NEET-UG EXAMINATION PAPER-2010

(Solved)

Time allowed : 3 hours | Maximum Marks : 802

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **200 questions.** All questions are **compulsory.**

ii. This question paper is divided into **1 sections.**

iii. **Section A** – questions number **1 to 200** are multiple choice questions

iv. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

v. Use of calculator is NOT allowed.

Section A

Question 1.

The number of atoms in 0.1 mol of a triatomic gas is: ($N_A = 6.02 \times 10^{23}$ mol^{-1})

[4 Marks]

(A) 1.806×10^{23}

(B) 1.800×10^{22}

(C) 3.600×10^{23}

(D) 6.026×10^{22}

Explanation:

The number of atoms in 0.1 mol of a triatomic gas

$= 0.1 \times 3 \times 6.023 \times 10^{23}$

= 1.806×10^{23}

Question 2.

Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl?

[4 Marks]

(A) O < S < F < Cl

(B) F < S < O < Cl

(C) S < O < Cl < F

(D) Cl < F < O < S

Explanation:

O < S < F < Cl

Electron gain enthalpy of the given elements are −141, −200, −333 and −349 kJ mol^{-1} respectively.

Question 3.

The correct order of increasing ionic radii among the following isoelectronic species are:

[4 Marks]

(A) $Ca^{2+} > K^{+} > S^{2-} > Cl^{-}$

(B) $Cl^{-} > S^{2-} > Ca^{2+} > K^{+}$

(C) $S^{2-} > Cl^{-} > K^{+} > Ca^{2+}$

(D) $K^{+} > Ca^{2+} > Cl^{-} > S^{2-}$

Explanation:

Among the isoelectronic species, size increases with the increase in negative charge. Thus S^{2-} has the highest negative charge and hence largest in size followed by Cl^{-}, K^{+} and Ca^{2+}.

Question 4.

In which one of the following species the central atom has the type of hybridization which is not the same as that present in the other three?

[4 Marks]

(A) SF_4

(B) I_3^-

(C) $SbCl_5^{2-}$

(D) PCl_5

Explanation:

For $SbCl_5^{2-}$: 5 + 5 + 2 / 2 = 6 means sp^3d^2 hybridisation.

I_3^-, SF_4, and PCl_5 ; all have sp^3d hybridization.

Question 5.

In which of the following pairs of molecules/ions, the central atoms have sp^2 hybridization?

[4 Marks]

(A) BF_3 and NH_2^-

(B) NH_2^- and H_2O

(C) BF_3 and NO_2^-

(D) NO_2^- and NH_3

Explanation:

BF_3: 3+3/2 = 3 means sp^2 hybridisation.

NO_2^-: 5+1/2 = 3 means sp^2 hybridisation.

Question 6.

Which one of the following species does not exist under normal conditions?

[4 Marks]

(A) B_2

(B) Li_2

(C) Be_2^+

(D) Be_2

Explanation:

Bond order of Be_2 = 0, hence Be_2 cannot exist.

Question 7.

Standard entropies of X_2, Y_2 and XY_3 are 60, 40 and 50 JK^{-1} mol^{-1}, respectively.

(1 / 2) X_2 + (3 / 2)Y_2 ⇌ XY_3, ΔH = −30 kJ

to be at equilibrium, the temperature should be:

[4 Marks]

(A) 500 K

(B) 1250 K

(C) 750 K

(D) 1000 K

Explanation:

ΔS for the reaction (1 / 2) X_2 + (3 / 2)Y_2 ⇌ XY_3,

ΔS = 50 − (30 + 60) = −40 J

For equilibrium,

ΔG = 0 = ΔH − TΔS

T = ΔH / ΔS = −30000 / -40 = 750 K

Question 8.

In which of the following equilibrium K_c and K_p are not equal?

[4 Marks]

(A) $2NO(g) ⇌ N_2(g) + O_2(g)$

(B) $SO_2(g) + NO_2(g) ⇌ SO_3(g) + NO(g)$

(C) $2C(s) + O_2(g) ⇌ 2CO_2(g)$

(D) $H_2(g) + I_2(g) ⇌ 2HI(g)$

Explanation:

$2C(s) + O_2(g) ⇌ 2CO_2(g)$

Δn = 2 − 1 = +1

∴ K_c and K_p are not equal.

Question 9.

Which one of the following molecular hydrides acts as a Lewis acid?

[4 Marks]

(A) CH_4

(B) B_2H_6

(C) NH_3

(D) H_2O

Explanation:

Boron in B_2H_6 is electron deficient.

Question 10.

If pH of a saturated solution of $Ba(OH)_2$ is 12, the value of its K_sp is:

[4 Marks]

(A) $5.00 \times 10^{-7}\ M^3$

(B) $5.00 \times 10^{-6}\ M^3$

(C) $4.00 \times 10^{-7}\ M^3$

(D) $4.00 \times 10^{-6}\ M^3$

Explanation:

.

$$Ba(OH)_2(s) \longrightarrow Ba^{2+}(aq) + 2\,OH^-(aq)$$

$pH = 12$ or $pOH = 2$

$[OH^-] = 10^{-2}\ M$

$$Ba(OH)_2 \longrightarrow \underset{0.5 \times 10^{-2}}{Ba^{2+}} + \underset{10^{-2}}{2\,OH^-}$$

$[\because$ Concentration of Ba^{2+} is half of $OH^-]$

$$K_{sp} = [Ba^{2+}]\,[OH^-]^2$$

$$= [0.5 \times 10^{-2}]\,[1 \times 10^{-2}]^2$$

$$= 0.5 \times 10^{-6} = 5 \times 10^{-7}\ M^3$$

Question 11.

What is $[H^+]$ in mol/L of a solution that is 0.20 M in CH_3COONa and 0.10 M in CH_3COOH? (For CH_3COOH, $K_a = 1.8 \times 10^{-5}$)

[4 Marks]

(A) 9.0×10^{-6}

(B) 1.8×10^{-5}

(C) 1.1×10^{-5}

(D) 3.5×10^{-4}

Explanation:

$pH = pK_a + \log[\text{Salt} / \text{Acid}]$

$\log[H^+] = \log K_a - \log[\text{Salt} / \text{Acid}]$

$\log[H^+] = \log K_a + \log[\text{Acid} / \text{Salt}]$

$[H^+] = K_a[\text{Acid} / \text{Salt}]$

$= 1.8 \times 10^{-5} \times 0.1 / 0.2 = 9 \times 10^{-6}$ M

Question 12.

In a buffer solution containing equal concentration of B^- and HB, the K_b for B^- is 10^{-10}. The pH of the buffer solution is:

[4 Marks]

(A) 10

(B) 7

(C) 6

(D) 4

Explanation:

$K_b = 10^{-10}$, $K_a = 10^{-4}$ or $pK_a = 4$

For the buffer solution containing equal concentration of B^- and HB,

$pH = pK_a + \log 1$

$pH = pK_a = 4$

Question 13.

Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy?

[4 Marks]

(A) $CaSO_4$

(B) $BeSO_4$

(C) $BaSO_4$

(D) $SrSO_4$

Explanation:

Be^{2+} is very small, hence its hydration enthalpy is greater than its lattice enthalpy. Also, hydration energy decreases down the group.

Question 14.

Property of the alkaline earth metals that increases with their atomic number:

[4 Marks]

(A) Solubility of their hydroxides in water

(B) Solubility of their sulphates in water

(C) Ionization energy

(D) Electronegativity

Explanation:

The magnitude of hydration energy for the hydroxides of alkaline earth metals remains almost the same whereas lattice energy decreases appreciably down the group. Hence, solubility increases down the group.

Question 15.

The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence:

[4 Marks]

(A) $BF_3 > BCl_3 > BBr_3$

(B) $BBr_3 > BF_3 > BCl_3$

(C) $BBr_3 > BCl_3 > BF_3$

(D) $BCl_3 > BF_3 > BBr_3$

Explanation:

In BF_3, p–p overlap between B and F is maximum due to the identical size and energy of p-orbitals, so electron deficiency in boron of BF_3 is neutralized partially to the maximum extent by back donation. Also, the tendency to back donate decreases from F to I. So the order will be:

$BF_3 > BCl_3 > BBr_3$.

Question 16.

In the following the most stable conformation of n-butane is:

[4 Marks]

(A)



(B)



(C)



(D)



Explanation:

The bulky methyl groups are maximum away from each other.

Question 17.

Liquid hydrocarbons can be converted to a mixture of gaseous hydrocarbons by :

[4 Marks]

(A) Hydrolysis

(B) Cracking

(C) Distillation under reduced pressure

(D) Oxidation

Explanation:

During cracking, higher hydrocarbons (liquid) are converted to lower gaseous hydrocarbons.

Question 18.

Which one is most reactive towards electrophilic reagent?

[4 Marks]

(A)

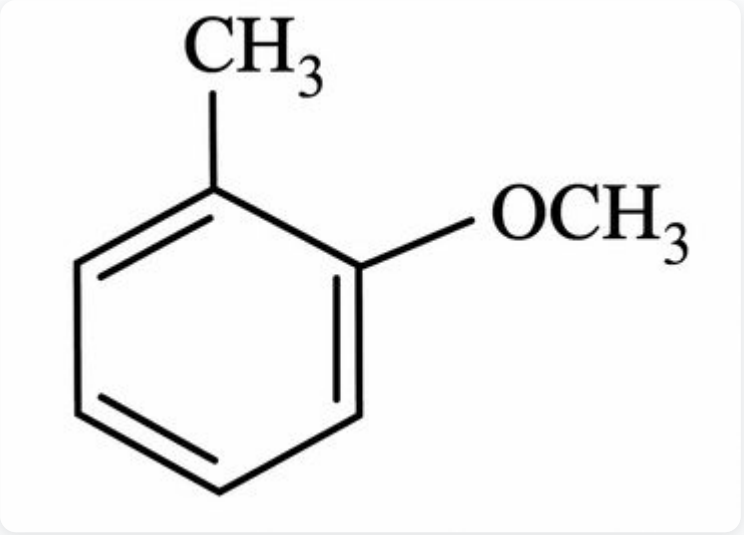
(B)

(C)

(D)

Explanation:

Among –OH, $–CH_2OH$, $–NHCOCH_3$ and $–OCH_3$, methoxy ($–OCH_3$) group has the highest +M effect.



Question 19.

AB crystallizes in a body centred cubic lattice with edge length 'a' = 387 pm. The distance between two oppositely charged ions in the lattice is:

[4 Marks]

(A) 200 pm

(B) 300 pm

(C) 335 pm

(D) 250 pm

Explanation:

For bcc lattice, diagonal = $a\sqrt{3}$

The distance between the two oppositely charged ions =

$(a / 2)\sqrt{3} = 387 \times 1.732 / 2 \simeq 335pm$

Question 20.

25.3 g of sodium carbonate, Na_2CO_3, is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ions, Na^+, and carbonate ions, CO_3^{2-}, are respectively. (Molar mass of Na_2CO_3 = 106 g mol^{-1})

[4 Marks]

(A) 0.477 M and 0.477 M

(B) 1.90 M and 1.910 M

(C) 1.910 M and 0.955 M

(D) 0.955 M and 1.910 M

Explanation:

Concentration of

Na_2CO_3 = 25.3/106 × 1000/250 = 0.955 M

$[Na^+]$ = 2 × 0.955 = 1.91 M

$[CO_3^{2-}]$ = 0.955 M

Question 21.

An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase?

[4 Marks]

(A) Addition of Na_2SO_4

(B) Addition of water

(C) Addition of 1.00 molal KI

(D) Addition of NaCl

Explanation:

When the aqueous solution of one molal KI is diluted with water, concentration decreases; therefore, the vapour pressure of the resulting solution increases.

Question 22.

A solution of sucrose (molar mass = 342 g mol^{-1}) has been prepared by dissolving 68.5 g of sucrose in 1000 g of water. The freezing point of the solution obtained will be (K_f for water = 1.86 K kg mol^{-1}):

[4 Marks]

(A) −0.520°C

(B) −0.570°C

(C) +0.372°C

(D) −0.372°C

Explanation:

$\Delta T_f = K_f \times (1000W_2 / M_2W_1)$

$= (1.86 \times 1000 \times 68.5) / (342 \times 1000)$

$= 0.372°C$

$T_f = -0.372°C \because (0 - \Delta T_f)$

Question 23.

An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to:

[4 Marks]

(A) increase in ionic mobility of ions

(B) increase in both i.e. number of ions and ionic mobility of ions

(C) increase in number of ions

(D) 100% ionisation of electrolyte at normal dilution

Explanation:

Strong electrolytes are completely ionised at all concentrations. On increasing dilution, the number of ions remains the same but the ionic mobility increases.

Question 24.

For the reduction of silver ions with copper metal, the standard cell potential was found to be +0.46 V at 25°C. The value of standard Gibbs energy, $\Delta G°$, will be: ($F = 96500\ C\ mol^{-1}$)

[4 Marks]

(A) −89.0 kJ

(B) −44.5 kJ

(C) −98.0 kJ

(D) −89.0 J

Explanation:

$Cu + 2Ag^+_(aq) \rightarrow Cu^{2+}_(aq) + 2Ag_{(s)}$

Here,

$n = 2, E_{cell}° = +0.46\ V$

$\Delta G^\circ = -nE^\circ F = (-2 \times 0.46 \times 96500) / 1000\ kJ = -89\ kJ$

Question 25.

For the reaction [$N_2O_5(g) \rightarrow 2NO_2(g) + 1/2O_2(g)$] the value rate of disappearance of N_2O_5 is given as 6.25×10^{-3} mol L^{-1} s^{-1}. The rate of formation of NO_2 and O_2 is given respectively as:

[4 Marks]

(A) 1.25×10^{-2} mol L^{-1} s^{-1} and 6.25×10^{-3} mol L^{-1} s^{-1}

(B) 6.25×10^{-3}mol L^{-1} s^{-1} and 3.125×10^{-3} mol L^{-1} s^{-1}

(C) 1.25×10^{-2} mol L^{-1} s^{-1} and 3.125×10^{-3} mol L^{-1} s^{-1}

(D) 6.25×10^{-3} mol L^{-1} s^{-1} and 6.25×10^{-3} mol L^{-1} s^{-1}

Explanation:

$N_2O_5(g) \longrightarrow 2\ NO_2(g) + 1/2\ O_2(g)$

$-\ d/dt\ [N_2O_5] = +\ (1/2)\ (d/dt)\ [NO_2] = 2\ (d/dt)\ [O_2]$

$d/dt\ [NO_2] = 1.25 \times 10^{-2}$ mol L^{-1} s^{-1} and

$d/dt\ [O_2] = 3.125 \times 10^{-3}$ mol L^{-1} s^{-1}

Question 26.

During the kinetic study of the reaction, $2A + B \rightarrow C + D$ following results were obtained:

[4 Marks]

Run	[A]/mol L^{-1}	[B]/mol L^{-1}	Initial rate of formation of D/mol L^{-1} min^{-1}
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

(A) rate = k $[A]^2$ [B]

(B) rate = k $[A]^2$ $[B]^2$

(C) rate = k [A] $[B]^2$

(D) rate = k [A] [B]

Explanation:

In case of (II) and (III), keeping the concentration of [A] constant, when the concentration of [B] is doubled, the rate quadruples. Hence, it is second order with respect to B.

In case of (I) and (IV), keeping the concentration of [B] constant, when the concentration of [A] is increased four times, the rate also increases four times. Hence, the order with respect to A is one.

hence

Rate = k [A] $[B]^2$

Question 27.

For an endothermic reaction, energy of activation is E_a and enthalpy of reaction is ΔH (both of these in kJ mol^{-1}). Minimum value of E_a will be:

[6 Marks]

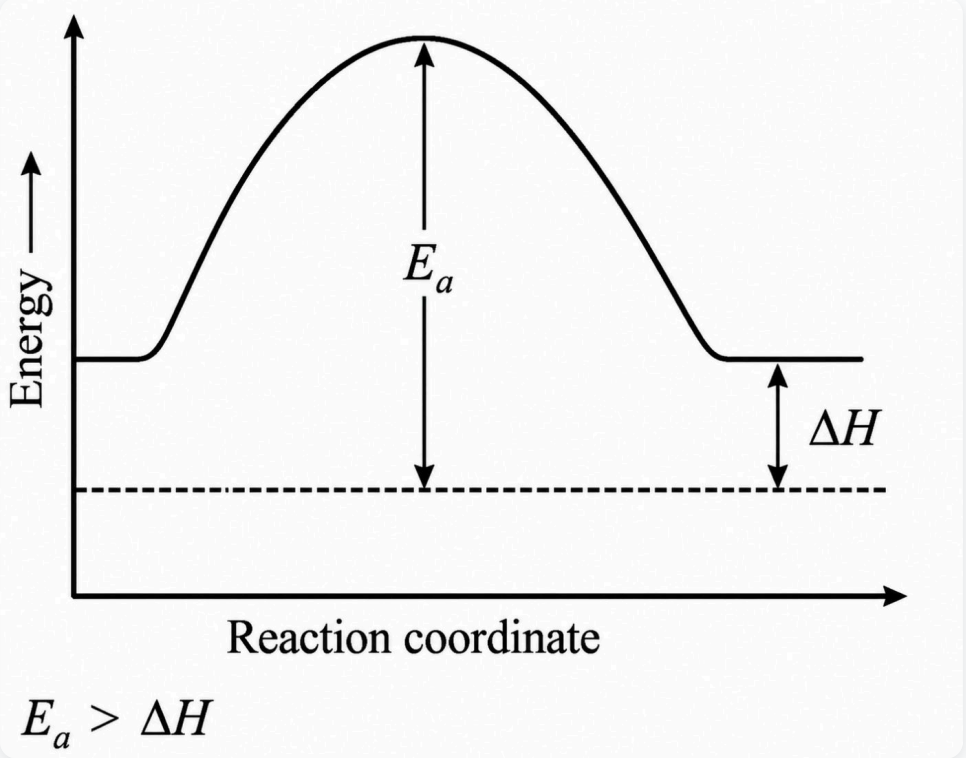
(A) Less than ΔH

(B) Equal to ΔH

(C) Equal to zero

(D) More than ΔH

Explanation:



Question 28.

Oxidation states of P in $H_4P_2O_5$, $H_4P_2O_6$, and $H_4P_2O_7$ are respectively:

[4 Marks]

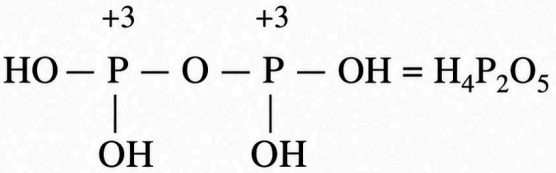
(A) +5, +3, +4

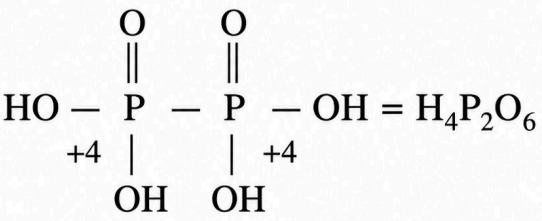
(B) +3, +5, +4

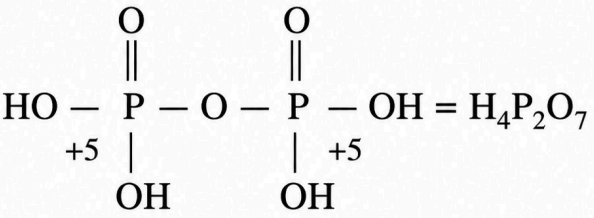
(C) +5, +4, +3

(D) +3, +4, +5

Explanation:







Question 29.

Which one of the following compounds is a peroxide?

[4 Marks]

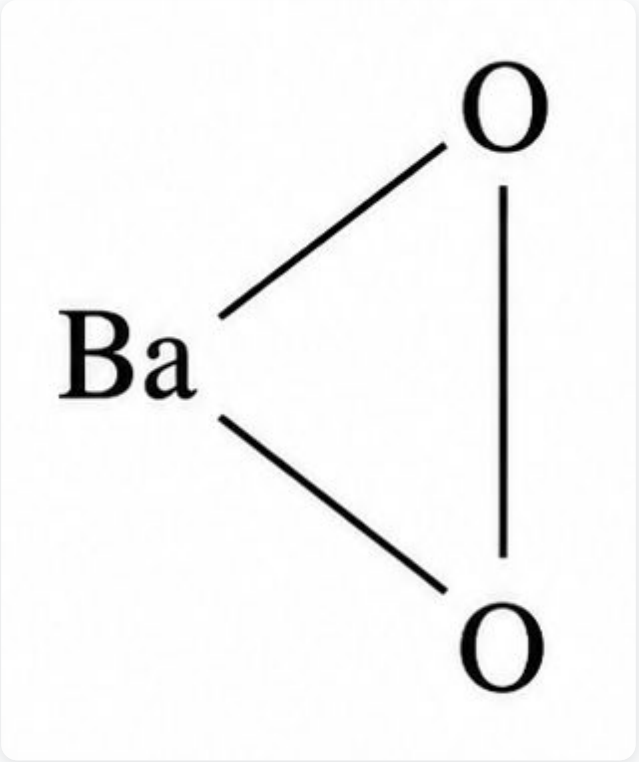
(A) BaO_2

(B) NO_2

(C) MnO_2

(D) KO_2

Explanation:



Question 30.

The correct order of increasing bond angles in the following species is:

[4 Marks]

(A) $ClO_2^- < Cl_2O < ClO_2$

(B) $Cl_2O < ClO_2^- < ClO_2$

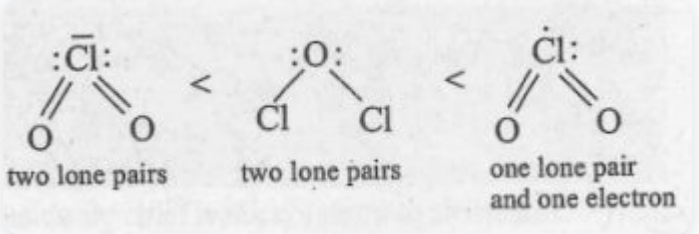
(C) $ClO_2 < Cl_2O < ClO_2^-$

(D) $Cl_2O < ClO_2 < ClO_2^-$

Explanation:

(i) As the number of lone pair of electrons increases, bond angle decreases due to repulsion between lp — lp.

(ii) As the electronegativity of the central atom increases, bond angle increases. Hence, the correct order of bond angle:



Question 31.

Which of the following ions will exhibit colour in aqueous solutions?

[4 Marks]

(A) Sc^{3+} (Z = 21)

(B) Lu^{3+} (Z = 71)

(C) Ti^{3+} (Z = 22)

(D) La^{3+} (Z = 57)

Explanation:

La^{3+} : 54 e^- = [Xe]
Ti^{3+} : 19 e^- = [Ar] $3d^1$ *(Colour)*
Lu^{3+} : 68 e^- = [Xe] $4f^{14}$
Sc^{3+} : 18 e^- = [Ar]

Question 32.

Which one of the following ions has electronic configuration [Ar] $3d^6$?

(At. Nos. Mn = 25, Fe = 26, Co = 27, Ni = 28)

[4 Marks]

(A) Ni^{3+}

(B) Mn^{3+}

(C) Fe^{3+}

(D) Co^{3+}

Explanation:

Ni^{3+} : [Ar] $3d^7$
Mn^{3+} : [Ar] $3d^4$
Fe^{3+} : [Ar] $3d^5$
Co^{3+} : [Ar] $3d^6$

Question 33.

Which one of the following pairs has the same size?

[4 Marks]

(A) Zr^{4+}, Ti^{4+}

(B) Fe^{2+}, Ni^{2+}

(C) Zr^{4+}, Hf^{4+}

(D) Zn^{2+}, Hf^{4+}

Explanation:

Due to lanthanide contraction, the size of Zr and Hf (atoms and ions) become nearly similar.

Question 34.

The existence of two different coloured complexes with the composition $[Co(NH_3)_4Cl_2]^+$ is due to:

[4 Marks]

(A) Linkage isomerism

(B) Geometrical isomerism

(C) Coordination isomerism

(D) Ionization isomerism

Explanation:

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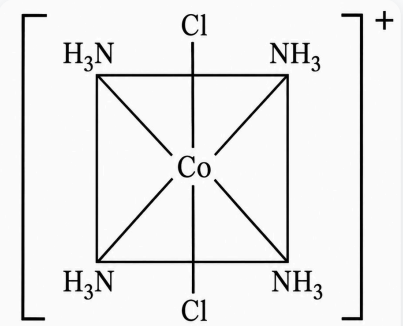
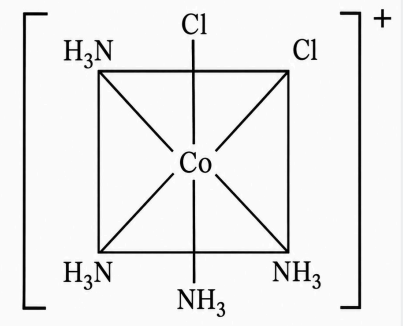


trans (violet)



cis (green)

Question 35.

Which one of the following complex ions is not expected to absorb visible light?

[4 Marks]

(A) $[Fe(H_2O)_6]^{2+}$

(B) $[Ni(H_2O)_6]^{2+}$

(C) $[Cr(NH_3)_6]^{3+}$

(D) $[Ni(CN)_4]^{2-}$

Explanation:

$[Ni(CN)_4]^{2-}$: Number of unpaired electrons = 0

$[Cr(NH_3)_6]^{3+}$: Number of unpaired electrons = 3

$[Fe(H_2O)_6]^{2+}$: Number of unpaired electrons = 4

$[Ni(H_2O)_6]^{2+}$: Number of unpaired electrons = 2

Question 36.

Crystal field stabilization energy for high-spin d^4 octahedral complex is:

[4 Marks]

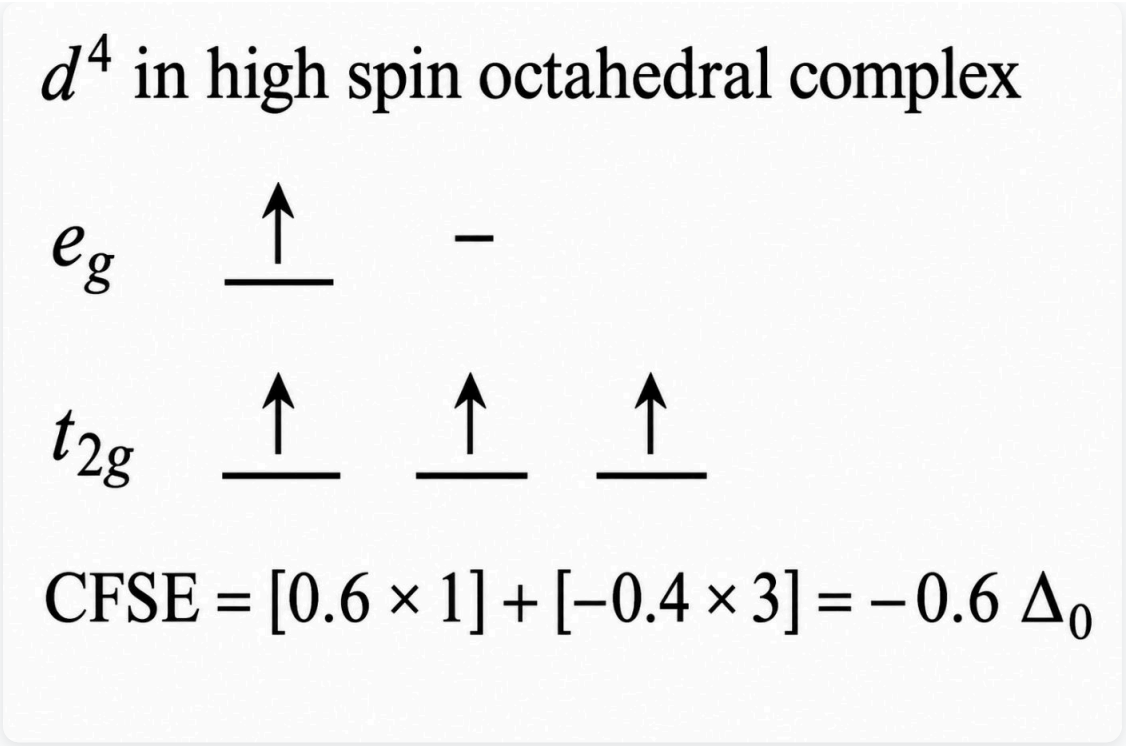
(A) $-1.6\ \Delta_0 + P$

(B) $-0.6\ \Delta_o$

(C) $-1.8\ \Delta_0$

(D) $-1.2\ \Delta_0$

Explanation:



Question 37.

The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives 'X' and reaction in presence of light gives 'Y'. Thus, 'X' and 'Y' are:

[4 Marks]

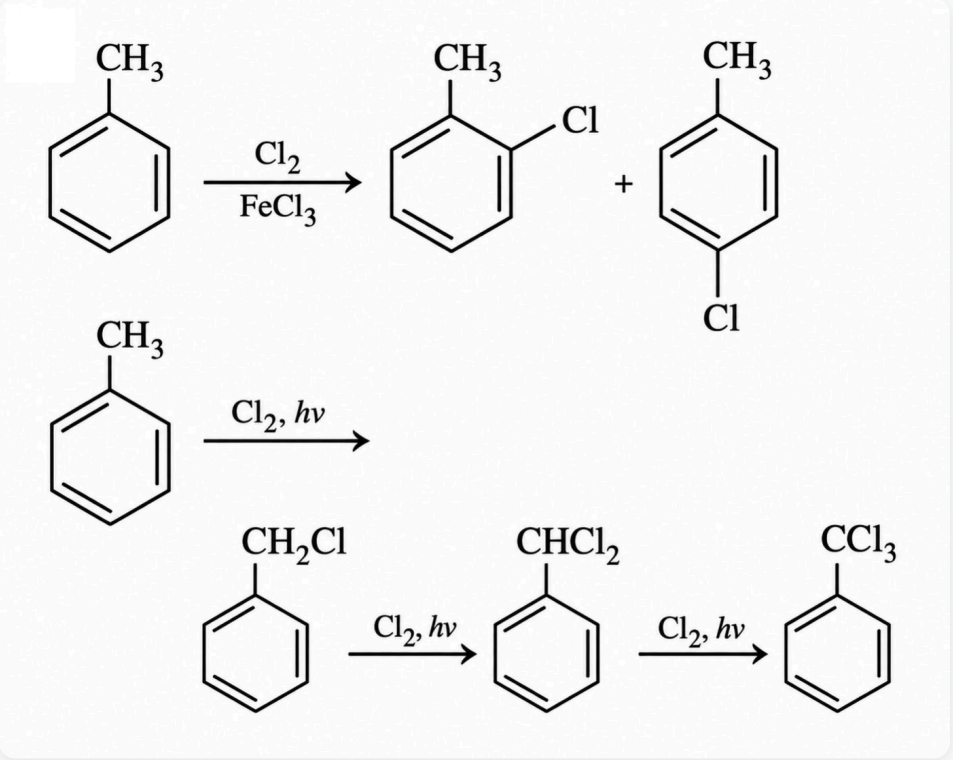
(A) X = Benzal chloride, Y = o - Chlorotoluene

(B) X = Benzyl chloride, Y = m - Chlorotoluene

(C) X = m - Chlorotoluene, Y = p - Chlorotoluene

(D) X = o- and p-Chlorotoluene, Y = Trichloromethyl - benzene

Explanation:



Question 38.

Which one is most reactive towards S_N1 reaction?

[4 Marks]

(A) $C_6H_5CH(CH_3)Br$

(B) $C_6H_5CH(C_6H_5)Br$

(C) $C_6H_5C(CH_3)(C_6H_5)Br$

(D) $C_6H_5CH_2Br$

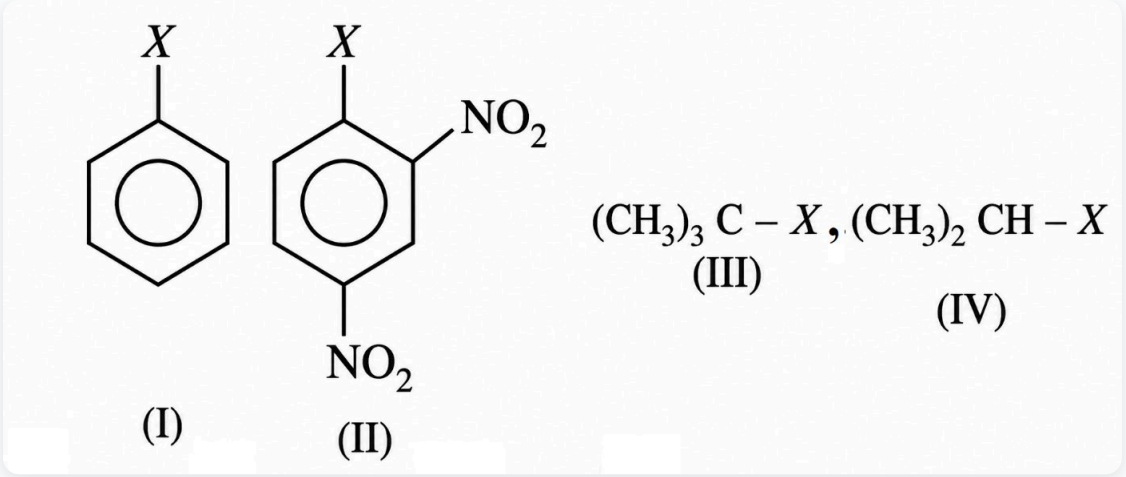
Explanation:

S_N1 reactions involve the formation of carbocations; hence, the higher the stability of intermediate carbocation, the more reactivity of the parent alkyl halide. The tertiary carbocation formed from (c) is stabilized by two phenyl groups and one methyl group, hence it is the most stable.

Question 39.

The correct order of increasing reactivity of C - X bond towards nucleophile in the following compounds is

[4 Marks]



(A) IV < III < I < II

(B) III < II < I < IV

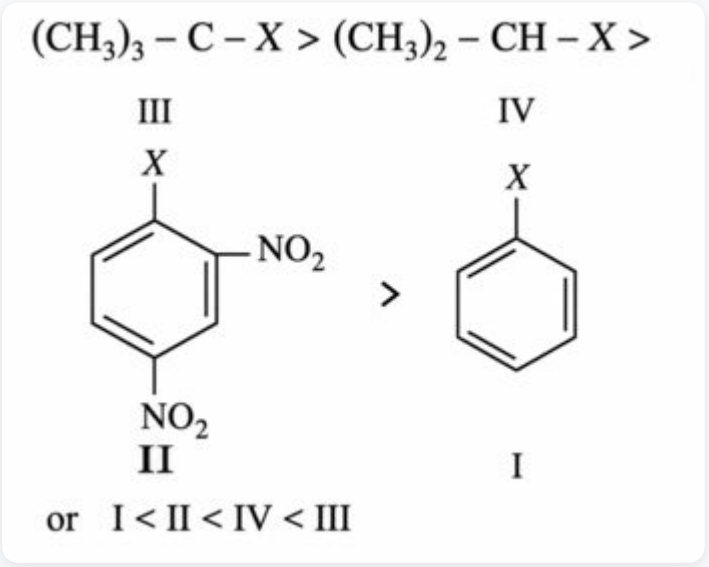
(C) II < III < I < IV

(D) I < II < IV < III

Explanation:

Tertiary alkyl halide is most reactive towards nucleophilic substitution because the corresponding carbocation (3°) is most stable. Aryl halide is least reactive due to the partial double bond character of the C–Cl bond.

Presence of $–NO_2$ groups at ortho and para positions increases the reactivity of the C–Cl bond towards nucleophiles.

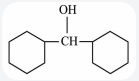


Question 40.

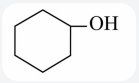
Which one of the following compounds has the most acidic nature?

[4 Marks]

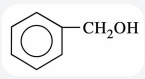
(A)



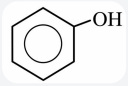
(B)



(C)



(D)



Explanation:

Phenol is most acidic because its conjugate base is stabilised due to resonance, while the rest three compounds are alcohols, hence, their corrosponding conjugate bases do not exhibit resonance.

Question 41.

Which of the following reactions will not result in the formation of carbon–carbon bonds?

[4 Marks]

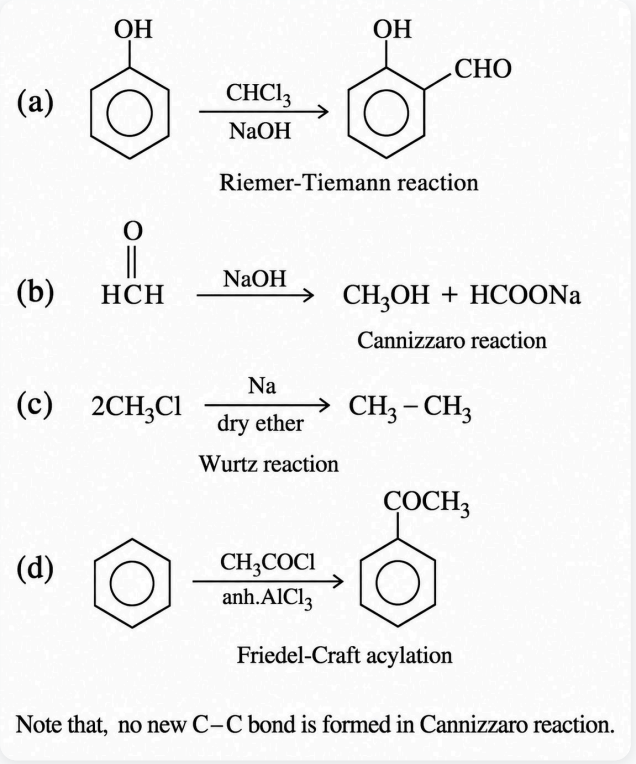
(A) Wurtz reaction

(B) Cannizaro reaction

(C) Friedel–Crafts acylation

(D) Reimer–Tiemann reaction

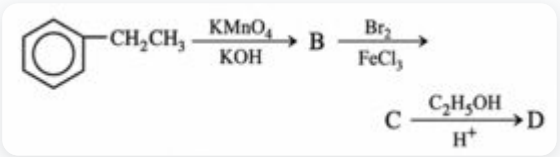
Explanation:



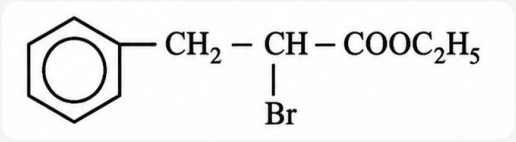
Question 42.

In a set of reactions, ethylbenzene yielded a product D.

[4 Marks]



(A)



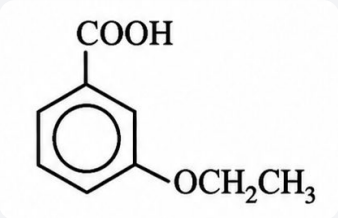
(B)



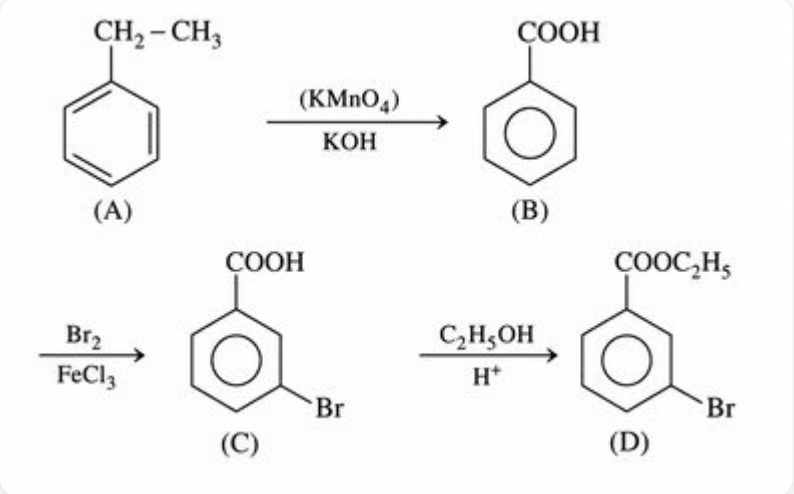
(C)



(D)



Explanation:



Question 43.

Given are cyclohexanol (I), acetic acid (II), 2,4,6-trinitrophenol (III) and phenol (IV). In these, the order of decreasing acidic character will be:

[4 Marks]

(A) III > II > IV > I

(B) II > III > IV > I

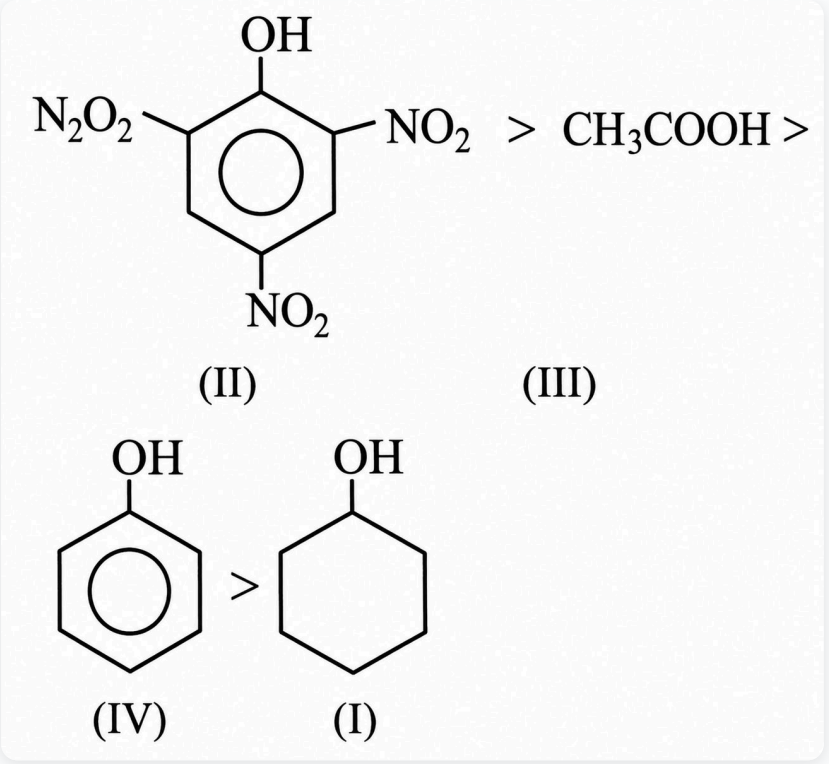
(C) III > IV > II > I

(D) II > III > I > IV

Explanation:

Explanation: Presence of three $–NO_2$ groups in o-, p- positions to phenolic groups (in III) makes phenol strongly acidic because its corresponding phenate ion (conjugate base) is highly stabilised due to resonance.

Conjugate base of CH_3COOH (II) (i.e., CH_3COO^-) shows resonance hybrid of two equivalent structures. The conjugate base of phenol (IV) is stabilized due to resonance (note that here all resonating structures are not equivalent). The conjugate base of cyclohexanol, I does not exhibit resonance, hence, not formed.



Question 44.

Among the given compounds, the most susceptible to nucleophilic attack at the carbonyl group is:

[4 Marks]

(A) CH_3COOCH_3

(B) CH_3CONH_2

(C) $CH_3COOCOCH_3$

(D) CH_3COCl

Explanation:

Cl^- is the weakest base and hence a better leaving group.

Question 45.

Which of the following statements about primary amines is False?

[4 Marks]

(A) Alkyl amines are stronger bases than ammonia.

(B) Aryl amines react with nitrous acid to produce phenols.

(C) Alkyl amines are stronger bases than aryl amines.

(D) Alkyl amines react with nitrous acid to produce alcohols.

Explanation:

Aryl amines react with nitrous acid to produce diazonium salt and not phenol.

Question 46.

Acetamide is treated with the following reagents separately. Which one of these would yield methylamine?

[4 Marks]

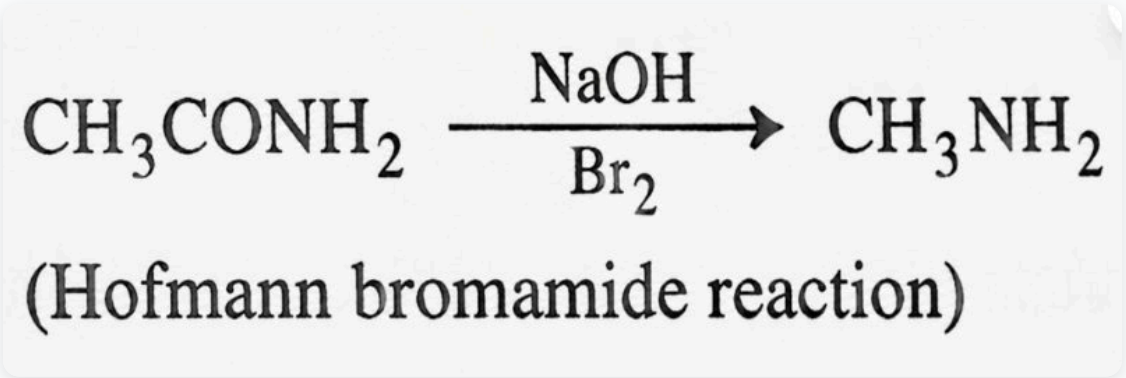
(A) Sodalime

(B) NaOH – Br_2

(C) Hot conc. H_2SO_4

(D) PCl_5

Explanation:

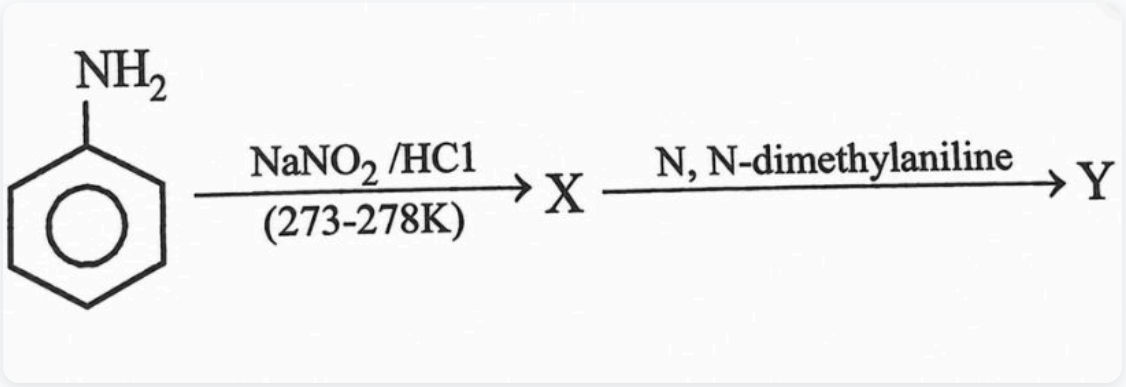


Question 47.

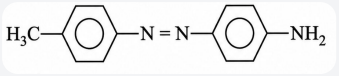
Aniline in a set of the following reactions yielded a coloured product 'Y'

The structure of 'Y' would be ;

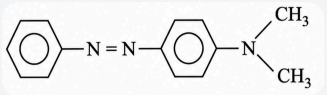
[4 Marks]



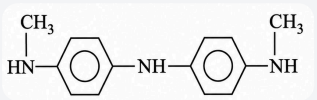
(A)



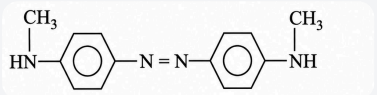
(B)



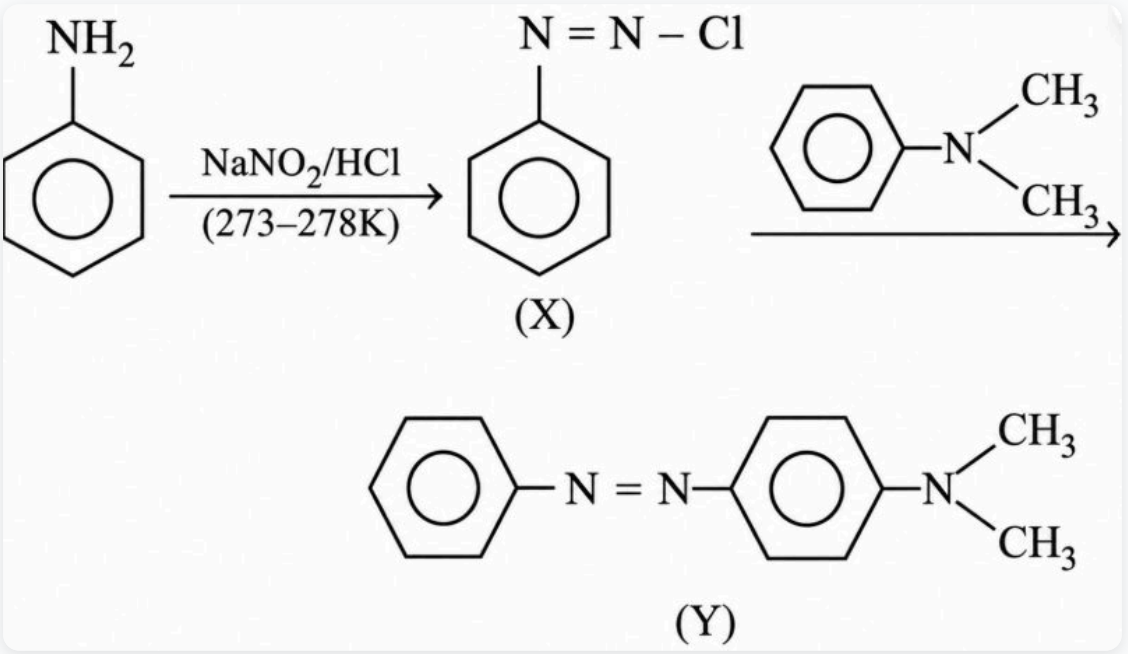
(C)



(D)



Explanation:



Question 48.

Which one of the following does not exhibit the phenomenon of mutarotation ?

[4 Marks]

(A) (+) - Lactose

(B) (+) - Sucrose

(C) (+) - Maltose

(D) (-) - Fructose

Explanation:

Sucrose does not have free –CHO or CO group; hence, it does not undergo mutarotation.

Question 49.

Which one of the following is employed as a tranquilizer drug?

[4 Marks]

(A) Promethazine

(B) Valium

(C) Naproxen

(D) Mifepristone

Explanation:

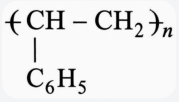
Valium is used as a sedative.

Question 50.

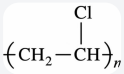
Which of the following structures represents neoprene polymer?

[4 Marks]

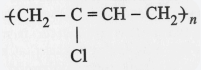
(A)



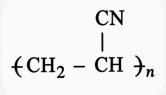
(B)



(C)



(D)



Explanation:

Neoprene is a polymer of chloroprene (2-chloro-1,3-butadiene).

Question 51.

Single-celled eukaryotes are included in:

[4 Marks]

(A) Protista

(B) Fungi

(C) Archaea

(D) Monera

Explanation:

Single celled eukaryotes are included in protista. Protista includes all unicellular and colonial eukaryotes except green and red algae. It is also known as kingdom of unicellular eukaryotes.

Question 52.

Membrane-bound organelles are absent in:

[4 Marks]

(A) Saccharomyces

(B) Streptococcus

(C) Chlamydomonas

(D) Plasmodium

Explanation:

Membrane-bound organelles are absent in Streptococcus. It is a bacterium that is included under kingdom Monera. Monerans are prokaryotes, which lack membrane-bound organelles like mitochondria, E.R., Golgi etc. Saccharomyces, Chlamydomonas and Plasmodium are eukaryotes that have membrane-bound organelles.

Question 53.

Virus envelope is known as:

[4 Marks]

(A) Capsid

(B) Virion

(C) Nucleoprotein

(D) Core

Explanation:

Virus envelope is known as capsid. The capsid is composed of protein subunits called capsomere.

Question 54.

Algae have cell wall made up of:

[4 Marks]

(A) Cellulose, galactans and mannans

(B) Pectins, cellulose and proteins

(C) Hemicellulose, pectins and proteins

(D) Cellulose, hemicellulose and pectins

Explanation:

Algae possess a definite cell wall containing cellulose, galactans and mannans.

Question 55.

Some hyperthermophilic organisms that grow in highly acidic (pH_2) habitats belong to the two groups:

[4 Marks]

(A) Liverworts and yeasts

(B) Protists and mosses

(C) Cyanobacteria and diatoms

(D) Eubacteria and archaea

Explanation:

Hyperthermophilic organisms that grow in highly acidic habitats belong to eubacteria and archaea groups.

Question 56.

Male and female gametophytes are independent and free-living in:

[4 Marks]

(A) Mustard

(B) Pinus

(C) Sphagnum

(D) Castor

Explanation:

Sphagnum is a bryophyte in which male and female gametophytes are independent and free-living. In Pinus (a gymnosperm), mustard and castor (angiosperms), the main plant body is sporophytic. Gametophyte is highly reduced and is completely dependent on sporophyte.

Question 57.

Which one of the following kinds of animals are triploblastic?

[4 Marks]

(A) Sponges

(B) Flat worms

(C) Ctenophores

(D) Corals

Explanation:

Triploblastic condition can be seen in flatworms. Ctenophores, sponges and corals are diploblastic.

Question 58.

One example of animals having a single opening to the outside that serves both as mouth as well as anus is:

[4 Marks]

(A) Octopus

(B) Ascidia

(C) Asterias

(D) Fasciola

Explanation:

Fasciola, a flatworm, has a single body cavity to the outside that serves both as mouth for ingestion and anus for egestion of undigested food. This is known as blind sac plan.

Question 59.

Which one of the following statements about certain given animals is correct?

[4 Marks]

(A) Flat worms (Platyhelminthes) are coelomates

(B) Insects are pseudocoelomates

(C) Round worms (Aschelminthes) are pseudocoelomates.

(D) Molluscs are acoelomates

Explanation:

Acoelomates are animals that have no body cavity or coelom. The examples are poriferans, coelenterates, ctenophores, platyhelminthes and nemertean. Pseudo-coelomates are animals that have false or pseudo coelom. Examples are aschelmin-thes.

Question 60.

Which one of the following statements about all the four of Spongilla, Leech, Dolphin and Penguin is correct?

[4 Marks]

(A) Leech is a fresh water form while all others are marine

(B) All are bilaterally symmetrical

(C) Spongilla has special collared cells called choanocytes, not found in the remaining three

(D) Penguin is homeothermic while the remaining three are poikilothermic

Explanation:

Spongilla is a fresh water sponge that belongs to phylum Porifera. It has special collared cells called choanocytes. Choanocytes are not found in leech, dolphin and penguin.

Question 61.

In a unilocular ovary with a single ovule, the placentation is:

[4 Marks]

(A) Marginal

(B) Basal

(C) Free Central

(D) Axile

Explanation:

In basal type of placentation, the ovary is unilocular with a single ovule. In this, the placenta is at the base of the ovary. It is seen in Polygonum.

Question 62.

Ovary is half-inferior in the flowers of:

[4 Marks]

(A) Guava

(B) Plum

(C) Brinjal

(D) Cucumber

Explanation:

A flower in which floral parts arise from around the ovary is called perigynous. In this, the ovary is half inferior and half superior. It can be seen in the flowers of plum, peach etc.

Question 63.

The technical term used for the androecium in a flower of China rose (Hibiscus rosa-sinensis) is:

[4 Marks]

(A) Monadelphous

(B) Polyandrous

(C) Diadelphous

(D) Polyadelphous

Explanation:

Hibiscus belongs to family Malvaceae. It possess numerous stamens that are called monadelphous.

Question 64.

Keel is characteristic of the flowers of:

[4 Marks]

(A) Gulmohur

(B) Calotropis

(C) Cassia

(D) Bean

Explanation:

Keel is the characteristic of the flowers of family papilionaceae. For example, bean, gram, pea etc.

Question 65.

The chief water conducting elements of xylem in gymnosperms are:

[4 Marks]

(A) vessels

(B) transfusion tissue

(C) fibres

(D) tracheids

Explanation:

Tracheids are chief water conducting elements of xylem in gymnosperms. They are devoid of protoplasm and hence dead. The wall constituting the tracheids is hard, thick and lignified. These are elongated cells with tapering ends.

Question 66.

Which one of the following is **not** a lateral meristem?

[4 Marks]

(A) Phellogen

(B) Intercalary meristem

(C) Intrafascicular cambium

(D) Interfascicular cambium

Explanation:

Meristem is divided onthe basis of position in plant bodies into apical meristem, lateral meristem and intercalary meristem. Lateral meristem is present on the lateral sides, that is fascicular and interfascicular cambium and cork cambium (phellogen).

Question 67.

Heartwood differs from sapwood in:

[4 Marks]

(A) Absence of vessels and parenchyma

(B) Presence of rays and fibres

(C) Having dead and non-conducting elements

(D) Being susceptible to pests and pathogens

Explanation:

Heartwood differs from sapwood in having dead and non-conducting elements. In old trees, the inner region that comprises dead elements with highly lignified walls is called heartwood.

Question 68.

The kind of epithelium which forms the inner walls of blood vessels is:

[4 Marks]

(A) Cuboidal epithelium

(B) Ciliated columnar epithelium

(C) Squamous epithelium

(D) Columnar epithelium

Explanation:

Squamous epithelium is formed of thin discoidal and polygonal cells that fit like tiles in a floor, so is also called pavement epithelium. It is found in the walls of blood vessels, in the alveoli of lung for exchange of gas, and in Bowman’s capsule of nephron for ultra filtration.

Question 69.

Which one of the following structures between two adjacent cells is an effective transport pathway?

[4 Marks]

(A) Plasmodesmata

(B) Endoplasmic reticulum

(C) Plastoquinones

(D) Plasmalemma

Explanation:

Plasmodesmata are the structures present between two adjacent cells that permits the transport and communication between them. They are the fine cytoplasmic strands that connect the protoplasts of adjacent plant cells by passing through the cell walls.

Question 70.

Which one of the following has its own DNA?

[4 Marks]

(A) Dictyosome

(B) Mitochondria

(C) Lysosome

(D) Peroxisome

Explanation:

Mitochondria has its own DNA. It is a structure within cytoplasm of eukaryotic cells that carries out aerobic respiration. It is the site of Kreb’s cycle and ETS. Therefore, it is also called as cell’s energy production site.

Question 71.

The main arena of various types of activities of a cell is:

[4 Marks]

(A) Plasma membrane

(B) Mitochondrion

(C) Nucleus

(D) Cytoplasm

Explanation:

The main arena of various types of activities of a cell is cytoplasm. It forms the living protoplasm of a cell excluding the nucleus. It consists of proteins, fats, carbohydrates, nucleic acids, vitamins, waste metabolites and all organelles.

Question 72.

The plasma membrane consists mainly of:

[4 Marks]

(A) Phospholipids embedded in a protein bilayer

(B) Proteins embedded in a polymer of glucose molecules

(C) Proteins embedded in a phospholipid bilayer

(D) Proteins embedded in a carbohydrate bilayer

Explanation:

Plasma membrane comprises of mainly proteins embedded in a phospholipid bilayer. Protein molecules occur at places both inside and outer side of the lipid bilayer.

Question 73.

During mitosis, ER and nucleolus begin to disappear at:

[4 Marks]

(A) Late prophase

(B) Early metaphase

(C) Late metaphase

(D) Early prophase

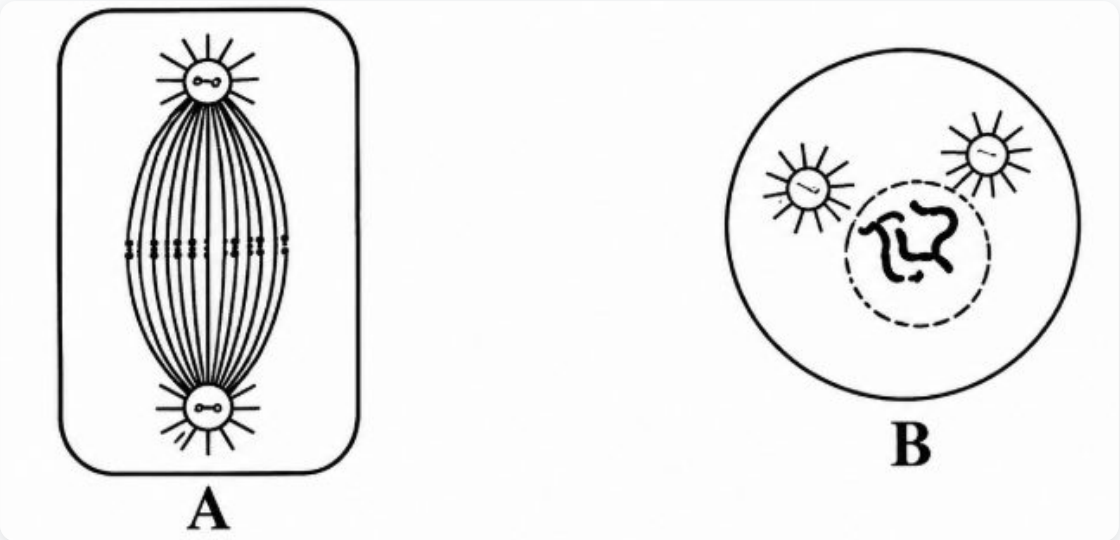
Explanation:

During mitosis, endoplasmic reticulum and nucleus begin to disappear at early prophase. Also, nucleus and cell become spherical and DNA molecules condense to form shortened chromosome.

Question 74.

Which stages of cell division do the following figures A and B represent respectively?

[4 Marks]



(A)

Fig. A		Fig. B
Metaphase	-	Telophase

(B)

Fig. A		Fig. B
Telophase	-	Metaphase

(C)

Fig. A		Fig. B
Late Anaphase	-	Prophase

(D)

Fig. A		Fig. B
Prophase	-	Anaphase

Explanation:

The figure A represents late anaphase while figure B represents prophase stage of mitosis.

Question 75.

Which one of the following is not a micronutrient?

[4 Marks]

(A) Molybdenum

(B) Magnesium

(C) Zinc

(D) Boron

Explanation:

Magnesium is a macronutrient. Micronutrients are essential elements that are required by plants in small amounts. They include Fe, Cu, B, Mo, Mn, Cl, and Ni. Macronutrients, on the other hand, are those essential elements that are required by plants in larger amounts. The examples include C, H, O, N, S, P, K, Ca and Mg.

Question 76.

An element playing important role in nitrogen fixation is:

[4 Marks]

(A) Zinc

(B) Manganese

(C) Copper

(D) Molybdenum

Explanation:

Molybdenum is a micronutrient that plays an important role in nitrogen fixation. It is a part of nitrate reductase enzyme that helps in nitrogen fixation.

Question 77.

One of the free-living, anaerobic nitrogen-fixer is:

[4 Marks]

(A) Azotobacter

(B) Rhizobium

(C) Rhodospirillum

(D) Beijernickia

Explanation:

Rhodospirillum is a free-living, anaerobic nitrogen fixer bacteria. It can synthesize its food in presence of light under anaerobic conditions.

Beijernickia and Azotobacter are free living aerobic nitrogen fixing bacteria. Rhizobium is a symbiotic nitrogen fixing bacteria.

Question 78.

PGA as the first CO_2 fixation product was discovered in photosynthesis of:

[4 Marks]

(A) Gymnosperm

(B) Bryophyte

(C) Angiosperm

(D) Alga

Explanation:

Phosphoglyceric acid (PGA) is the first stable product of photosynthesis. It was first discovered by Calvin, Benson and their colleagues in Chlorella, (alga).

Question 79.

C_4 plants are more efficient in photosynthesis than C_3 plants due to:

[4 Marks]

(A) Presence of larger number of chloroplasts in the leaf cells

(B) Higher leaf area

(C) Presence of thin cuticle

(D) Lower rate of photorespiration

Explanation:

C_4 plants are more efficient in photosynthesis than C_3 plants due to photorespiration. Photorespiration is an inhibitory process that decreases the rate of photosynthesis. It is absent in C_4 plants and present only in C_3 plants.

Question 80.

The energy-releasing metabolic process in which substrate is oxidised without an external electron acceptor is called:

[4 Marks]

(A) Glycolysis

(B) Fermentation

(C) Aerobic respiration

(D) Photorespiration

Explanation:

The energy releasing metabolic process in which substrate is oxidised without an external electron acceptor is called fermentation.

Question 81.

Coiling of garden pea tendrils around any support is an example of:

[4 Marks]

(A) Thigmotaxis

(B) Thigmonasty

(C) Thermotaxis

(D) Thigmotropism

Explanation:

The coiling of garden pea tendrils around any support is an example of thigmotropism. Thigmotropism is the growth movement in response to touch. The stems and tendrils of the climbers are positively thigmotrophic in their response.

Question 82.

Phototropic curvature is the result of uneven distribution of:

[4 Marks]

(A) Phytochrome

(B) Gibberellin

(C) Auxin

(D) Cytokinins

Explanation:

Phototropic curvature is the result of uneven distribution of auxin. The experiments conducted by Charles Darwin concluded that the tip of coleoptile of canary grass contain auxin that causes the bending of the entire coleoptile towards the light source.

Question 83.

Photoperiodism was first characterised in:

[4 Marks]

(A) Potato

(B) Tobacco

(C) Tomato

(D) Cotton

Explanation:

Photoperiodism is the response to duration and timings of light and dark period. It was first characterised in tobacco plant.

Question 84.

If for some reason our goblet cells are non functional, this will adversely affect:

[4 Marks]

(A) secretion of sebum from the sebaceous glands

(B) production of somatostatin

(C) maturation of sperms

(D) smooth movement of food down the intestine

Explanation:

Goblet cells, found in the intestinal mucosal epithelium, secrete mucus. The mucus lubricates the food for an easy passage. So, if for some reason, goblet cells become non-functional, it will adversely affect the smooth movement of food down the intestine.

Question 85.

Listed below are four respiratory capacities (i–iv) and four jumbled respiratory volumes of a normal human adult:

Respiratory capacities	Respiratory volumes
(i) Residual volume	2500 mL
(ii) Vital capacity	3500 mL
(iii) Inspiratory reserve volume	1200 mL
(iv) Inspiratory capacity	4500 mL

Which one of the following is the correct matching of two capacities and volumes?

[4 Marks]

(A) (iii) 1200 mL, (iv) 2500 mL

(B) (iv) 3500 mL, (i) 1200 mL

(C) (i) 4500 mL, (ii) 3500 mL

(D) (ii) 2500 mL, (iii) 4500 mL

Explanation:

The correct matching of respiratory capacities with their respiratory volumes are:

Respiratory Capacities	Respiratory Volumes
Residual volume	1200 mL
Vital capacity	4500 mL
Inspiratory reserve volume	2500 mL
Expiratory volume	3500 mL

Question 86.

Which two of the following changes (a–d) usually tend to occur in the plain dwellers when they move to high altitudes (3,500 m or more)?

(i) Increase in red blood cell size
(ii) Increase in red blood cell production
(iii) Increased breathing rate
(iv) Increase in thrombocyte count

Changes occurring are:

[4 Marks]

(A) (ii) and (iii)

(B) (iii) and (iv)

(C) (i) and (iv)

(D) (i) and (ii)

Explanation:

At high altitude, the body undergoes numerous changes in order to increase oxygen delivery to cells and improve the efficiency of oxygen usage. The early changes include increased breathing rate and increased red blood cell production.

Question 87.

ABO blood groups in humans are controlled by the gene I. It has three alleles—I^A, I^B and i. Since there are three different alleles, six different genotypes are possible. How many phenotypes can occur?

[4 Marks]

(A) One

(B) Two

(C) Three

(D) Four

Explanation:

The three alleles in ABO blood groups in humans can produce six different genotypes and four different phenotypes.

Genotypes	Phenotypes
$I^A I^A, I^A i$	Blood group A
$I^B I^B, I^B i$	Blood group B
$I^A I^B$	Blood group AB
$i\ i$	Blood group O

Question 88.

What is true about RBCs in humans?

[4 Marks]

(A) They do not carry CO_2 at all.

(B) They transport 99.5 per cent of O_2.

(C) They carry about 20–25 per cent of CO_2.

(D) They transport about 80 per cent oxygen only and the rest 20 per cent of it is transported in dissolved state in blood plasma.

Explanation:

Blood transports oxygen from respiratory organs to the tissue cells and also transports carbon dioxide from the tissue cells to the respiratory membrane. About 97% of oxygen is transported by RBCs in the blood while the remaining three percent of oxygen is carried in a dissolved state through plasma.

Nearly 20-25% of carbon dioxide is transported by RBCs whereas 70% is carried as bicarbonate. About 7% of CO_2, is carried in dissolved state through plasma.

Question 89.

If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect?

[4 Marks]

(A) The blood will tend to flow back into the left atrium.

(B) The flow of blood into the pulmonary artery will be reduced.

(C) The flow of blood into the aorta will be slowed down.

(D) The 'pacemaker' will stop working.

Explanation:

Chordae tendinae are thread like bands of fibrous tissue which attach on one end to the edges of the tricuspid and mitral valves of the heart and on the other end to the papillary muscles, that serve to anchor the valves. Tricuspid valve is the valve in the heart between the right atrium and right ventricle. The valve opens to allow blood to flow from atrium into the ventricle. Thus if tricuspid valve is partially non-functional, then, the flow of blood into the pulmonary artery will be reduced.

Question 90.

Which one of the following statements in regard to the excretion by the human kidneys is correct?

[4 Marks]

(A) Ascending limb of Loop of Henle is impermeable to electrolytes.

(B) Nearly 99 per cent of the glomerular filtrate is reabsorbed by the renal tubules.

(C) Distal convoluted tubule is incapable of reabsorbing HCO_3^-.

(D) Descending limb of Loop of Henle is impermeable to water.

Explanation:

Urine formation involves three main processes called, glomerular filtration, reabsorption and secretion. A comparison of the volume of the filtrate formed per day (which is 180 litres per day) with that of urine released (about 1.5 litres) suggests that nearly 99 percent of the glomerular filtrate is resorbed by the renal tubules. The descending limb of loop of Henle is permeable to water but impermeable to electrolytes.

The ascending limb is impermeable to water but allows transport of electrolytes. Reabsorption of sodium ions and water takes place in distal convoluted tubule.

Also, it is capable of reabsorption of HCO_3.

Question 91.

The principal nitrogenous excretory compound in humans is synthesised:

[4 Marks]

(A) In kidneys as well as eliminated by kidneys.

(B) In kidneys but eliminated mostly through liver.

(C) In liver and also eliminated by the same through bile.

(D) In the liver, but eliminated mostly through kidneys.

Explanation:

The principal nitrogenous excretory compound in humans is urea. It is synthesized in the mitochondrial matrix and cytosol of liver cells and eliminated through kidneys.

Question 92.

Consider the following four statements (i–iv) regarding kidney transplant and select the two correct ones out of these.

(i) Even if a kidney transplant is proper, the recipient may need to take immune suppresants for a long time.

(ii) The cell-mediated immune response is responsible for graft rejection.

(iii) The B lymphocytes are responsible for rejection of the graft.

(iv) The acceptance or rejection of a kidney transplant depends only on specific interferons.

The two correct statements are:

[4 Marks]

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (iii) and (iv)

(D) (i) and (iii)

Explanation:

Tissue and blood group matching are essential before undertaking kidney transplant. Even if kidney transplant is proper, the recipient may need to take immuno suppresant all his/her life. The ability of body to differentiate self and non-self and the cell-mediated immune response is responsible for graft rejection.

Question 93.

Low Ca^{++} in the body fluid may be the cause of:

[4 Marks]

(A) Gout

(B) Angina pectoris

(C) Tetany

(D) Anaemia

Explanation:

Tetany is caused by reduction in the calcium level due to underactive parathyroid hormone.

Question 94.

The nerve centres which control the body temperature and the urge for eating are contained in:

[4 Marks]

(A) Cerebellum

(B) Thalamus

(C) Pons

(D) Hypothalamus

Explanation:

Hypothalamus contains important nerve centres that controls the body temperature, thirst, hunger and eating, water balance and sexual function.

Question 95.

Injury to adrenal cortex is **not** likely to affect the secretion of which one of the following?

[4 Marks]

(A) Cortisol

(B) Adrenaline

(C) Both Androstenedione and Dehydroep iandrosterone

(D) Aldosterone

Explanation:

Adrenal gland has two parts—cortex and medulla. The medulla is stimulated by sympathetic nervous tissue to produce adrenaline and nor-adrenaline while the cortex is stimulated by pituitary hormone to release cortisol, aldosterone and estrogens. Thus injury to adrenal cortex does not likely to affect the secretion of adrenaline.

Question 96.

Which one of the following pairs is incorrectly matched?

[4 Marks]

(A) Glucagon – Beta cells (source)

(B) Somatostatin - Delta cells (source)

(C) Corpus luteum - Relaxin (secretion)

(D) Insulin - Diabetes mellitus (disease)

Explanation:

Glucagon is secreted by α-cells of the islets of Langerhans in the pancreas. It increases the concentration of glucose in the blood by stimulating the breakdown of glycogen.

Question 97.

Toxic agents present in food which interfere with thyroxine synthesis lead to the development of:

[4 Marks]

(A) toxic goitre

(B) cretinism

(C) simple goitre

(D) thyrotoxicosis

Explanation:

Goitre is caused by deficiency of iodine in diet. Iodine is needed for the synthesis of thyroxine. Toxic agents present in food interfere with thyroxine synthesis and lead to goitre.

Question 98.

Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called

[4 Marks]

(A) Xenogamy

(B) Geitonogamy

(C) Karyogamy

(D) Autogamy

Explanation:

Geitonogamy is the process of transfer of pollen grains from the anther to the stigma of another flower of the same plant. Example, maize.

Question 99.

Wind pollinated flowers are

[4 Marks]

(A) small, producing large number of dry pollen grains

(B) large producing abundant nectar and pollen

(C) small, brightly coloured, producing large number of pollen grains

(D) small, producing nectar and dry pollen

Explanation:

Pollination by wind is called anemophily. Wind-pollinated flowers are small in size, producing large number of dry pollen grains. Pollens are small, dry and light in weight. Grasses are anemophilous plants.

Question 100.

Apomictic embryos in citrus arise from

[4 Marks]

(A) Synergids

(B) Maternal sporophytic tissue in ovule

(C) Antipodal cells

(D) Diploid egg

Explanation:

Apomixis is an asexual type of reproduction in which the plant embryos grow from egg cells without being fertilized by pollen—the male part of the plant. In *Citrus*, apomictic embryos arise from maternal sporophytic tissue like nucellus and integuments in ovule. This type of embryony is called adventive embryony.

Question 101.

The scutellum observed in a grain of wheat or maize is comparable to which part of the seed in other monocotyledons?

[4 Marks]

(A) Cotyledon

(B) Endosperm

(C) Aleurone layer

(D) Plumule

Explanation:

Scutellum is the modified cotyledon observed in a grain of wheat or maize. It lies between embryo and the endosperm.

Question 102.

Sertoli cells are found in

[4 Marks]

(A) adrenal cortex and secrete adrenaline

(B) ovaries and secrete progesterone

(C) seminiferous tubules and provide nutrition to germ cells

(D) pancreas and secrete cholecystokinin

Explanation:

Sertoli cells are found in the walls of seminiferous tubules of the testes. They anchor and provide nutrition to the developing germ cells especially the spermatids.

Question 103.

Vasa efferentia are the ductules leading from

[4 Marks]

(A) testicular lobules to rete testis

(B) rete testis to vas deferens

(C) vas deferens to epididymis

(D) epididymis to urethra

Explanation:

Vasa efferentia are ductuless leading from rete testis to vas deferens. The rete testis is an anastomosing network of tubules located in the hilum of the testicles that carries sperm from the seminiferous tubules to the vasa efferentia.

Question 104.

Seminal plasma in human males is rich in :

[4 Marks]

(A) fructose and calcium

(B) glucose and calcium

(C) ribose and potassium

(D) DNA and testosterone

Explanation:

Seminal plasma in human males are rich in fructose, calcium and certain enzymes. They provide a medium for transport of sperms, nourishes and activates sperms.

Question 105.

Which one of the following statements about human sperm is correct?

[4 Marks]

(A) Acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilization

(B) The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation

(C) Acrosome serves as a sensory structure leading the sperm towards the ovum

(D) Acrosome serves no particular function

Explanation:

Acrosome a small pointed structure at the tip of nucleus. It breaks down just before fertilization, releasing hydrolytic enzymes that assist penetration between follicle cells that surrounds the ovum, thus facilitating fertilization.

Question 106.

The part of fallopian tube closest to the ovary is

[4 Marks]

(A) isthmus

(B) infundibulum

(C) cervix

(D) ampulla

Explanation:

The part of fallopian tube closest to the ovary is infundibulum. Infundibulum possess finger-like projections called fimbriae that help in collection of ovum after ovulation. It leads to wider part of oviduct called ampulla. The last part of oviduct is isthmus that has a narrow lumen and joins the uterus.

Question 107.

The second maturation division of the mammalian ovum occurs

[4 Marks]

(A) shortly after ovulation before the ovum makes entry into the fallopian tube

(B) until after the ovum has been penetrated by a sperm

(C) until the nucleus of the sperm has fused with that of the ovum

(D) in the graafian follicle following the first maturation division

Explanation:

In Oogenesis, the second maturation division occurs until after the ovum has been penetrated by a sperm. Oogenesis involves the formation of haploid female gametes, ova from diploid egg mother cells, oogonia of ovary of female organism.

Question 108.

In vitro fertilisation is a technique that involves transfer of which one of the following into the fallopian tube?

[4 Marks]

(A) Embryo of 32 cell stage

(B) Either zygote or early embryo upto 8 cell stage

(C) Zygote only

(D) Embryo only, upto 8 cell stage

Explanation:

In vitro fertilization is a process where fertilization of egg occurs outside the mother's womb. This method is used as a major treatment for infertility. This method involves the removal of eggs from the female ovaries. This egg is then allowed to fertilize with sperm in a fluid medium in a test tube. The zygote is allowed to develop for a week. Either zygote or early embryo up to 8 blastomeres is then transferred into the fallopian tube to complete its further development. If the embryo is with more than 8 blastomeres, it is transferred into uterus for successful pregnancy. A baby conceived by fertilization that occurs outside mother body is called test tube baby.

Question 109.

The signals for parturition originate from

[4 Marks]

(A) placenta only

(B) placenta as well as fully developed foetus

(C) oxytocin released from maternal pituitary

(D) fully developed foetus only

Explanation:

Parturition is the process of delivery of the foetus. The signals for parturition originate from the fully developed foetus and placenta that induce uterine contraction called foetal ejection reflex. This triggers the release of oxytocin hormone from pituitary. This in turn leads to expulsion of the baby out of uterus.

Question 110.

The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?

[4 Marks]

(A) Fourth month

(B) Fifth month

(C) Third month

(D) Sixth month

Explanation:

In human beings, after one month of pregnancy, the embryo's heart is formed. By end of second month pregnancy, the foetus develops 1imbs and digits. By end of 12 weeks, major organ systems are formed. After fifth month, the first movement of foetus and appearance of hair on its head are observed. By the end of 24 weeks, the body is covered with hairs, eye lids separate and eyelashes are formed.

Question 111.

Which one of the following statements about morula in humans is correct?

[4 Marks]

(A) It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA.

(B) It has far less cytoplasm as well as less DNA than in an uncleaved zygote.

(C) It has more or less equal quantity of cytoplasm and DNA as in uncleaved zygote.

(D) It has more cytoplasm and more DNA than an uncleaved zygote.

Explanation:

Morula is a solid ball contained within the zone pellucida. It has almost equal quantity of cytoplasm as an uncleaved zygote but much more DNA.

Question 112.

Cu ions released from copper-releasing Intra Uterine Devices (IUDs):

[4 Marks]

(A) Increase phagocytosis of sperms.

(B) Make uterus unsuitable for implantation.

(C) Prevent ovulation.

(D) Suppress sperm motility.

Explanation:

Cu ions released by copper-releasing intra uterine devices suppresses sperm motility. Intra-uterine devices are inserted by doctors in the uterus through vagina. They are available as the non-medicated IUDs, copper releasing IUDs and hormone releasing IUDs.

Question 113.

The permissible use of the technique amniocentesis is for:

[4 Marks]

(A) Detecting any genetic abnormality.

(B) Artificial insemination.

(C) Detecting sex of the unborn foetus.

(D) Transfer of embryo into the uterus of the surrogate mother.

Explanation:

Amniocentesis involves prenatal diagnosis of metabolic error and other genetic abnormalities.

Question 114.

Which one of the following cannot be explained on the basis of Mendel's Law of Dominance?

[4 Marks]

(A) Factors occur in pairs.

(B) Alleles do not show any blending and both the characters recover as such in F_2 generation.

(C) Out of one pair of factors one is dominant, and the other recessive

(D) The discrete unit controlling a particular character is called a factor.

Explanation:

According to Mendel's law of dominance, out of two contrasting allelomorphic factors only one expresses itself in an individual. The factor that expresses itself is called dominant while the other which has not shown its effect in the heterozygous individual is termed as recessive. The option (Alleles do not show any blending and both the characters recover as such in F_2 generation) in the given question cannot be explained on the basis of law of dominance. It can only be explained on the basis of Mendel's law of independent assortment, according to which in a dihybrid cross, the two alleles of each character assort independently of the alleles of other character and separate at the time of gamete formation.

Question 115.

The genotype of a plant showing the dominant phenotype can be determined by:

[4 Marks]

(A) Test cross

(B) Dihybrid cross

(C) Pedigree analysis

(D) Back cross

Explanation:

Test cross is the cross of an individual having dominant phenotype with an individual having recessive phenotype. It is used to determine the genotype of a plant showing the dominant phenotype, that means to determine whether the individual exhibiting dominating characters are homozygous or heterozygous.

Question 116.

Select the correct statement from the ones given below with respect to dihybrid cross.

[4 Marks]

(A) Tightly linked genes on the same chromosome show higher recombinations.

(B) Genes far apart on the same chromosome show very few recombinations.

(C) Tightly linked genes on the same chromosome show very few recombinations.

(D) Genes loosely linked on the same chromosome show similar recombinations as the tightly linked ones.

Explanation:

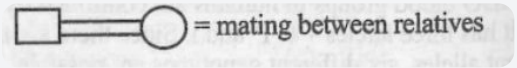
Linkage is the inheritance of genes of same chromosome together and capacity of these genes to retain their parental combination in subsequent generation. The strength of linkage between two genes is inversely proportional to the distance between the two. This means, that greater the distance, lower is the linkage strength. Two linked genes show higher frequency of recombination if the distance between them is higher and lower frequency if the distance is smaller.

Question 117.

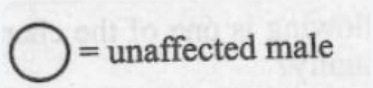
Which one of the following symbols and its representation, used in human pedigree analysis, is correct?

[4 Marks]

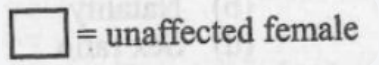
(A)



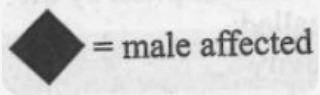
(B)



(C)



(D)



Explanation:

Pedigree analysis is a record of the occurrence of a trait in several generations of a human family. In this, male members are shown by squares and female by circles. Sibs are represented horizontally on a line in order of birth. It helps us in giving information about genotype of an individual for trait under investigation.

Question 118.

Infectious proteins are present in:

[4 Marks]

(A) Prions

(B) Gemini viruses

(C) Viroids

(D) Satellite viruses

Explanation:

Infectious proteins are rich in prions. Prions are made of proteins without nucleic acid. It is the causal agent of scrapie disease of sheep.

Question 119.

Which one of the following does not follow the central dogma of molecular biology?

[4 Marks]

(A) Chlamydomonas

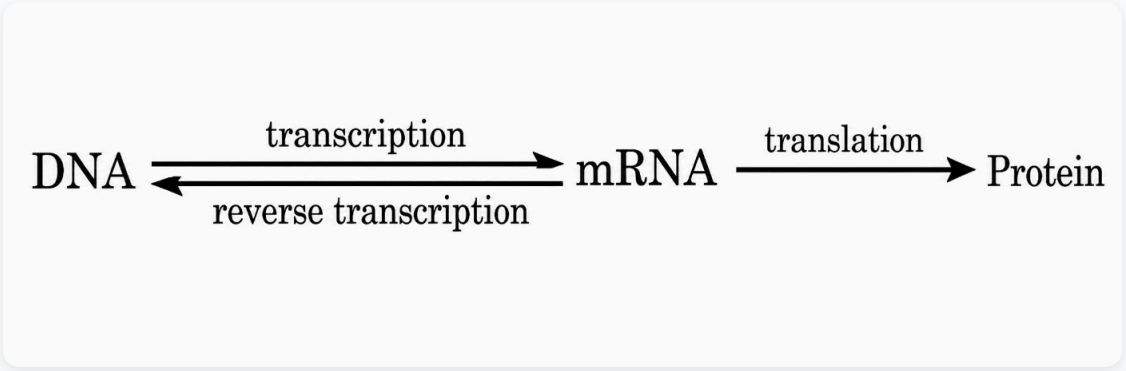
(B) HIV

(C) Mucor

(D) Pea

Explanation:

HIV viruses does not follow central dogma. Central dogma is a one way flow of information from DNA to mRNA and then to protein.



Question 120.

The one aspect which is not a salient feature of genetic code, is its being:

[4 Marks]

(A) ambiguous

(B) degenerate

(C) universal

(D) specific

Explanation:

Genetic code is non-ambiguous. There is no ambiguity for a particular codon. A particular codon will always code for the same amino acid, where ever it is found.

Question 121.

Select the two correct statements out of the four (a–d) given below about lac operon.

(i) Glucose or galactose may bind with the repressor and inactivate it.

(ii) In the absence of lactose the repressor binds with the operator region.

(iii) The Z-gene codes for permease.

(iv) This was elucidated by Francois Jacob and Jacque Monod.

The correct statements are:

[4 Marks]

(A) (i) and (ii)

(B) (ii) and (iv)

(C) (ii) and (iii)

(D) (i) and (iii)

Explanation:

Jacob and Monod proposed the *lac* operon of *E. coli*. The *lac* operon contains a promoter, an operator, and three structural genes called z, y, and a, coding for the enzyme β-galactosidase, permease and transacetylase respectively. The *lac* regulator gene, designated as i gene, codes for repressor. In the absence of the inducer, the repressor binds to the *lac* operator, preventing RNA polymerase from binding to the promoter and thus transcribing the structural gene.

Question 122.

Satellite DNA is useful tool in:

[4 Marks]

(A) Organ transplantation

(B) Sex determination

(C) Forensic science

(D) Genetic engineering

Explanation:

Satellite DNA is useful in forensic science. The polymorphism of minisatellite, microsatellite and minivariant repeats is analysed for DNA fingerprinting. DNA profiling helps in the resolution of crimes, legal disputes etc.

Question 123.

Darwin's finches are a good example of:

[4 Marks]

(A) Industrial melanism

(B) Connecting link

(C) Adaptive radiation

(D) Convergent evolution

Explanation:

Adaptive radiation

Question 124.

Widal test is used for the diagnosis of:

[4 Marks]

(A) Malaria

(B) Pneumonia

(C) Typhoid

(D) Tuberculosis

Explanation:

Widal test is used for the diagnosis of typhoid. It is an agglutination test for the presence of antibodies against the *Salmonella* organisms, which cause typhoid fever.

Question 125.

Ringworm in humans is caused by:

[4 Marks]

(A) Viruses

(B) Nematodes

(C) Fungi

(D) Bacteria

Explanation:

Ring worm is a fungal disease caused by the dermatophyte fungal species of Microsporum, Trichophyton and Epider-mophyton.

Question 126.

Which one of the following statements is correct with respect to AIDS?

[4 Marks]

(A) The HIV can be transmitted through eating food together with an infected person.

(B) Drug addicts are least susceptible to HIV infection.

(C) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers.

(D) AIDS patients are being fully cured cent per cent with proper care and nutrition.

Explanation:

AIDS (Acquired Immune Deficiency Syndrome) is caused by HIV retrovirus. The virus destroys the helper T lymphocytes, thus reducing their numbers.

Question 127.

Select the correct statement from the ones given below?

[4 Marks]

(A) Barbiturates when given to criminals make them tell the truth

(B) Morphine is often given to persons who have undergone surgery as a pain killer

(C) Chewing tobacco lowers blood pressure and heart rate

(D) Cocaine is given to patients after surgery as it stimulates recovery

Explanation:

Morphine is often given to persons who have undergone surgery as a pain killer

Question 128.

Breeding of crops with high levels of minerals, vitamins and proteins is called

[4 Marks]

(A) Micropropagation

(B) Biomagnification

(C) Biofortification

(D) Somatic hybridisation

Explanation:

Biofortification.

Question 129.

An improved variety of transgenic basmati rice

[4 Marks]

(A) gives high yield but has no characteristic aroma

(B) is completely resistant to all insect pests and diseases of paddy

(C) gives high yield and is rich in vitamin A

(D) does not require chemical fertilizers and growth hormones

Explanation:

An improved variety of transgenic basmati rice gives high yield and is rich in vitamin A.

Question 130.

A common biocontrol agent for the control of plant diseases is

[4 Marks]

(A) Trichoderma

(B) Glomus

(C) Bacillus thuringiensis

(D) Baculovirus

Explanation:

Trichoderma.

Question 131.

The common nitrogen fixer in paddy fields is

[4 Marks]

(A) Azospirillum

(B) Rhizobium

(C) Oscillatoria

(D) Frankia

Explanation:

The common nitrogen fixer in paddy field is Azospirillum. It is an anaerobic bacteria that forms loose association with roots of paddy crops.

Question 132.

Which one of the following is not used in organic farming

[4 Marks]

(A) Glomus

(B) Oscillatoria

(C) Earthworm

(D) Snail

Explanation:

Snail

Question 133.

Select the correct statement from the following

[4 Marks]

(A) Biogas, commonly called gobar gas, is pure methane

(B) Methanobacterium is an aerobic bacterium found in rumen of cattle

(C) Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria

(D) Biogas is produced by the activity of aerobic bacteria on animal waste

Explanation:

Activated sludge is a process for treating sewage and industrial wastewaters using air and a biological floc composed of bacteria and protozoans. During the process, the primary effluent is taken to aeration tank that contain large number of aerobic heterotrophic microbes. They form flocs that digest a lot of organic matter. As the biological oxygen demand of waste water is reduced, it is passed into settling tank to undergo sedimentation. The sediment of the settling tank is called activated sludge that is a rich source of aerobic bacteria. Hence, the statement (Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria) is correct.

Biogas is produced by anaerobic breakdown of biomass with the help of methanogenic bacteria. It is made up of methane, carbon dioxide with traces of nitrogen, hydrogen sulphide and hydrogen.

Question 134.

Which one of the following is used as vector for cloning genes info higher organisms?

[4 Marks]

(A) Baculovirus

(B) Rhizopus nigricans

(C) Salmonella typhimurium

(D) Retrovirus

Explanation:

Retrovirus

Question 135.

DNA or RNA segment tagged with a radioactive molecule is called:

[4 Marks]

(A) Probe

(B) Vector

(C) Clone

(D) Plasmid

Explanation:

DNA or RNA segment tagged with a radioactive molecule is called probe. They are used to detect the presence of complementary sequences in nucleic acid samples. Probes are used for identification and isolation of DNA and RNA,

Question 136.

Restriction endonucleases are enzymes which:

[4 Marks]

(A) Make cuts at specific positions within the DNA molecule.

(B) Recognize a specific nucleotide sequence for binding of DNA ligase.

(C) Restrict the action of the enzyme DNA polymerase.

(D) Remove nucleotides from the ends of the DNA molecule.

Explanation:

Make cuts at specific positions within the DNA molecule.

Question 137.

Stirred tank bioreactors have been designed for:

[4 Marks]

(A) Ensuring anaerobic conditions in the culture vessel.

(B) Availability of oxygen throughout the process.

(C) Purification of the product.

(D) addition of preservatives to the product

Explanation:

A stirred-tank bioreactor is a cylindrical or curved base to facilitate the mixing of the reaction content. It has been designed for availability of oxygen throughout the process.

Question 138.

Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme?

[4 Marks]

(A)

5' ..... GATATG ..... 3'
3' ..... CTACTA ..... 5'

(B)

5' .....CGTTCG.....3'
3' .....ATGGTA.....5'

(C)

5' ..... GAATTC ..... 3'
3' ..... CTTAAG ..... 5'

(D)

5' ..... CACGTA ..... 3'
3' ..... CTCAGT ..... 5'

Explanation:

5' ..... GAATTC ..... 3'
3' ..... CTTAAG ..... 5'

Question 139.

The genetically-modified (GM) brinjal in India has been developed for:

[4 Marks]

(A) enhancing mineral content

(B) drought-resistance

(C) insect-resistance

(D) enhancing shelf life

Explanation:

The genetically-modified (GM) brinjal in India has been developed for insect-resistance .

Question 140.

Some of the characteristics of Bt cotton are:

[4 Marks]

(A) long fibre and resistance to aphids

(B) medium yield, long fibre and resistance to beetle pests

(C) high yield and production of toxic protein crystals which kill dipteran pests

(D) high yield and resistance to bollworms

Explanation:

Bt toxin genes were isolated from Bacillus thuringiensis which incorporated into cotton plant to form a genetically modified crop called Bt cotton. Bt cotton has high yield and resistance to bollworms.

Question 141.

Genetic engineering has been successfully used for producing:

[4 Marks]

(A) Transgenic cow Rosie which produces high-fat milk for making ghee

(B) Transgenic models for studying new treatments for certain cardiac diseases

(C) Transgenic mice for testing safety of polio vaccine before use in humans

(D) Animals like bulls for farm work as they have super power

Explanation:

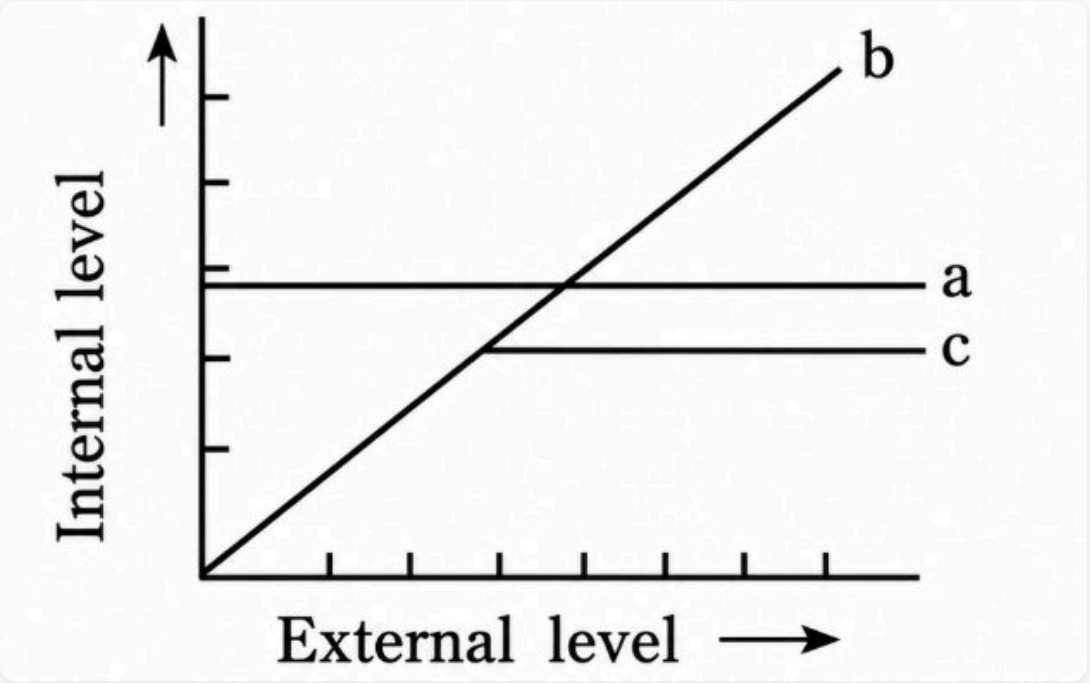
Genetic engineering has been successfully used for producing transgenic mice. Many transgenic mice are designed to increase our understanding of how genes contribute to development of diseases.

For example transgenic mice are being used to test the safety of polio vaccine.

Question 142.

The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively?

[4 Marks]



(A)

(i)	(ii)	(iii)
regulator	partial regulator	conformer

(B)

(i)	(ii)	(iii)
conformer	regulator	partial regulator

(C)

(i)	(ii)	(iii)
regulator	conformer	partial regulator

(D)

(i)	(ii)	(iii)
partial regulator	regulator	conformer

Explanation:

(i)	(ii)	(iii)
regulator	conformer	partial regulator

Question 143.

Which one of the following is one of the characteristics of a biological community?

[4 Marks]

(A) Natality

(B) Stratification

(C) Mortality

(D) Sex ratio

Explanation:

Stratification is one of the characteristics of biological community. Natality, mortality, age, structure and sex ratio are basic characteristics of a population.

Question 144.

The biomass available for consumption by the herbivores and the decomposers is called:

[4 Marks]

(A) Net primary productivity

(B) Standing crop

(C) Secondary productivity

(D) Gross primary productivity

Explanation:

The biomass available for consumption by the herbivores and the decomposers is called net primary productivity.

Question 145.

Study the four statements (i–iv) given below and select the two correct ones out of them:

(i) A lion eating a deer and a sparrow feeding on grain are ecologically similar in being consumers.

(ii) Predator star fish *Pisaster* helps in maintaining species diversity of some invertebrates.

(iii) Predators ultimately lead to the extinction of prey species.

(iv) Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders.

The two correct statements are:

[4 Marks]

(A) (i) and (ii)

(B) (i) and (iv)

(C) (iii) and (iv)

(D) (ii) and (iii)

Explanation:

(i) and (ii)

Question 146.

Which one of the following is an example of Exsitu conservation?

[4 Marks]

(A) National park

(B) Sacred groves

(C) Seed bank

(D) Wildlife sanctuary

Explanation:

Seed bank

Question 147.

dB is a standard abbreviation used for the quantitative expression of:

[4 Marks]

(A) The density of bacteria in a medium

(B) A particular pollutant

(C) A certain pesticide

(D) The dominant Bacillus in a culture

Explanation:

dB is a standard abbreviation for the quantitative expression of noise. Unwanted sound is called noise. Generally sound above 80 dB is noise.

Question 148.

A renewable exhaustible natural resource is:

[4 Marks]

(A) Coal

(B) Minerals

(C) Petroleum

(D) Forest

Explanation:

A renewable exhaustible natural resource is forest.

Question 149.

The two gases making highest relative contribution to the greenhouse gases are:

[4 Marks]

(A) CH_4 and N_2O

(B) CFC_5 and N_2O

(C) CO_2 and N_2O

(D) CO_2 and CH_4

Explanation:

The gases that makes highest relative contribution to the green house gases are carbon dioxide (CO_2) and methane (CH_4).

Question 150.

Carrier ions like Na^+ facilitate the absorption of substances like:

[4 Marks]

(A) Glucose and fatty acids

(B) Amino acids and glucose

(C) Fatty acids and glycerol

(D) Fructose and some amino acids

Explanation:

Amino acids and glucose

Question 151.

The dimension of $(1 / 2)\varepsilon_0 E^2$, where ε_0 is permittivity of free space and E is electric field, is:

[4 Marks]

(A) $[ML^2T^{-2}]$

(B) $[ML^{-1}T^{-2}]$

(C) $[MLT^{-1}]$

(D) $[ML^2T^{-1}]$

Explanation:

$(1 / 2)\varepsilon_0 E^2$ represents energy density i.e., energy per unit volume.

$= [(1 / 2)\varepsilon_0 E^2] = [ML^2T^{-2}] / [L^3] = [ML^{-1}T^{-2}]$

Question 152.

A particle has initial velocity $(3\hat{i} + 4\hat{j})$ and has acceleration $(0.4\hat{i} + 0.3\hat{j})$. It's speed after 10 s is:

[4 Marks]

(A) $7\sqrt{2}$ units

(B) 8.5 units

(C) 7 units

(D) 10 units

Explanation:

Given,

□□ = 3î + 4ĵ and □□ = 0.4î + 0.3ĵ

⇒ u_x = 3 units, u_y = 4 units

a_x = 0.4 units, a_y = 0.3 units

Along x-axis,

∴ $v_x = u_x + a_x \times 10 = 3 + 4 = 7$ units

Along y-axis,

v_y = 4 + 0.3 × 10 = 4 + 3 = 7 units

Net final velocity

∴ $v = \sqrt{(v_x^2 + v_y^2)} = 7\sqrt{2}$ units

□□$_i$ = 3î + 4ĵ, □□ = 0.4î + 0.3ĵ

Time, t = 10 sec

Final velocity □□_f after t = 10 sec,

□□_f = □□$_i$ + □□t

□□_f = (3î + 4ĵ) + (0.4î + 0.3ĵ)(10) = 7î + 7ĵ

Question 153.

A particle moves a distance x in time t according to the equation $x = (t+5)^{-1}$. The acceleration of the particle is proportional to:

[4 Marks]

(A) $(\text{velocity})^{2/3}$

(B) $(\text{distance})^{-2}$

(C) $(\text{distance})^2$

(D) $(\text{velocity})^{3/2}$

Explanation:

distance $x = 1 / (t+5)$

$\therefore$ velocity $v = dx / dt = (-1) / (t+5)^2$

$\therefore$ acceleration $a = d^2x / dt^2 = 2 / (t+5)^3 = 2x^3$

Therefore, $v^{3/2} = -(t+5)^{-3}$

So, $a \propto v^{3/2}$

Question 154.

A ball is dropped from a high-rise platform at t = 0 starting from rest. After 6 seconds, another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 s. What is the value of v? (Take g = 10 m/s^2)

[4 Marks]

(A) 55 m/s

(B) 75 m/s

(C) 60 m/s

(D) 40 m/s

Explanation:

Clearly, distance moved by the 1st ball in 18 s = distance moved by the 2nd ball in 12 s.....(i)

Now, distance moved in 18 s by the 1st ball, $= 1 / 2 \times 10 \times 18^2$

$= 90 \times 18 = 1620$ m

Distance moved in 12 s by the 2nd ball,

$= ut + (1 / 2)gt^2 \Rightarrow 12v + 1 / 2 \times 10 \times (12)^2$

$\Rightarrow 12v + 720$

From equation (i),

$\therefore 1620 = 12v + 5 \times 144$

$\Rightarrow v = 135 - 60 = 75\ ms^{-1}$

Question 155.

A man of 50 kg mass is standing in a gravity-free space at a height of 10 m above the floor. He throws a stone of 0.5 kg mass downwards with a speed of 2 m/s. When the stone reaches the floor, the

distance of the man above the floor will be:

[4 Marks]

(A) 20 m

(B) 10 m

(C) 10.1 m

(D) 9.9 m

Explanation:

No external force is acting, therefore, momentum is conserved.

By momentum conservation,

$50u + 0.5 \times 2 = 0$

where u is the velocity of man.

$u = (-1 / 50)\ ms^{-1}$

Negative sign of u shows that the man moves upward.

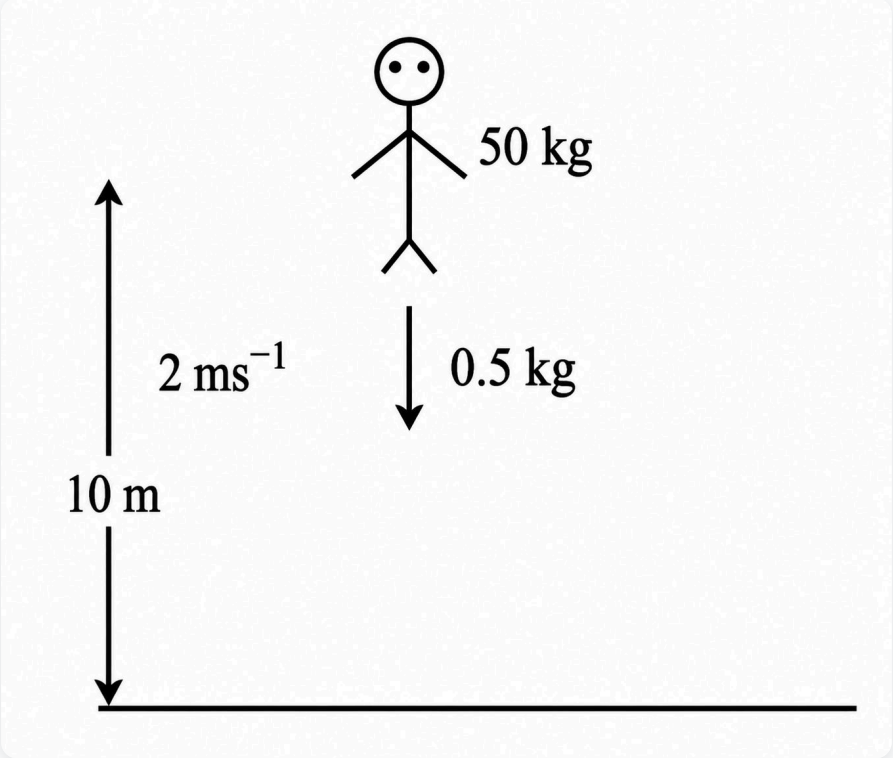
Time taken by the stone to reach the ground

$= 10 / 2 = 5$ sec

Distance moved by the man,

$= 5 \times 1 / 50 = 0.1$ m

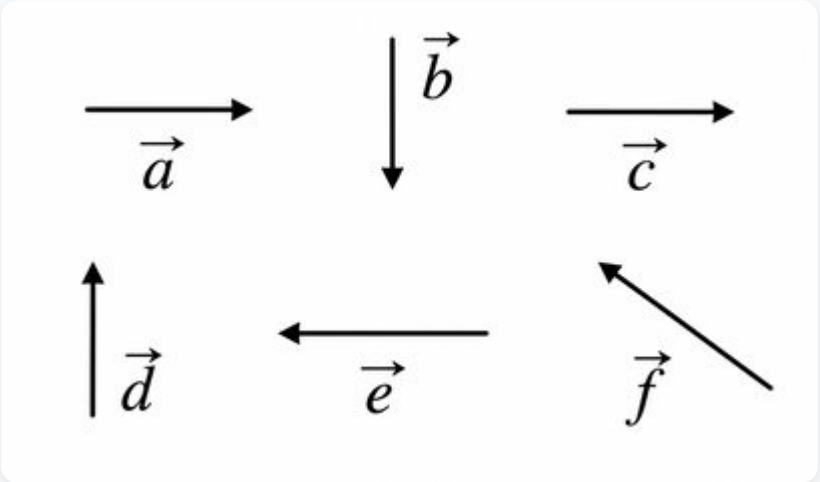
∴ When the stone reaches the floor, the distance of the man above the floor is 10.1 m.



Question 156.

Six vectors, □□ through □□ have the magnitudes and directions indicated in the figure. Which of the following statements is true?

[4 Marks]



(A) □□ + □□ = □□

(B) □□ + □□ = □□

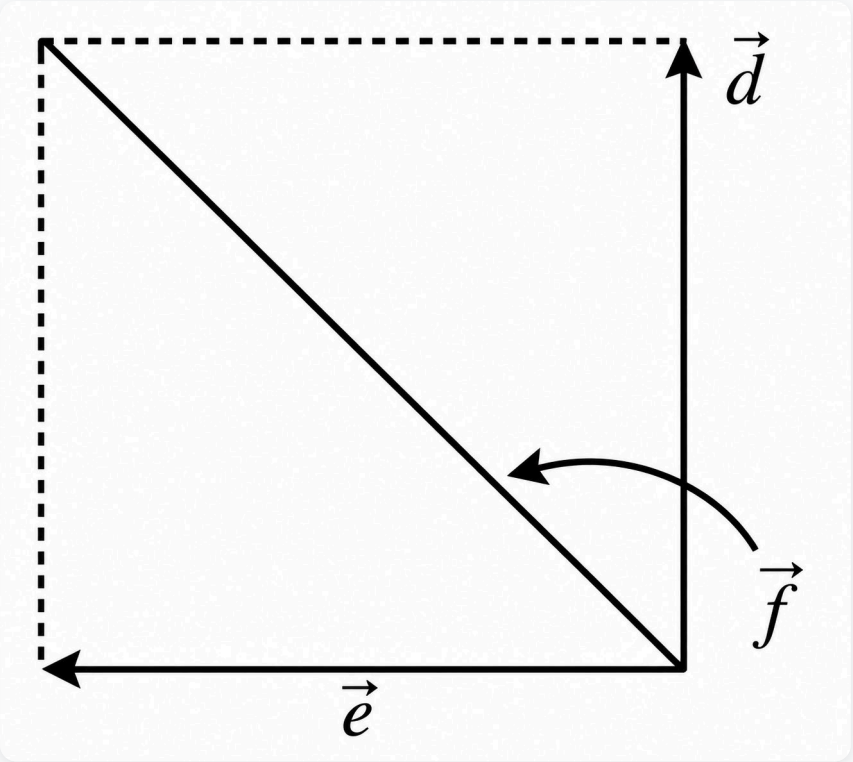
(C) □□ + □□ = □□

(D) □□ + □□ = □□

Explanation:

Using the law of vector addition, (□□ + □□) is as shown in the fig.

∴ □□ + □□ = □□

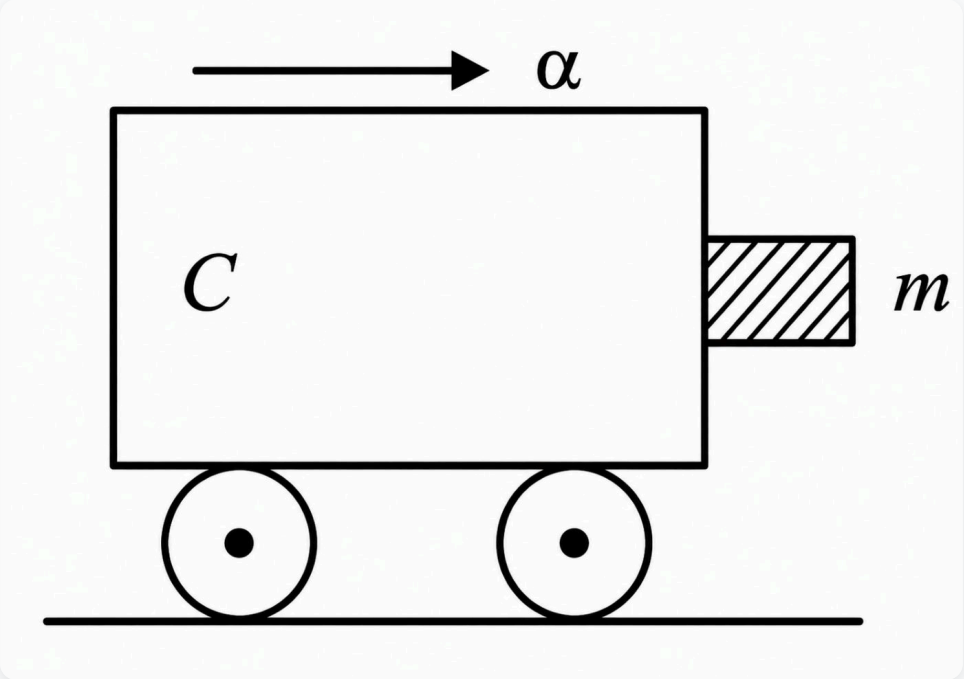


Question 157.

A block of mass m is in contact with the cart C as shown in the Figure.

The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies:

[4 Marks]



(A) α ≥ (g / μ)

(B) α < (g / μ)

(C) α > mg / μ

(D) α > g / μm

Explanation:

Forces acting on the block are as shown in the fig. Normal reaction N is provided by the force ma due to acceleration α

∴ N = ma

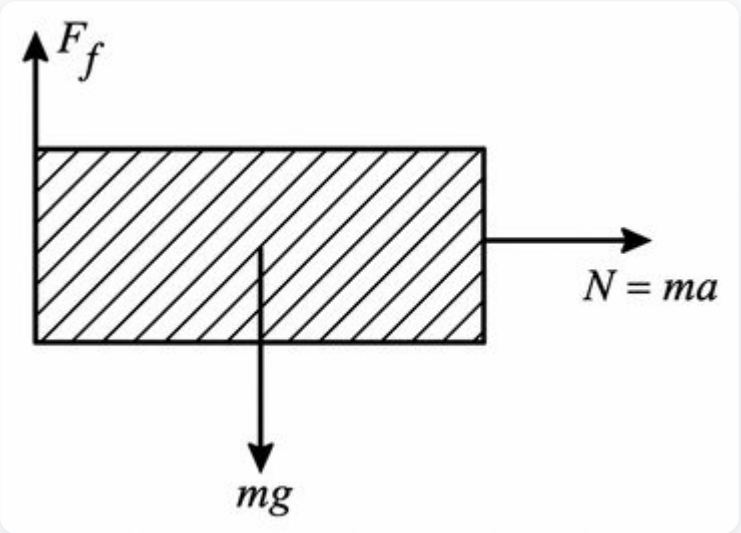
For the block not to fall, the frictional force,

F_f ≥ mg

⇒ μN ≥ mg

⇒ μma ≥ mg

⇒ a ≥ g / μ



Question 158.

An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?

[4 Marks]

(A) 400 W

(B) 200 W

(C) 100 W

(D) 800 W

Explanation:

Amount of water flowing per second from the pipe = m / time == (m / ℓ) · (ℓ / t) = (m / ℓ) v= (m / ℓ)v

Power = K.E. of water flowing per second

= 1 / 2(m / ℓ)v.v²

= 1 / 2(m / ℓ)v³

= 1 / 2 × 100 × 8 = 400 W

Question 159.

A ball moving with velocity 2 m/s collides head-on with another stationary ball of double the mass. If the coefficient of restitution is 0.5, then their velocities (in m/s) after collision will be:

[4 Marks]

(A) 1, 0.5

(B) 0, 1

(C) 1, 1

(D) 0, 2

Explanation:

Clearly $v_1 = 2\ ms^{-1}$, $v_2 = 0$

$m_1 = m$ (say), $m_2 = 2m$

$v_1' = ?$, $v_2' = ?$

$e = (v_1' - v_2') / (v_2 - v_1)$.....(i)

By conservation of momentum,

$2m = mv_1' + 2mv_2'$ ...(ii)

From (i),

$0.5 = (v_2' - v_1') / 2$

$\therefore v_2' = 1 + v_1'$

From (ii),

$2 = v_1' + 2 + 2v_1'$

$\Rightarrow v_1' = 0$ and $v_2' = 1\ ms^{-1}$

Question 160.

Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and 2v at any instant, then the speed of centre of mass of the system will be:

[4 Marks]

(A) zero

(B) 2v

(C) v

(D) 1.5

Explanation:

If no external force action a system of particles, the centre of mass remains at rest. So, speed of centre of mass is zero.

Question 161.

A circular disk of moment of inertia I_t is rotating in a horizontal plane, its symmetry axis, with a constant angular speed ω_i. Another disk of moment of inertia I_b is dropped coaxially onto the rotating disk. Initially the second disk has zero angular speed. Eventually both the disks rotate with a constant angular speed ω_f. The energy lost by the initially rotating disk to friction is:

[4 Marks]

(A) $1 / 2\ [I_b^2 / (I_t + I_b)]\ \omega_i^2$

(B) $[I_t^2 / (I_t + I_b)]\ \omega_i^2$

(C) $1 / 2\ [I_b\ I_t / (I_t + I_b)]\ \omega_i^2$

(D) $[(I_b - I_t) / (I_t + I_b)]\ \omega_i^2$

Explanation:

By conservation of angular momentum,

$I_t\omega_i = (I_t + I_b)\omega_f$

where ω_f is the final angular velocity of disks.

$\therefore\ \omega_f = (I_t / (I_t + I_b))\ \omega_i$

Loss in K.E., ΔK = Initial K.E. − Final K.E.

$= (1 / 2) I_t \omega_i^2 - 1 / 2 (I_t + I_b)\omega_f^2$

$= (1 / 2) I_t \omega_i^2 - 1 / 2 (I_t + I_b) [I_t^2 / (I_t + I_b)^2] \omega_i^2$

$= (1 / 2) \omega_i^2 [I_t / (I_t + I_b)] (I_t + I_b - I_t)$

$= (1 / 2) \omega_i^2 (I_t I_b) / (I_t + I_b)$

Question 162.

A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at a / 2 distance from the centre, will be:

[4 Marks]

(A) -2GM / a

(B) -3GM / a

(C) -GM / a

(D) -4GM / a

Explanation:

Potential at the given point = Potential at the point due to the shell + Potential due to the particle

= - GM / a - 2GM / a = -3GM / a

Question 163.

The radii of circular orbits of two satellites A and B of the Earth are 4R and R, respectively. If the speed of satellite A is 3 V, the speed of satellite B will be:

[4 Marks]

(A) 3V / 2

(B) 12V

(C) 6V

(D) 3V / 4

Explanation:

Orbital velocity of a satellite in a circular orbit of radius a is given by

$v = \sqrt{(GM / a)}$

$\Rightarrow v \propto \sqrt{(1 / a)}$

$\Rightarrow v_2 / v_1 = \sqrt{(a_1 / a_2)}$

$\therefore v_2 - v_1\sqrt{(4R / R)} = 2v_1 = 6V$

Question 164.

A cylindrical metallic rod in thermal contact with two reservoirs of heat at its two ends conducts an amount of heat Q in time t. The metallic rod is melted and the material is formed into a rod of half the radius of the original rod. What is the amount of heat conducted by the new rod, when placed in thermal contact with the two reservoirs, in time t?

[4 Marks]

(A) 2Q

(B) Q / 2

(C) Q / 16

(D) Q / 4

Explanation:

The rate of heat flow is given by

$Q / t = K.A. \Delta T / \ell$

Area of Original rod $A = \pi R^2$;

Area of new rod $A' = \pi R^2 / 4$

$A' = A / 4$

Volume of original rod will be equal to the volume of new rod.

So, $A'\ell' = A\ell$

or,

$\therefore \pi R^2\ell = \pi(R / 2)^2\ell'$

$\Rightarrow \ell' / \ell = R^2 / (R^2 / 4) = 4$

$\therefore Q' / Q = (A' / A).(\ell / \ell') = (1 / 4).(1 / 4) = 1 / 16$

$\therefore Q' = Q / 16$

Question 165.

The total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose surface radiates as a black body at a temperature T K is given by:

(where σ is Stefan's constant)

[4 Marks]

(A) $4\pi\sigma r^2T^4 / R^2$

(B) $\sigma r^4T^4 / R^{42}$

(C) $\sigma r^2 T^4 / R^2$

(D) $\sigma r^2T^4 / 4\pi R^2$

Explanation:

$E = (S / S_0)\sigma T^4 = (4\pi r^2 / 4\pi R^2)\sigma T^4$

$= \sigma(r^2 / R^2)T^4$

Question 166.

If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true?

[4 Marks]

(A) ΔU = ΔW, in an adiabatic process

(B) ΔU = −ΔW, in an adiabatic process

(C) ΔU = − ΔW, in an isothermal process

(D) ΔU = ΔW, in an isothermal process

Explanation:

By first law of thermodynamics,

ΔQ = ΔU + ΔW

In adiabatic process, ΔQ = 0

∴ ΔU = - ΔW

In isothermal process, ΔU = 0

∴ ΔQ = ΔW

Question 167.

The displacement of a particle along the x-axis is given by $x = a \sin^2(\omega t)$. The motion of the particle corresponds to:

[4 Marks]

(A) Non-simple harmonic motion

(B) Simple harmonic motion of frequency $\omega / 2\pi$

(C) Simple harmonic motion of frequency ω / π

(D) Simple harmonic motion of frequency $3\omega / 2\pi$

Explanation:

$x = a \sin^2(\omega t) = a / 2(1-\cos 2\omega t)$

$dx / dt = (a / 2)\, 2\omega \sin 2\omega t$

$d^2x / dt^2 = (4\omega^2 a / 2).\cos 2\omega t$

This represents an S. H. M. of frequency = ω / π

Question 168.

The period of oscillation of a mass M suspended from a spring of negligible mass is T. If along with it another mass M is also suspended, the period of oscillation will now be:

[4 Marks]

(A) T

(B) $T/\sqrt{2}$

(C) $\sqrt{2}T$

(D) 2T

Explanation:

$T = 2\pi\sqrt{(M/K)}$

$\therefore T_1/T_2 = \sqrt{(M_1/M_2)}$

$\therefore T_2 = T_1\sqrt{(M_2/M_1)} = T_1\sqrt{(2M/M)}$

$T_2 = T_1\sqrt{2} = \sqrt{2}T$ (where $T_1 = T$)

Question 169.

A transverse wave is represented by y = Asin(ωt − kx). For what value of the wavelength is the wave velocity equal to the maximum particle velocity?

[4 Marks]

(A) πA/2

(B) 2πA

(C) A

(D) πA

Explanation:

y = Asin(ωt − kx)

Particle velocity,

$v_p = dy/dt = A\,\omega\cos(\omega t - kx)$

$\therefore v_{p\ max} = A\omega$

wave velocity = ω/k

$\therefore A\omega = \omega/k$

i.e., A = 1/k But k = 2π/λ

$\therefore \lambda = 2\pi A$

Question 170.

A tuning fork of frequency 512 Hz makes 4 beats per second with the vibrating string of a piano. The beat frequency decreases to 2 beats per second when the tension in the piano string is slightly increased. The frequency of the piano string before increasing the tension was:

[4 Marks]

(A) 514 Hz

(B) 510 Hz

(C) 508 Hz

(D) 516 Hz

Explanation:

The frequency of the piano string = 512 ± 4 = 516 or 508. When the tension is increased, beat frequency decreases to 2, it means that frequency of the string is 508 as frequency of string increases with tension.

Question 171.

Two positive ions, each carrying a charge q, are separated by a distance d. If F the force of repulsion between the ions, the number of electrons missing from each ion will be (e being the charge of an electron):

[4 Marks]

(A) $4\pi\varepsilon_0 Fd^2 / e^2$

(B) $\sqrt{(4\pi\varepsilon_0 Fd^2 / e^2)}$

(C) $4\pi\varepsilon_0 Fd^2 / q^2$

(D) $\sqrt{(4\pi\varepsilon_0 Fe^2 / d^2)}$

Explanation:

Let n be the number of electrons missing.

$F = (1 / 4\pi\varepsilon_0). (q^2 / d^2)$

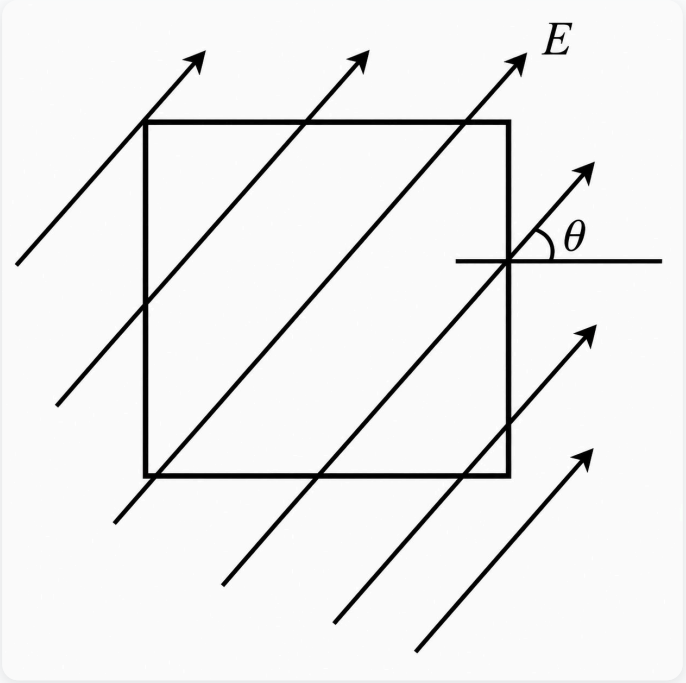
$\Rightarrow q = \sqrt{(4\pi\varepsilon_0 d^2 F)} = ne$

$\therefore n = \sqrt{(4\pi\varepsilon_0 Fd^2 / e^2)}$

Question 172.

A square surface of side L meter in the plane of the paper is placed in a uniform electric field E (volt/m) acting along the same plane at an angle θ with the horizontal side of the square as shown in the figure. The electric flux linked to the surface, in units of volt·m, is:

[4 Marks]



(A) EL^2

(B) $EL^2 \cos \theta$

(C) $EL^2 \sin \theta$

(D) zero

Explanation:

Electric flux, $\Phi = EA \cos \theta$, where θ = angle between E and normal to the surface.

Here $\theta = \pi/2$

$\Phi = 0$

Question 173.

A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference 4 V. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then

[4 Marks]

(A) $2C_1 / n_1n_2$

(B) $16(n_2 / n_1) C_1$

(C) $2(^{n}{}_2 / n_1) C_1$

(D) $16C_1 / n_1n_2$

Explanation:

In series, $C_eff = C_1 / n_1$

∴ Energy stored,

$E_S = (1 / 2)C_eff\ V_S^2$

$= (1 / 2)\ (C_1 / n_1)16V^2$

$= 8V^2\ (C_1 / n_1)$

In parallel,

$C_eff = n_2C_2$

∴ Energy stored,

$E_p = (1 / 2)\ n_2C_2V^2$

According to question,

$E_s = E_p$

$\therefore 8V^2C_1 / n_1 = (1 / 2)\ n_2C_2V^2$

$\Rightarrow C_2 = 16C_1 / n_1n_2$

Question 174.

In producing chlorine by electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated? (E.C.E. of chlorine is 0.367×10^{-6} kg/C)

[4 Marks]

(A) 3.67×10^{-3} kg

(B) 17.61×10^{-3} kg

(C) 9.67×10^{-3} kg

(D) 1.76×10^{-3} kg

Explanation:

$I = P / V = ((100 \times 10^3) / 125)\ A = (10^5 / 60)\ A$

E.C.E. = 0.367×10^{-6} kg C^{-1}

Charge per minute = (I ×60)C

= $((10^5 \times 60) / 125)$ C= $((6 \times 10^6) / 125)$C

∴ Mass liberated = $(6 \times 10^6) / 125 \times 0.367 \times 10^{-6}$

= $(6 \times 1000 \times 0.367 \times 10^{-3}) / 125$

= 17.61×10^{-3} kg

Question 175.

Consider the following two statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

[4 Marks]

(A) Both (A) and (B) are wrong

(B) (A) is correct and (B) is wrong

(C) (A) is wrong and (B) is correct

(D) Both (A) and (B) are correct

Explanation:

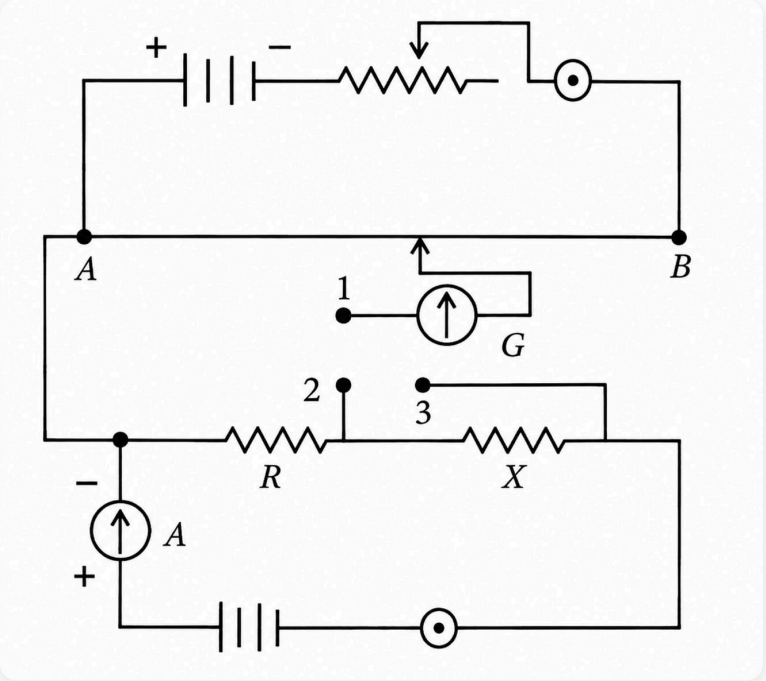
Junction law follows from conservation of charge and loop law is the conservation of energy

Question 176.

A potentiometer circuit is set up as shown. The potential gradient across the potentiometer wire is k volt/cm and the ammeter, present in the circuit, reads 1.0 A when two way key is switched off. The balance points, when the key between the terminals (i) 1 and 2 (ii) 1 and 3 is plugged in, are found to be at lengths l_1 cm and l_2 cm, respectively.

The magnitudes of the resistors R and X, in ohms, are then equal, respectively, to

[4 Marks]



(A) k I_1 and k I_2

(B) k(I_2-I_1) and k I_1

(C) k I_1 and k(I_2-I_1)

(D) k(I_2-I_1) and k I_2

Explanation:

(i) When key between the terminals 1 and 2 is plugged in,

P.D. across R = IR = kI_1

⇒ R = kI_1 as I = 1A

(ii) When key between terminals 1 and 3 is plugged in, P.D. across

(X + R) = I(X + R) = k I_2

⇒ X + R = kI_2

∴ X = k(I_2 - I_1)

∴ R = kI_1 and X = k(I_2 - I_1)

Question 177.

Charge q is uniformly spread on a thin ring of radius R. The ring rotates about its axis with a uniform frequency f Hz. The magnitude of magnetic induction at the centre of the ring is

[4 Marks]

(A) $\mu_0 q / 2f R$

(B) $\mu_0 qf / 2R$

(C) $\mu_0 q / 2\pi f R$

(D) $\mu_0 qf / 2\pi R$

Explanation:

When the ring rotates about its axis with a uniform frequency f Hz, the current flowing in the ring is

$I = q / T = qf$

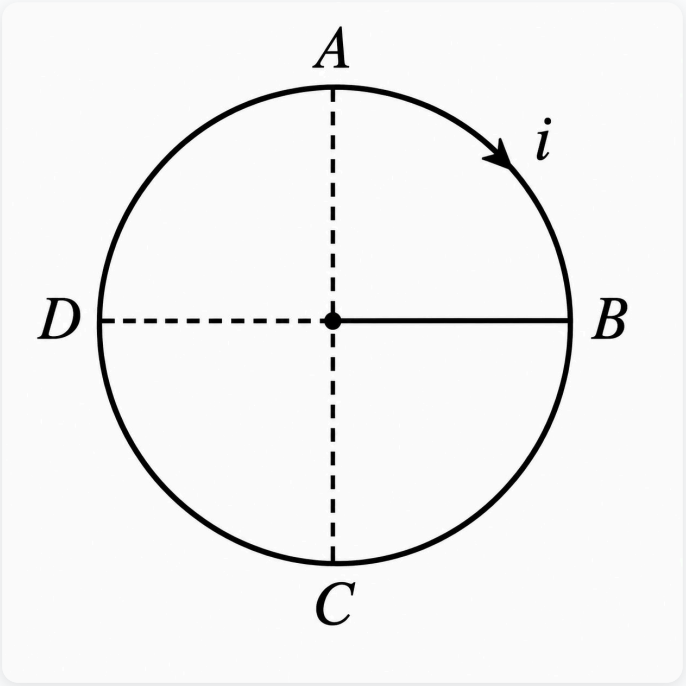
Magnetic field at the centre of the ring is

$B = \mu_0 I / 2R = \mu_0 qf / 2R$

Question 178.

A circular coil ABCD carrying a current i is placed in a uniform magnetic field. If the magnetic force on the segment AB is □□, the force on the remaining segment BCDA is:

[4 Marks]



(A) 3□□

(B) -□□

(C) -3□□

(D) □□

Explanation:

Here, □□_ *AB* + □□_BCDA = $\vec{0}$

□□_BCDA = -□□_AB = -□□

(∵ F_AB = □□)

Question 179.

A galvanometer has a coil of resistance 100 Ω and gives a full-scale deflection for 30 mA current. It is to work as a voltmeter of 30 volt range, the resistance required to be added will be:

[4 Marks]

(A) 900 Ω

(B) 1800 Ω

(C) 1000 Ω

(D) 500 Ω

Explanation:

Let the resistance to be added be R, then

30 = I_g(r+R)

R = 30 / I_g - r = (30 / 30 × 10^{-3}) - 100

= 1000 - 100 = 900 Ω

Question 180.

Electromagnets are made of soft iron because soft iron has:

[4 Marks]

(A) Low retentivity and low coercive force

(B) High retentivity and low coercive force

(C) Low retentivity and high coercive force

(D) High retentivity and high coercive force

Explanation:

Soft iron is a soft magnetic material soft iron has low retentivity and low coercive force or coercivity suitable for electromagnets.

Retentivity is the residual magnetism i.e., the magnetism remains in a materials even on the removal of the magnetising field.

Magnetic hard substance like steel has high coercivity and magnetic soft substance-soft iron has low coercivity.

Question 181.

A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in Earth's horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earth's field by placing a current-carrying wire, the new time period of magnet will be:

[4 Marks]

(A) 4 s

(B) 3 s

(C) 2 s

(D) 1 s

Explanation:

Time period of a vibration magnetometer,

$T \propto 1 / \sqrt{B}$

$T_1 / T_2 = \sqrt{(B_2 / B_1)}$

$T_2 = T_1\sqrt{(B_1 / B_2)} = 2\sqrt{(24\times10^{-6}) / (6\times10^{-6})} = 4s$

Question 182.

A conducting circular loop is placed in a uniform magnetic field, B = 0.025 T, with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of 1 mm s^{-1}. The induced e.m.f. when the radius is 2 cm, is

[4 Marks]

(A) (π / 2) μV

(B) 2μ V

(C) π μV

(D) 2π μV

Explanation:

Magnetic flux linked with the loop is $\phi = B\pi r^2$

$|e| = d\phi / dt = B\pi \cdot 2r (dr / dt)$

When r = 2 cm, $dr / dt = 1$ mm s^{-1}

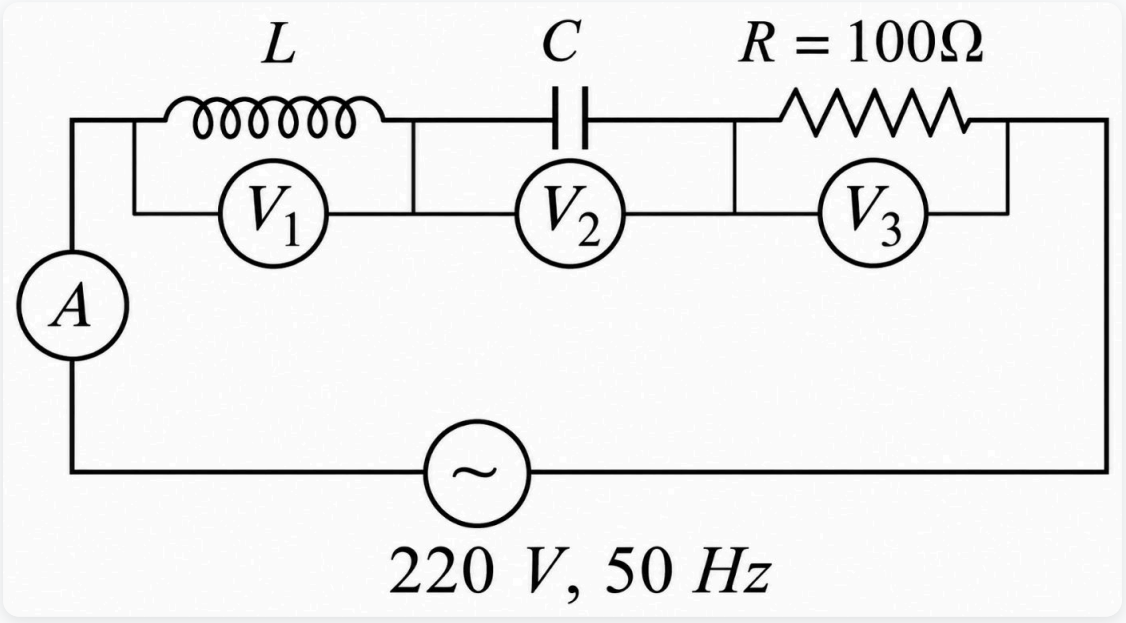
$e = 0.025 \times \pi \times 2 \times 2 \times 10^{-2} \times 10^{-3}$

$= 0.100 \times \pi \times 10^{-5} = \pi \times 10^{-6}$ V = πμV

Question 183.

In the given circuit, the reading of voltmeter V_1 and V_2 are 300 volts each. The reading of the voltmeter V_3 and ammeter A are respectively:

[4 Marks]



(A) 100 V, 2.0 A

(B) 220 V, 2.0 A

(C) 150 V, 2.2 A

(D) 220 V, 2.2 A

Explanation:

As V_L = V_C = 300 V, resonance will take place

∴ V_R = 220 V

Current, I = 220/100 = 2.2 A

∴ reading of V_3, =220 V and reading of A = 2.2 A

Question 184.

A 220 volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is:

[4 Marks]

(A) 2.5 ampere

(B) 5.0 ampere

(C) 2.8 ampere

(D) 3.6 ampere

Explanation:

$V_2 / V_1 = 0.8(I_1 / I_2)$

$\Rightarrow V_2I_2 / V_1I_1 = 0.8$

$V_1 = 220$ V, $I_2 = 2.0$ A, $V_2 = 440$ V

$I_1 = V_2I_2 / V_1 \times 10 / 8 = (440 \times 2 \times 10) / (220 \times 8) = 5$ A

Question 185.

Which one of the following statements is false for the properties of electromagnetic wave?

[4 Marks]

(A) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave.

(B) These waves do not require any material medium for propagation.

(C) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time.

(D) The energy in electromagnetic wave is divided equally between electric and magnetic field vectors.

Explanation:

Electromagnetic waves are the combination of mutually perpendicular electric and magnetic fields. So, option (Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave.) is false.

Question 186.

A ray of light travelling in a transparent medium of refractive index μ, falls on a surface separating the medium from air at an angle of incidence of 45°. For which of the following values of μ the ray can undergo total internal reflection?

[4 Marks]

(A) μ = 1.25

(B) μ = 1.40

(C) μ = 1.50

(D) μ = 1.33

Explanation:

For total internal reflection,

$\mu \geq 1/\sin C \geq \sqrt{2} \geq 1.414$

$\Rightarrow \mu = 1.50$

Question 187.

A lens having focal length f and aperture of diameter d forms an image of intensity I. Aperture of diameter d/2 in the central region of the lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively:

[4 Marks]

(A) f / 2 and I / 2

(B) f and 3I / 4

(C) f and I / 4

(D) 3f / 4 and I / 2

Explanation:

By covering aperture, focal length does not change.

But intensity is reduced by 1 / 4 times, as aperture diameter d / 2 is covered.

∴ I' = I - I / 4 = 3I / 4

∴ New focal length = f and intensity = 3I / 4.

Question 188.

A source S_1 is producing 10^{15} photons per second of wavelength 5000 Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100 Å. Then, (power of S_2) (power of S_1) is equal to:

[4 Marks]

(A) 0.98

(B) 1.04

(C) 1.00

(D) 1.02

Explanation:

Energy emitted/sec by S_1, $P_1 = n_1(hc / \lambda_1)$

Energy emitted/sec by S_2, $P_2 = n_2.(hc / \lambda_2)$

$\therefore P_2 / P_1 = (n_2 / n_1).(\lambda_1 / \lambda_2)$

$= (1.02 \times 10^{15}) / 10^{15} . 5000 / 5100 = 1.0$

Question 189.

The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be:

[4 Marks]

(A) −2.4 V

(B) 1.2 V

(C) 2.4 V

(D) −1.2 V

Explanation:

$K_{max} = hc / \lambda - W = hc / \lambda - 5.01$

$= 12375 / \lambda(\text{in Å}) - 5.01$

= 12375 / 2000 - 5.01 = 6.1875 - 5.01 = 1.17775

≈ 1.2 V

The potential difference that must be applied to stop photoelectrons = -1.2V

Question 190.

An alpha nucleus of energy $(1 / 2)mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to:

[4 Marks]

(A) 1 / Ze

(B) v^2

(C) $1 / v^4$

(D) 1 / m

Explanation:

Kinetic energy of alpha nucleus is equal to electrostatic potential energy of the system of the alpha particle and the heavy nucleus. That is,

$(1 / 2)mv^2 = (1 / 4\pi\varepsilon_0)(q_\alpha Ze / r_0)$

where r_0 is the distance of closest approach

$r_0 = (2 / 4\pi\varepsilon_0)(q_\alpha Ze) / mv^2$

$r_0 \propto Ze \propto q_\alpha \propto 1 / m \propto 1 / v^2$

Question 191.

The energy of hydrogen atom in the ground state is −13.6 eV. The energy of a He^+ ion in the first excited state will be:

[4 Marks]

(A) −13.6 eV

(B) −27.2 eV

(C) −6.8 eV

(D) −54.4 eV

Explanation:

Energy of a H-like atom in its nth state is given by

$E_n = -Z^2 \times (13.6 / n^2)$ eV

For first excited state of He^+

n = 2, Z = 2

∴ E_He^+ = - 4 / 2^2 × 13.6 = - 13.6 eV

Question 192.

The mass of a $^7_3$Li nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of the $^7_3$Li nucleus is nearly:

[4 Marks]

(A) 46 MeV

(B) 5.6 MeV

(C) 3.9 MeV

(D) 23 MeV

Explanation:

B.E. = 0.042 × 931 ≈ 42 MeV

Number of nucleons in $^7_3$Li is **7**.

∴ B.E./nucleon = 42/7= 6 MeV ≈ 5.6 MeV

Question 193.

The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minute at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is:

[4 Marks]

(A) $\log_e 2/5$

(B) $5/\log_e 2$

(C) $5 \log_e 2$

(D) $5 \log_{10} 2$

Explanation:

.

$$N = N_0 e^{-\lambda t}$$

Here, $t = 5$ minutes

$$\frac{N_0}{e} = N_0 \cdot e^{-5\lambda}$$

$$\Rightarrow \quad 5\lambda = 1, \ \lambda = \frac{1}{5},$$

$$\text{Now, } T_{1/2} = \frac{\ell n 2}{\lambda} = 5 \ \ell n 2$$

Question 194.

Which one of the following statement is FALSE?

[4 Marks]

(A) Pure Si doped with trivalent impurities gives a p-type semiconductor

(B) Majority carriers in a n-type semiconductor are holes

(C) The resistance of intrinsic semiconductor decreases with increase of temperature

(D) Minority carriers in a p-type semiconductor are electrons

Explanation:

Majority carriers in an n-type semiconductor are electrons.

Question 195.

Which one of the following bonds produces a solid that reflects light in the visible region and whose electrical conductivity decreases with temperature and has high melting point?

[4 Marks]

(A) Metallic bonding

(B) van der Waal's bonding

(C) Ionic bonding

(D) Covalent bonding

Explanation:

For a metal, conductivity decreases with increase in temperature.

Also, metal has high melting point.

Question 196.

A common emitter amplifier has a voltage gain of 50, an input impedance of 100 Ω and an output impedance of 200 Ω. The power gain of the amplifier is:

[4 Marks]

(A) 1000

(B) 500

(C) 1250

(D) 50

Explanation:

Power gain = voltage gain × current gain

= V_G.I_G = V_0/V_i . I_0/I_i

= V_0^2/V_i^2 . R_i/R_0 = 50 × 50 × 100/200

= 2500/2 = 1250

Question 197.

The device that can act as a complete electronic circuit is:

[4 Marks]

(A) Junction diode

(B) Integrated circuit

(C) Junction transistor

(D) Zener diode

Explanation:

Integrated circuit can act as a complete electronic circuit.

Question 198.

A beam of cathode rays is subjected to crossed electric (E) and magnetic field (B). The fields are adjusted such that the beam is not deflected. The specific charge of the cathode rays is given by:

(where V is the potential difference between cathode and anode.)

[4 Marks]

(A) $E^2 / 2VB^2$

(B) $2VE^2 / B^2$

(C) $B^2 / 2VE^2$

(D) $2VB^2 / E^2$

Explanation:

As the electron beam is not deflected, then

$F_m = F_e$

or $Bev = Ee$ or $v = E / B$ .....(i)

As the electron moves from cathode to anode, its potential energy at the cathode appears as its kinetic energy at the anode. If V is the potential difference between the anode and cathode, then potential energy of the electron at cathode is eV. Also, kinetic energy of the electron at anode = $(1 / 2)mv^2$. According to the law of conservation of energy

$(1 / 2)\ mv^2 = eV$ or $v = \sqrt{(2eV / m)}$ ...(ii)

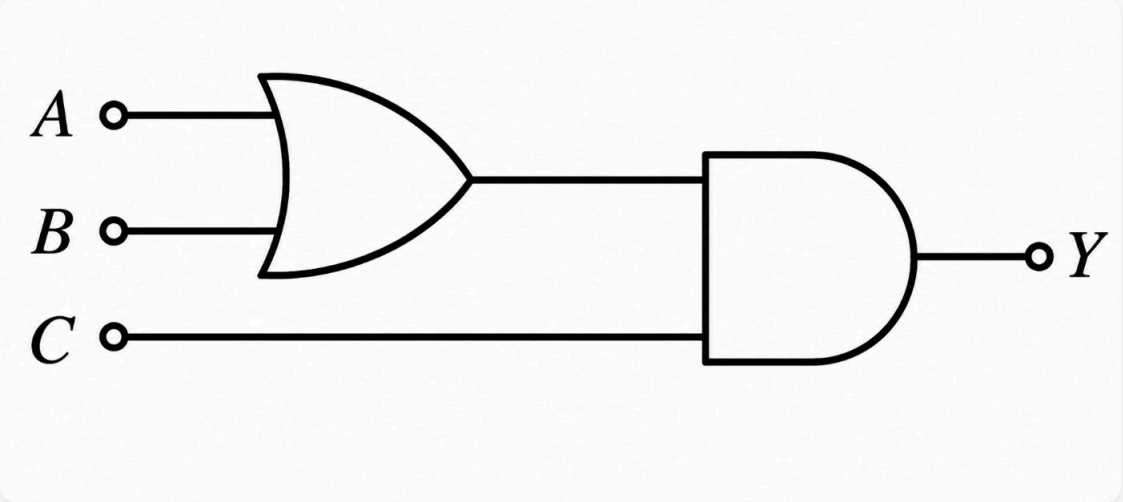
From Eqs. (i) and (ii), we have

$\sqrt{(2eV / m)} = E / B$ or $e / m = E^2 / 2VB^2$

Question 199.

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

[4 Marks]



(A) A = 0, B = 1, C = 0

(B) A = 1, B = 0, C = 0

(C) A = 1, B = 1, C = 0

(D) A = 1, B = 0, C = 1

Explanation:

The Boolen expression for the given combination is output Y=(A+B) C

Truth table

A	B	C	$Y = (A + B) \cdot C$
0	0	0	0
1	0	0	0
0	1	0	0
0	0	1	0
1	1	0	0
0	1	1	1
1	0	1	1
1	1	1	1

Hence, A = 1, B = 0, C = 1

Question 200.

A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if

[4 Marks]

(A) $r \geq \mu g/\omega^2$

(B) $r \leq \mu g/\omega^2$

(C) $r < \omega^2/\mu g$

(D) $r = \mu g \omega^2$

Explanation:

When the disc spins, the frictional force between the gramophone record and the coin is **μ mg**.

The coin will revolve with the record if:

$F_{frictional} \geq F_{centripetal}$

$\mu mg \geq m\omega^2 r$

$\mu g / r \geq \omega^2$
