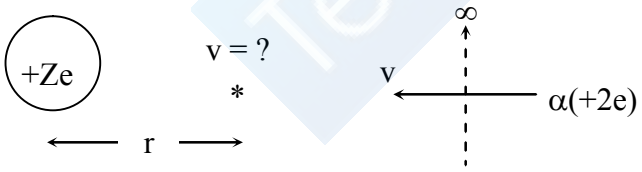
(1) $\frac{1}{\sqrt{m}}$ (2) $\frac{1}{m^2}$ (3) m (4) $\frac{1}{m}$

Students may find similar question in CP exercise sheet :

[*Chapter : Nuclear Physics, Exercise # 3(A), Page No.21, Q.45*]

Ans. **[4]**

Sol.



by conservation of mechanical energy

$(K + U)_\infty = (K + U)_r$

$\frac{1}{2}mv^2 + 0 = 0 + \frac{k(Ze)(2e)}{r}$

$\therefore \quad r = \frac{4kZe^2}{mv^2}$

$r \propto \frac{1}{m}$

Q.178 A refrigerator works between 4ºC and 30ºC. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is : (Take 1 cal = 4.2 Joules)

(1) 23.65 W (2) 236.5 W (3) 2365 W (4) 2.365 W

Students may find similar Example in CP sheet :

[*Chapter : Thermodynamics, Page No.157, Q.2*]

Ans. **[2]**

Sol. $C.O.P = \frac{Q_1}{W} = \frac{Q_1}{Q_2 - Q_1} = \frac{T_1}{T_2 - T_1}$ $\left[\begin{matrix} T_1 = 273 + 4 = 277\,K \\ T_2 = 30 + 273 = 303K \end{matrix}\right]$

$C.O.P = \frac{P_{out}}{P_{in}} = \frac{T_1}{T_2 - T_1}$

$P_{in} = P_{out}\left(\frac{T_2 - T_1}{T_1}\right)$

$= 600 \times 4.2 \left(\frac{303 - 277}{277}\right)$

$= 236.53$ watt

Q.179 A particle of mass 10 g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8×10^{-4} J by the end of the second revolution after the beginning of the motion ?

(1) 0.15 m/s^2 (2) 0.18 m/s^2 (3) 0.2 m/s^2 (4) 0.1 m/s^2

Students may find similar question in CP exercise sheet :

[*Chapter : Rotational Motion, Exercise # 1, Page No.140, Q.6*]

Ans. **[4]**

Sol. $\frac{1}{2}mv^2 = 8 \times 10^{-4}$

$\frac{1}{2} \times 10 \times 10^{-3}\, v^2 = 8 \times 10^{-4}$

$v^2 = 16 \times 10^{-2}$

$v = 0.4$ m/s

$v^2 = u^2 + 2as$

$(0.4)^2 = 0 + 2a \times 2(2\pi r)$

$0.16 = 8 \times 3.14 \times 6.4 \times 10^{-2}\, a$

$a = 0.1$ m/s^2

Q.180 The angle of incidence for a ray of light at a refracting surface of a prism is 45º. The angle of prism is 60º. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are :

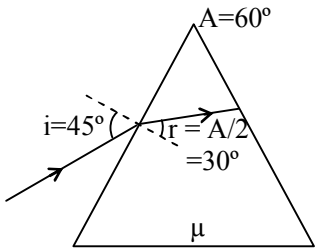
(1) 30º ; $\sqrt{2}$ (2) 45º ; $\sqrt{2}$ (3) 30º ; $\frac{1}{\sqrt{2}}$ (4) 45º ; $\frac{1}{\sqrt{2}}$

Students may find similar question in CP exercise sheet :

[*Chapter : Ray Optics, Solved Example, Page No.42, Q.4*]

Ans. **[1]**

Sol.



$i = \frac{\delta_m + A}{2}$

$45^\circ = \frac{\delta_m + 60^\circ}{2}$

$\delta_m = 30^\circ$

$\sin 45^\circ = \mu \sin 30^\circ$

$\frac{1}{\sqrt{2}} = \frac{\mu}{2}$

$\boxed{\mu = \sqrt{2}}$