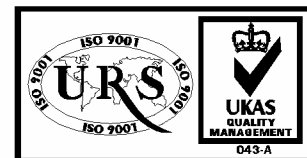




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Questions & Solution for DUMET-2011

(Delhi University Medical/Dental Entrance Test)

HELD : 22/05/2011

CHEMISTRY

91. In the given structure of a compound, the correct various bond moments direction involving are shown as

1. $\text{Br} \leftarrow \text{N} \leftarrow \text{CH}_2 \rightarrow \text{SiH}_2 \leftarrow \text{CH}_2 \rightarrow \text{O} \leftarrow \text{CH}_3$
2. $\text{Br} \leftarrow \text{N} \leftarrow \text{CH}_2 \leftarrow \text{SiH}_2 \leftarrow \text{CH}_2 \rightarrow \text{O} \leftarrow \text{CH}_3$
3. $\text{Br} \leftarrow \text{N} \rightarrow \text{CH}_2 \leftarrow \text{SiH}_2 \rightarrow \text{CH}_2 \rightarrow \text{O} \leftarrow \text{CH}_3$
4. $\text{Br} \leftarrow \text{N} \rightarrow \text{CH}_2 \leftarrow \text{SiH}_2 \leftarrow \text{CH}_2 \rightarrow \text{O} \rightarrow \text{CH}_3$

Correct option is (3)

Hints :

Bond moment is shown from less electronegative to more electronegative.

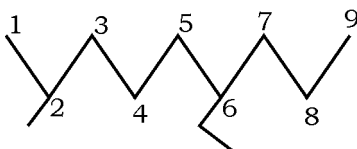
92. For the given alkane



1. 1,1-dimethyl-5-ethyl octane
2. 6-ethyl-2-methyl nonane
3. 4-ethyl-8-methyl nonane
4. 2-methyl,-6-propyl octane

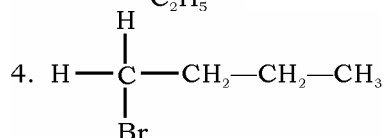
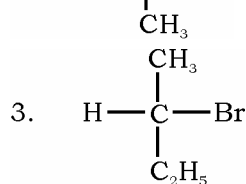
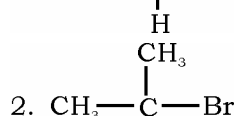
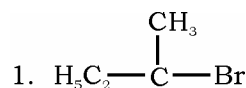
Correct option is (2)

Hints :-



The correct name is 6-ethyl-2-methyl nonane

93. Which will undergo fastest $\text{S}_{\text{N}}2$ substitution reaction when treated with NaOH ?

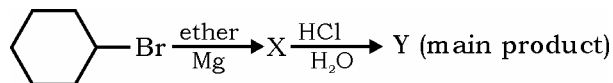


Correct option is (4)

Hints :

Primary alkyl halides undergo Bimolecular nucleophilic substitution most readily hence (4)

94. Given reaction :

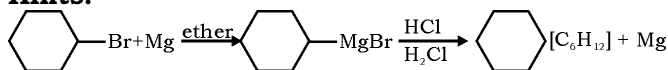


'Y' in the reaction is :

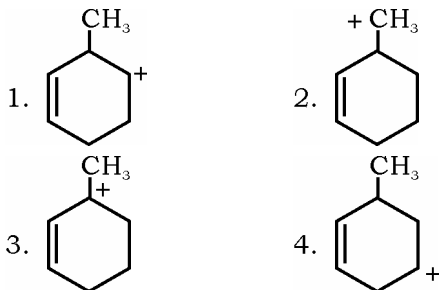
1. Hexane
2. Cyclohexane
3. Cyclohexylcyclohexane
4. Cyclohexylether

Correct option is (2)

Hints:

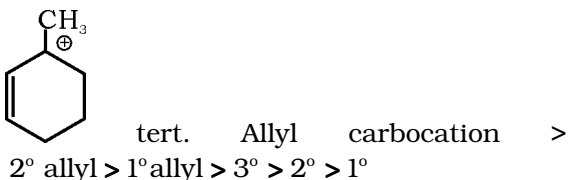


Q5. Most stable carbocation is :

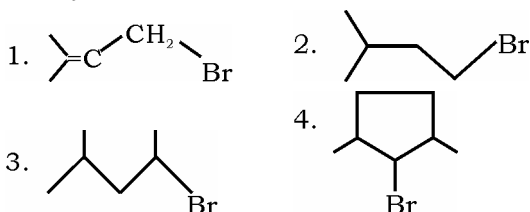


Correct option is (3)

Hints :



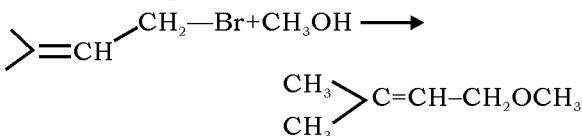
Q6. Which one of the following alkyl bromides undergoes most rapid solvolysis in methanol solution to give corresponding methyl ether ?



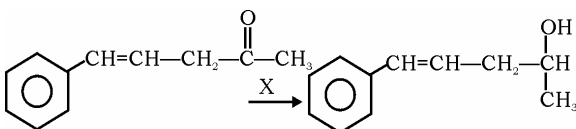
Correct option is (1)

Hints:- ∵ 1-Bromo-3-methyl prop-2-en react most readily both by SN¹ because the Bromine is allylic.

Since CH₃OH is a weak nucleophile and weak nucleophile favours SN¹.



Q7. In the conversion of



'X' is :

- H₂/Pt
- Zn-Hg/HCl
- Li/NH₃
- NaBH₄

Correct option is (4)

Hints : NaBH₄ does not reduce offline double bond.

Q8. Which is not the correct statement about RNA and DNA?

- DNA is active in virus where RNA never appears in virus
- DNA exists as dimer while RNA is usually single stranded
- DNA contains deoxyribose as its sugar and RNA contains ribose
- RNA contains uracil in place of thymine (found in DNA) as a base

Correct option is (1) Knowledge based.

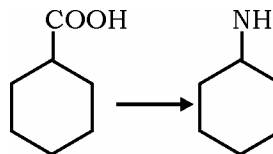
Q9. What is nature of glucose-glucose linkage in starch that makes its so susceptible to acid hydrolysis?

- Starch is hemiacetal
- Starch is acetal
- Starch is polymer
- Starch contains only few molecules of glucose

Correct option is (2)

Hints : Starch is acetal, Monosaccharides are hemiacetal. Acetals and hemiacetals get readily hydrolysed by acids to give alcohol.

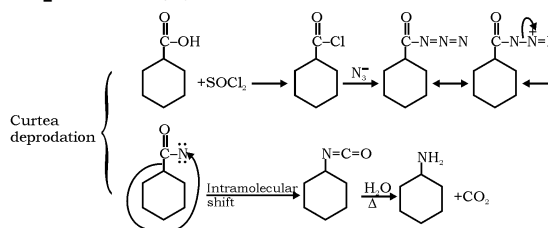
Q10. In the conversion



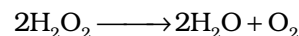
The sequence of the reagent used are :

- (i) SOCl₂ (ii) N₃⁻ (iii) H₂O, heat
- (i) SOCl₂ (ii) NH₃
- (i) SOCl₂ (ii) NH₃ (iii) Heat
- (i) SOCl₂ (ii) KCN (iii) LiAlH₄

Correct option is (1)



Q11. In the reaction



- Oxygen is oxidised only

- Oxygen is reduced only
- Oxygen is neither oxidised nor reduced
- Oxygen is both oxidised and reduced

Correct option is (4) Knowledge based

Q12. Which one of the following is *not* acid-base conjugate pair ?

- HONO, NO₂⁻
- CH₃NH₃⁺, CH₃NH₂
- C₆H₅-COOH, C₆H₅COO⁻
- H₃O⁺, OH⁻

Correct option is (4)

Hints : H₃O⁺; OH⁻ it is not a conjugate acid base pair

Q13. Which one of the following has the strongest O-O bond?

- O₂⁺
- O₂⁰
- O₂⁻
- O₂²⁻

Correct option is (1)

Hints: O₂⁺ because Bond order in

$$O_2^+ = 2.5; O_2 = 2; O_2^- = 1.5; O_2^{2-} = 1$$

Higher the bond order greater the bond energy because of smaller the bond length.

Q14. For the reactions

$I_2(aq) \rightleftharpoons I_2(oil)$ Equilibrium constant is K₁

$I_2(oil) \rightleftharpoons I_2(ether)$ Equilibrium constant is K₂ for reaction

$I_2(aq) \rightleftharpoons I_2(ether)$ Equilibrium constant = K₃.

The relation between K₁, K₂, K₃ is :

- K₃ = K₁ + K₂
- K₃ = K₁K₂
- K₃ = K₁/K₂
- K₃ = K₂/K₁

Correct option is (2)

Hints : If the equation is obtained by adding two equation, equilibrium constants are multiplied. So (2)

Q15. The geometry of electron pairs around I in IF₅ is :

- Octahedral
- Trigonal bipyramidal

- Square pyramidal
- Pentagonal planar

Correct option is (1)

Hints : IF₅ $7 + 5 \times 7 = \frac{42}{8} = 5 + 1$

sp³d² hybridization hence octahedral.

Q16. Which statement is not correct?

- Rate of an exothermic reaction increases with temperature
- Solubility of NaOH increases with temperature
- K_P for N₂(g) + 3H₂(g) \rightleftharpoons 2NH₃(g) increases with increase in pressure
- For gaseous reaction 2B → A K_P is smaller than K_C

Correct option is (3)

Hints: ∵ K_P is a function of temperature and stoichiometric coefficient only.

Q17. Which change requires an oxidizing agent

- 2S₂O₃²⁻ \rightleftharpoons S₄O₆²⁻
- Zn²⁺ \rightleftharpoons Zn
- ClO⁻ \rightleftharpoons Cl⁻
- SO₃ \rightleftharpoons SO₄²⁻

Correct option is (1)

Hints: S₂O₃²⁻ \longrightarrow S₄O₆²⁻

O.S. of S changes from 2 to 2.5

Q18. Given the following reactions involving, A, B, C and D :

- C + B⁺ → C⁺ + B
- A⁻ + D → No reaction
- C⁺ + A → No reaction
- D + B⁺ → D⁺ + B

The correct arrangement of A, B, C, D in order of their decreasing ability as reducing agent :

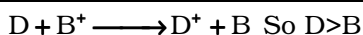
- D > B > C > A
- A > C > D > B
- C > A > B > D
- C > A > D > B

Correct option is (4)

Hints: C + B⁺ \longrightarrow C⁺ + B So C > B

A⁻ + D \longrightarrow No reaction So D > B

C⁺ + A \longrightarrow No reaction So C > A



Hence $C > A > D > B$

Q19. Which ion has the largest radius ?

1. Se^{2-}
2. F^-
3. O^{2-}
4. Rb^+

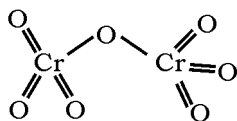
Correct option is (1)

Hints: Being isoelectronic greater the nuclear charge smaller the size and lesser the nucleolar charge larger the size hence Se^{2-} .

Q20. Which is correct statement about $\text{Cr}_2\text{O}_7^{2-}$ - structure?

1. It has neither Cr-Cr bonds nor O-O bonds
2. It has one Cr-Cr bond and six O-O bonds
3. It has no Cr-Cr bond and has six O-O bonds
4. It has one Cr-Cr bond and seven Cr-O bonds

Correct option is (1)



Hints:

Q21. Which reaction, with the following values of ΔH , ΔS at 400 K is spontaneous and endothermic ?

1. $\Delta H = -48 \text{ kJ}$; $\Delta S = +135 \text{ J/K}$
2. $\Delta H = -48 \text{ kJ}$; $\Delta S = -135 \text{ J/K}$
3. $\Delta H = +48 \text{ kJ}$; $\Delta S = +135 \text{ J/K}$
4. $\Delta H = +48 \text{ kJ}$; $\Delta S = -135 \text{ J/K}$

Correct option is (3)

Hints: $\Delta G = \Delta H - T\Delta S$

$$\begin{aligned} &= 48000 - 400 \times 135 \\ &= 48000 - 54000 \\ &= -600 \text{ J mol}^{-1} \end{aligned}$$

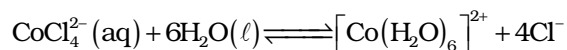
Q22. The correct decreasing order of dipole moment in CH_3Cl , CH_3Br and CH_3F is :

1. $\text{CH}_3\text{F} > \text{CH}_3\text{Cl} > \text{CH}_3\text{Br}$
2. $\text{CH}_3\text{F} > \text{CH}_3\text{Br} > \text{CH}_3\text{Cl}$
3. $\text{CH}_3\text{Cl} > \text{CH}_3\text{F} > \text{CH}_3\text{Br}$
4. $\text{CH}_3\text{Cl} > \text{CH}_3\text{Br} > \text{CH}_3\text{F}$

Correct option is (3)

Hints: C-F bond length is smaller than C-Cl bond length hence CH_3F dipole moment is less than CH_3Cl

Q23. Given exothermic reaction



Which one of the following will decrease the equilibrium concentration of CoCl_4^{2-} ?

1. Addition of HCl
2. Addition of $\text{Co}(\text{NO}_3)_2$
3. The solution is diluted with water
4. The temperature is increased

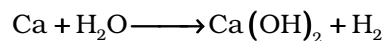
Correct option is (3)

Hints: Here water is a reactant so increase in conc. Of reactant shifts the equilibrium in the forward direction.

Q24. Hydrogen is prepared from H_2O by adding

1. Ca, which act as reducing agent
2. Al, which acts as oxidising agent
3. Ag, which acts as reducing agent
4. Au, which acts as oxidising agent

Correct option is (1)



Q25. For preparing a buffer solution of $\text{pH} = 7.0$, which buffer system you will choose?

1. H_3PO_4 , H_2PO_4^-
2. H_2PO_4^- , HPO_4^{2-}
3. HPO_4^{2-} , PO_4^{3-}
4. H_3PO_4 , PO_4^{3-}

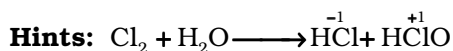
Correct option is (2)

Hints: A weak acid and its conjugate base HPO_4^{2-}

Q26. Which element undergoes disproportionation in water ?

1. Cl_2
2. F_2
3. K
4. Cs

Correct option is (1)



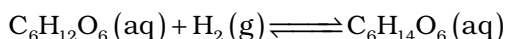
Q27. Which one of the following species acts only as a base ?

1. H_2S
2. HS^-
3. S^{2-}
4. H_2O

Correct option is (3)

Hints: S^{2-} can accept a proton only

Q28. For the following reaction



Which one of the following is not affected by the addition of catalyst?

1. Rate of forward reaction
2. Rate of backward reaction
3. Time required to reach the equilibrium
4. Spontaneity

Correct option is (4)

Hints: Catalyst can neither start a reaction nor stop.

Q29. Which is not the correct statement ?

1. The S_8 ring is not planar
2. Oxygen is more electronegative than sulphur
3. SF_4 exists, but OF_4 does not exist
4. SO_3 and SO_3^{2-} both have trigonal planar geometry

Correct option is (4)

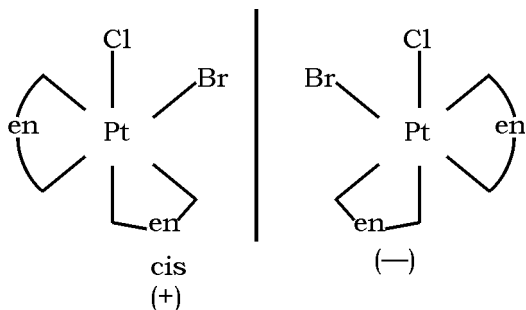
Hints: SO_3 is trigonal planar due to sp^2 hybridized sulphur

SO_3^{2-} is sp^3 hybridized but pyramidal due to lone pair of electron.

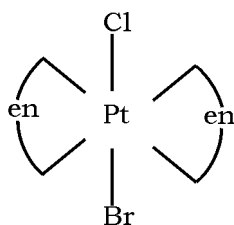
Q30. Which can exist both as diastereoisomer and enantiomer ?

1. $[Pt(en)_3]^{4+}$
2. $[Pt(en)_2ClBr]^{2+}$
3. $[Ru(NH_3)_4Cl_2]^0$
4. $[PtCl_2Br_2]^0$

Correct option is (2)



Hints:

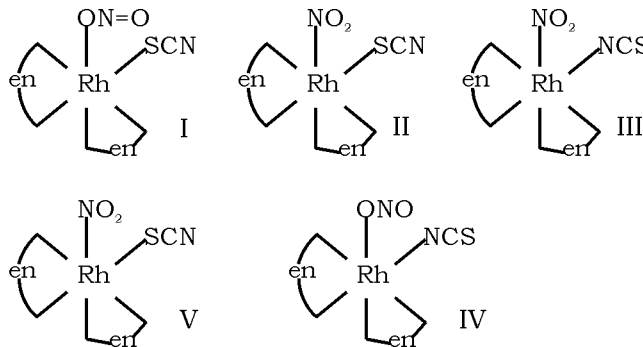


Q31. Number of isomeric forms (constitutional and stereoisomers) for $[Rh(en)_2(NO_2)(SCN)]^+$ are :

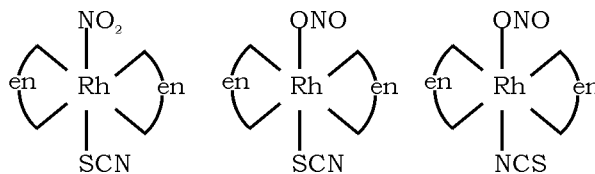
1. Three
2. Six
3. Nine
4. Twelve

Correct option is (4)

Hints: Ambidentate ligand NO_2 and SCN will give two different isomers.



I to V each will have two isomers (d and l) each



Q32. Four transition metal octahedral complexes, the choice between high and low spin electronic configurations arises only for :

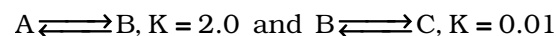
1. d^1 to d^3 complexes
2. d^4 to d^7 complexes
3. d^7 to d^9 complexes
4. d^1, d^2 and d^8 complexes

Correct option is (2)

Hints: The distribution of electrons of d^1, d^2, d^3, d^8, d^9 in t_{2g} and e_g sets both for strong and weak ligand field is same.

But for d^4, d^5, d^6 and d^7 there is difference in the arrangement of electrons in weak and strong field ligands. A weak ligand will have greater no. of unpaired electrons.

Q33. For a chemical reaction of the type



Equilibrium constant for the reaction $2C \rightleftharpoons 2A$ is :

1. 25

2. 50

3. 2500

4. 4×10^{-4} **Correct option is (3)****Hints:** $A \rightleftharpoons B \quad k = 2$

Multiply by (2) $2A \rightleftharpoons 2B \quad k_1 = (2)^2 = 4$
 (1)

$2B \rightleftharpoons 2C \quad k_2 = (0.01)^2 = 10^{-4} \dots (2)$

Adding (1) and (2)

$2A \rightleftharpoons 2C \quad k_1 \cdot k_2 = 4 \times 10^{-4}$

$2C \rightleftharpoons 2A \quad k = \frac{1}{4 \times 10^{-4}} = \frac{10000}{4} = 2500$

Q34. A chemical reaction proceeds into the following steps

Step I, $2A \rightleftharpoons X$ fast

Step II, $X + B \rightleftharpoons Y$ slow

Step III, $Y + B \rightleftharpoons \text{Product}$ fast

The rate law for the overall reaction is :

1. rate = $k[A]^2$ 2. rate = $k[B]^2$

3. rate = $k[A][B]$ 4. rate = $k[A]^2[B]$

Correct option is (4)**Hints:** $\frac{dx}{dt} = k'[X][B]$

From Step I $K_{eq} = \frac{[X]}{[A]^2}$

$[X] = K_{eq} [A]^2$

$\frac{dx}{dt} = k' \cdot K_{eq} [A]^2 [B]$

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

Q35. A solution is 0.1 M with respect to Ag^+ , Ca^{2+} , Mg^{2+} and Al^{3+} which will precipitate at lowest concentration of $[PO_4^{3-}]$ when solution of Na_3PO_4 is added ?

1. Ag_3PO_4 ($K_{sp} = 1 \times 10^{-6}$)

2. $Ca_3(PO_4)_2$ ($K_{sp} = 1 \times 10^{-33}$)

3. $Mg_3(PO_4)_2$ ($K_{sp} = 1 \times 10^{-24}$)

4. $AlPO_4$ ($K_{sp} = 1 \times 10^{-20}$)

Correct option is (4)**Hints:** $Ag_3PO_4 \rightleftharpoons 3Ag^+ + PO_4^{3-}$

$[PO_4^{3-}] = \frac{K_{sp}}{(0.1)^3} = \frac{1 \times 10^{-6}}{10^{-3}} = 10^{-3}$

$Ca_3(PO_4)_2 \rightleftharpoons 3Ca^{2+} + 2PO_4^{3-}$

$4x^2 (0.1)^3 = K_{sp}$

$x = \sqrt{\frac{K_{sp}}{4 \times 10^{-3}}} = \sqrt{\frac{10^{-33}}{4 \times 10^{-3}}} = \sqrt{2.5 \times 10^{-31}}$

$PO_4^{3-} = 5 \times 10^{-16}$

(3) $Mg_3(PO_4)_2 \rightleftharpoons 3Mg^{2+} + 2PO_4^{3-}$

0.1 2x

$(2x)^2 (0.1)^3 = 10^{-24}$

$4x^2 = \frac{10^{-24}}{0.001} = 10^{-21}$

$x = \sqrt{2.5 \times 10^{-22}}$
 $= 5 \times 10^{-11.5}$

(4) $AlPO_4 \rightleftharpoons Al^{3+} + PO_4^{3-}$

0.1 x

$x = \frac{K_{sp}}{0.1} = 10^{-19}$ (Hence (4))

Q36. In Tollen's test, aldehydes

1. are oxidised
2. are reduced to alcohol
3. neither reducer nor oxidised
4. precipitate Ag^+ as $AgCl$

Correct option is (1) Knowledge based

Q37. The half life time of 2g sample of radioactive nuclide 'X' is 15 min. The half time of 1 g sample of X is

1. 7.5 min
2. 15 min
3. 22.5 min
4. 30 min

Correct option is (2)**Hints:** Half life of a first order reaction is independent of original concentration.

Q38. Given a gas phase reaction

$2A(g) + B(g) \rightleftharpoons C(g) + D(g)$

Which one of the following changes will affect the value of KC?

1. Addition of inert gas
2. Addition of catalyst
3. Addition of reactants
4. Increasing in temperature

Correct option is (4)

Hints: K_c is a function of temperature only.

Q39. Lowest pK_a is associated with :

- 1.
- 2.
- 3.
- 4.

Correct option is (3)

Hints: All halogenated acids are stronger acid than benzoic acid due to minus inductive effect of halogen.

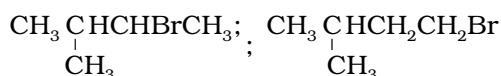
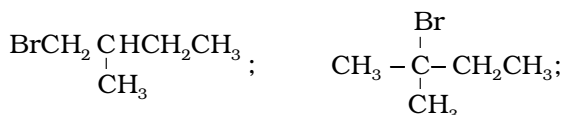
Q40. Monobromination of 2-methylbutane gives how many distinct isomers?

1. One
2. Two
3. Three
4. Four

Correct option is (4)

Hints: $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2\text{CH}_3$

Since there are four different types of Hydrogen.



However only one should be obtained \therefore Bromine is selective.

Q41. $\alpha - (D) \text{ glucose} \rightleftharpoons \beta - (D) \text{ glucose}$, equilibrium constant for this is 1.8. The percentage of $\alpha - (D) \text{ glucose}$ at equilibrium is :

1. 35.7
2. 55.6
3. 44.4
4. 64.3

Correct option is (1)

Hints: $\alpha - (D) \text{ glucose} \rightleftharpoons \beta - (D) \text{ glucose}$

$$\frac{x}{1-x} = 1.8$$

$$x = 1.8 - 1.8x$$

$$2.8x = 1.8$$

$$x = \frac{1.8}{2.8}$$

$$(1-x) \text{ 2-D-glucose} = \frac{1}{2.8}$$

$$\% = \frac{1000}{28} = 35.7$$

Q42. Equal weights of CH_4 and H_2 are mixed in a container at 25°C . Fraction of total pressure exerted by methane is :

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{1}{9}$
4. $\frac{8}{9}$

Correct option is (3)

Hints: Suppose 16 kg of each is taken

$$\eta_{\text{CH}_4} = 1$$

$$\eta_{\text{H}_2} = 8$$

$$P_{\text{CH}_4} = P_{\text{total}} \times \text{mole fraction}$$

$$= P_{\text{total}} \times \frac{1}{9}$$

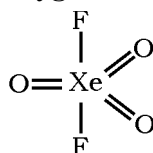
Q43. In which one of the given formulae of xenon compounds there are five σ -bonds and three π -bonds in it?

1. XeFO
2. XeF_2O_2
3. XeF_3O_2
4. XeF_2O_3

Correct option is (4)

Hints: $8 + 14 + 18 = \frac{40}{8} = 5$

sp^3d hybridization hence 5σ and 3π with oxygen.

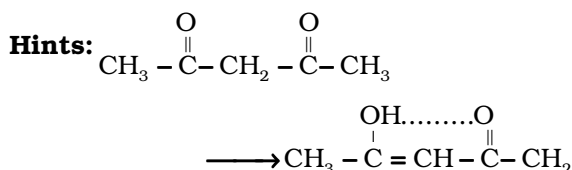


Q44. More acidic than ethanol is :

1. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$

2. $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$
3. $\text{CH}_3\text{COCH}_2\text{COCH}_3$
4. CH_3COCH_3

Correct option is (3)

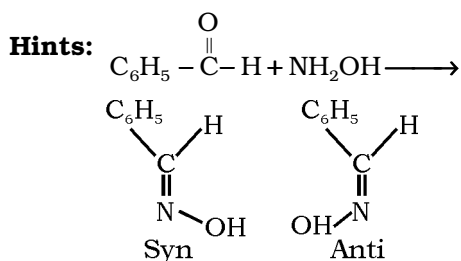


Due to intramolecular H bonding.

Q45. Of the followings, the oxime of which shows geometrical isomerism, is

1. Acetone
2. Diethylketone
3. Formaldehyde
4. Benzaldehyde

Correct option is (4)



Q46. Decreasing order of reactivity of hydrogen halide acid in the conversion of $\text{ROH} \rightarrow \text{RX}$ is

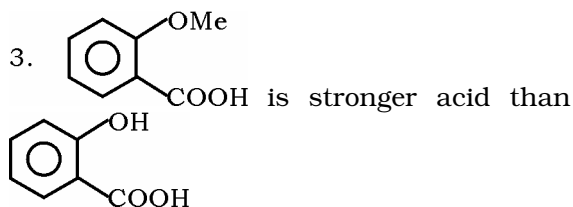
1. $\text{HCl} > \text{HBr} > \text{HI} > \text{HF}$
2. $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$
3. $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$
4. $\text{HF} > \text{HBr} > \text{HI} > \text{HCl}$

Correct option is (2)

Hints: $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$

Q47. Which is correct statement?

1. *o*-Nitrobenzoic acid is stronger than 3,5 dinitrobenzoic acid in H_2O
2. Branched carboxylic acids are more acidic than unbranched acids



4. Butanoic acid is stronger acid than succinic acid

Correct option is (1)

Hints: Ortho effect

Q48. Maximum efficiency of a commercial refrigerator which operates between -10° (inside temperature) and 25°C (outside temperature) is

1. 13.3%
2. 11.45%
3. 24.75%
4. 20%

Correct option is (2)

Hints: $\eta = \frac{T_2 - T_1}{T_2} = \frac{298 - 263}{298} = \frac{35}{298}$

$$\% = \frac{3500}{298}$$

Q49. $1 \times 10^{-3}\text{m}$ solution of $\text{Pt}(\text{NH}_3)_4\text{Cl}_4$ in H_2O shows depression in freezing point by 0.0054°C . The structure of the compound will be (Given $K_{\text{fp}}(\text{H}_2\text{O}) = 1.860 \text{ km}^{-1}$):

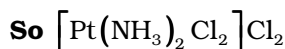
1. $[\text{Pt}(\text{NH}_3)_4]\text{Cl}_4$
2. $[\text{Pt}(\text{NH}_3)_3\text{Cl}]\text{Cl}_3$
3. $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]\text{Cl}_2$
4. $[\text{Pt}(\text{NH}_3)\text{Cl}_3]\text{Cl}$

Correct option is (3)

Hints: $\Delta T_f = iK_f m$

$$0.0054 = i \cdot 1.86 \times 0.001$$

$$i = \frac{5.4}{1.86} \approx 3$$



Q50. The typical range of molar enthalpies for the strongest intermolecular (Hydrogen) bonds is

1. 200 – 300 kJ
2. 300 – 500 kJ
3. 4 – 25 kJ
4. 4 – 25 J

Correct option is (3) Knowledge based.

BIOLOGY

Q51. The most important factor which determined the increase in human population in India during the 20th century:

1. Natality
2. Mortality
3. Immigration
4. Emigration

Correct option is (1)

Q52. Vascular bundles in monocotyledons are considered closed because:

1. Xylem is surrounded all around by phloem
2. There are no vessels with perforations

3. A bundle sheath surrounds each bundle
4. There is no secondary growth

Correct option is (4)

- Q53.** 3. When there are two haploid nuclei per cell in some fungi before the formation of diploid, this stage is called:
1. Diplotene 2. Diplophase
3. Dikaryophase 4. Dikaryote

Correct option is (3)

- Q54.** In blood group typing in human, if an allele contributed by one parent is IA and an allele contributed by the other parent is i, the resulting blood group of the offspring will be:
1. A 2. B
3. AB 4. O

Correct option is (1)

- Q55.** h A population growing in a habitat with limited resources shows four phases of growth in the following sequence:
1. Acceleration - deceleration - lag phase - asymptote
2. Asymptote - acceleration - deceleration - lag phase
3. Lag phase - acceleration - deceleration - asymptote
4. Acceleration - lag phase - deceleration - asymptote

Correct option is (3)

- Q56.** Necrosis in crops is due to the deficiency of:
1. Ca, K, S and Mo 2. N, K, S and Mo
3. N, S, Fe and Zn 4. Mg, S, Mn and Ca

Correct option is (4)

- Q57.** Presence of bundle sheath is a characteristic of:
1. Xerophytic plants
2. Members of the grass family
3. C₄ plants
4. C₃ plants

Correct option is (3)

- Q58.** Which one of the following would not lead to formation of clones?
1. Double fertilization
2. Apomixis
3. Vegetative reproduction

4. Tissue culture

Correct option is (1)

- Q59.** A plant species which has been exploited for the production of Hirudin is:
1. *Brassica napus* 2. *Zea mays*
3. *Solanun nigrum* 4. *Oryza sativa*

Correct option is (1)

- Q60.** The variation/difference in the offsprings of a species from their parents constitutes an important component of:
1. Genetics 2. Speciation
3. Species fixation 4. Heredity

Correct option is (2)

- Q61.** If two pea plants having red (dominant) coloured flowers with unknown genotypes are crossed, 75% of the flowers are red and 25% are white. The genotypic constitution of the parents having red coloured flowers will be:
1. Both homozygous
2. One homozygous and other heterozygous
3. Both heterozygous
4. Both hemizygous

Correct option is (3)

- Q62.** If the total amount of adenine and thymine in a doublestranded DNA is 60% the amount of guanine in this DNA will be
1. 15% 2. 20%
3. 30% 4. 40%

Correct option is (2)

- Q63.** The protein products of the following Bt toxin genes cryIAC and cryIIAB are responsible for controlling:
1. Bollworm 2. Roundworm
3. Moth 4. Fruit fly

Correct option is (1)

- Q64.** In a flowering plant, the pollen tube first arrives in:
1. Egg 2. An antipodal cell
3. A synergid 4. Central cell

Correct option is (3)

- Q65.** A peculiar odor that prevails in marshy areas and cowsheds is on account of a gas produced by:
1. Mycoplasma 2. Archaeobacteria
3. Slime moulds 4. Cyanobacteria

Correct option is (2)

Q66. A germplasm collection is a:

1. Collection of specimens of all the species of an area in a herbarium or botanical garden
2. Collection of modern varieties of a crop
3. Collection of plants or seeds having diverse alleles of all genes in a crop
4. Collection of seeds or pollen of rare and threatened species of a group or area

Correct option is (3)

Q67. Walter Sutton is famous for this contribution to:

1. Genetic engineering
2. Totipotency
3. Quantitative genetics
4. Chromosomal theory of inheritance

Correct option is (4)

Q68. The reaction, Amino acid + ATP → Aminoacyl-AMP + PP depicts:

1. Amino acid assimilation
2. Amino acid transformation
3. Amino acid activation
4. Amino acid translocation

Correct option is (3)

Q69. The problem of blindness in poor countries can be taken care of by using the following:

1. Golden rice
2. Transgenic tomato
3. Transgenic maize
4. Bt brinjal

Correct option is (1)

Q70. The transcription of any gene is the indication of its:

1. Induction
2. Activity
3. Stimulation
4. Hypersensitivity

Correct option is (2)

Q71. In C₄ plants, the bundle sheath cells:

1. Have thin walls to facilitate gaseous exchange
2. Have large intercellular spaces
3. Are rich in PEP carboxylase
4. Have a high density of chloroplasts

Correct option is (4)

Q72. In root nodules of legumes, leg-haemoglobin is important because it:

1. Transports oxygen to the root nodule
2. Acts as an oxygen scavenger
3. Provides energy to the nitrogen fixing bacterium
4. Acts as a catalyst in transamination

Correct option is (2)

Q73. Darwin judged the fitness of an individual by:

1. Ability to defend itself
2. Strategy to obtain food
3. Number of offspring
4. Dominance over other individuals

Correct option is (1)

Q74. Which of the following statements is wrong?

1. Pollen grains remain viable for several months because their outer covering is made of sporopollenin
2. No enzyme can degrade sporopollenin
3. Pollen grains are well represented in fossil strata due to sporopollenin
4. Pollen wall has cavities containing proteins

Correct option is (4)

Q75. In plant biotechnology, PEG is used in:

1. Protoplast isolation
2. Cell culture preparation
3. Protoplast fusion
4. Hardening

Correct option is (3)

Q76. A regulatory body working under MoEF for the release of transgenic crops is:

1. NBPGR
2. GEAC
3. NSC
4. NIPGR

Correct option is (2)

Q77. Analogous structures are:

1. Anatomically different but performing similar functions
2. Anatomically similar but performing different functions
3. Anatomically similar and functioning similarly

4. Anatomically different and functioning differently

Correct option is (2)

Q78. A polygenic trait is controlled by 3 genes A, B and C. In a cross $AaBbCc \times AaBbCc$, the phenotypic ratio of the offsprings was observed as:

1 : 6 : x : 20 : x : 6 : 1

What is the possible value of x?

1. 3
2. 9
3. 15
4. 25

Correct option is (3)

Q79. A transgenic rice (Golden rice) has been developed for increased content of:

1. Vitamin A
2. Vitamin B₁
3. Vitamin C
4. Vitamin D

Correct option is (1)

Q80. When the conditions are dry, a grass leaf curls inward to minimize water loss due to presence of:

1. Thick cuticle
2. Large xylem cavities
3. Parallel venation
4. Bulliform cells

Correct option is (4)

Q81. Long, ribbon-like pollen grains are seen in some:

1. Aquatic plants
2. Wind-pollinated grasses
3. Gymnosperms
4. Bird-pollinated flowers

Correct option is (1)

Q82. At present the concentration of CO₂ in the atmosphere is about:

1. 100 ppm
2. 240 ppm
3. 380 ppm
4. 520 ppm

Correct option is (3)

Q83. Littoral zone is located along the :

1. High mountains
2. Sea
3. Rivers
4. Desert

Correct option is (2)

Q84. Which of the following is used as a bioweapon?

1. *Bacillus subtilis*
2. *Bacillus licheniformis*
3. *Bacillus thuringiensis*
4. *Bacillus anthracis*

Correct option is (4)

Q85. The chromosome constitution $2n - 2$ of an organism represents:

1. Monosomic
2. Nullisomic
3. Haploid
4. Trisomic

Correct option is (2)

Q86. Meristem culture is practised in horticulture to get:

1. Somaclonal variation
2. Haploids
3. Virus-free plants
4. Slow-growing callus

Correct option is (3)

Q87. Tendrils in plants are an example of:

1. Convergent evolution
2. Adaptive radiation
3. Divergent evolution
4. Co-evolution

Correct option is (1)

Q88. Leghemoglobin is:

1. An oxygen carrier in human blood
2. A protein used as food supplement
3. An oxygen scavenger in root nodules
4. A plant protein with high lysine content

Correct option is (3)

Q89. Stomatal opening is affected by:

1. Nitrogen concentration, carbon dioxide concentration and light
2. Carbon dioxide concentration, temperature and light
3. Nitrogen concentration, light and temperature
4. Carbon dioxide concentration, nitrogen concentration and temperature

Correct option is (2)

Q90. Taxonomic hierarchy refers to:

1. Step-wise arrangement of all categories for classification of plants and animals
2. A group of senior taxonomists who decide the nomenclature of plants and animals

3. A list of botanists or zoologists who have worked on taxonomy of a species or group
4. Classification of a species based on fossil record

Correct option is (1)

- Q91.** Which of the following get accumulated in the vacuoles of guard cells during stomatal opening?
1. Water, calcium and magnesium
 2. Starch, potassium and chloride ions
 3. Malate, sodium and potassium ions
 4. Malate, potassium and chloride ions

Correct option is (4)

- Q92.** Which of the following is the most accepted theory for movement of water through plants?
1. Cohesion theory
 2. Capilarity
 3. Passive transport
 4. Root pressure

Correct option is (1)

- Q93.** Scutellum in a caryopsis represents:
1. Outermost layer of endosperm
 2. A sheath that protects that radicle
 3. The place where the seed is attached to raphe
 4. A cotyledon

Correct option is (4)

- Q94.** In an annual ring, the light coloured part is known as :
- | | |
|---------------|--------------|
| 1. Early wood | 2. Late wood |
| 3. Heartwood | 4. Sapwood |

Correct option is (1)

- Q95.** Natural cytokinins are synthesized in tissues that are:
1. Senescent
 2. Dividing rapidly
 3. Storing food material
 4. Differentiating

Correct option is (2)

- Q96.** Resemblance of one organism to another for protection and hiding is:
- | | |
|---------------|---------------|
| 1. Mimicry | 2. Predation |
| 3. Adaptation | 4. Camouflage |

Correct option is (1)

- Q97.** Spirochetes are:
1. A class of insects
 2. A class of viruses
 3. Bacteria
 4. Fungi

Correct option is (3)

- Q98.** The metachromatic granules are:
1. Present in plant cells at metaphase stage
 2. Inclusion bodies in bacteria
 3. Produced in insects during metamorphosis
 4. Chromatophores in animal skin

Correct option is (2)

- Q99.** The rough endoplasmic reticulum (RER) in the cells are because of the presence of:
1. Mitochondria associated with ER
 2. Ribosomes on the surface of ER
 3. Volutin granules on the surface of ER
 4. Sulphur granules on the surface of ER

Correct option is (2)

- Q100.** Elaioplasts store:
- | | |
|-----------|--------------------------|
| 1. Starch | 2. Proteins |
| 3. Fats | 4. Essential amino acids |

Correct option is (3)

- Q101.** Aggregates of lymphoid tissue present in the distal portion of the small intestine are known as:
- | | |
|----------|--------------------|
| 1. Villi | 2. Peyer's patches |
| 3. Rugae | 4. Choroid plexus |

Correct option is (2)

- Q102.** Mendel's principle of segregation means that the germ cells always receive:
1. One pair of alleles
 2. One quarter of the genes
 3. One of the paired alleles
 4. Any pair of alleles

Correct option is (3)

- Q103.** Rotenone is a:
1. Bioherbicide
 2. Commonly used biofertilizer
 3. Bioinsecticide
 4. Juvenile hormone

Correct option is (3)

Q104. Which of the following vitamins has some physiological effects similar to those of parathormone?

1. Vitamin A
2. Vitamin D
3. Vitamin C
4. Vitamin B

Correct option is (2)

Q105. Somatostatin:

1. Stimulates glucagon release while inhibits insulin release
2. Stimulates release of insulin and glucagons
3. Inhibits release of insulin and glucagon
4. Inhibits glucagon release while stimulates insulin release

Correct option is (3)

Q106. Hiccups can be best described as:

1. Forceful sudden expiration
2. Jerky incomplete inspiration
3. Vibration of the soft palate during breathing
4. Sign of indigestion

Correct option is (2)

Q107. ELISA assay:

1. Uses complement mediated cells lysis
2. Uses a radiolabelled second antibody
3. Involves addition of substrate which is converted into coloured end product
4. Requires red blood cells

Correct option is (3)

Q108. "Complete competitors cannot coexist" is true for:

1. Character displacement
2. Competitive exclusion
3. Primary succession
4. Secondary succession

Correct option is (2)

Q109. mRNA directs the building of proteins through a sequence of:

1. Introns
2. Codons
3. Exons
4. Anticodons

Correct option is (2)

Q110. Foramen ovale:

1. Connects the two atria in the fetal heart

2. Is a condition in which the heart valves do not completely close

3. Is a shallow depression in the interventricular septum

4. Is a connection between the pulmonary trunk and the aorta in the fetus

Correct option is (1)

Q111. Which of the following is a gram-negative bacterium?

1. *Escherichia coli*
2. *Bacillus subtilis*
3. *Streptomyces coelicolor*
4. *Ampycolatopsis orientalis*

Correct option is (1)

Q112. What is meant by the term "Darwin fitness"?

1. The ability to survive and reproduce
2. High aggressiveness
3. Healthy appearance
4. Physical strength

Correct option is (1)

Q113. Absence of one sex chromosome causes:

1. Turner's syndrome
2. Klinefelter's syndrome
3. Down's syndrome
4. Tay-Sach's syndrome

Correct option is (1)

Q114. Comparing small and large cells, which statement is correct?

1. Small cells have a small surface area per volume ratio
2. Exchange rate of nutrients is fast with large cells
3. Small cells have a large surface area per volume ratio
4. Exchange rate of nutrients is slow with small cells

Correct option is (3)

Q115. Which one of the following animals shows discontinuous distribution?

1. Green muscles
2. Bats
3. Lung fishes
4. Pacific salmons

Correct option is (3)

Q116. The number of autosomes in human primary spermatocyte is:

1. 46
2. 44

3. 23

4. 22

Correct option is (2)**Q117.** The most abundant molecule in cell is:

1. Water
2. Carbohydrate
3. Lipid
4. Protein

Correct option is (1)**Q118.** How many chromosomes will the cell have at G₁, after S and after M phase respectively, if it has 14 chromosomes at interphase?

1. 14, 14, 7
2. 14, 14, 14
3. 7, 7, 7
4. 7, 14, 14

Correct option is (2)**Q119.** The Golgi apparatus:

1. Is found only in animals
2. Is found in prokaryotes
3. Is a site of rapid ATP production
4. Modifies and packages proteins

Correct option is (4)**Q120.** Glycolysis:

1. Takes place in the mitochondria
2. Produces no ATP
3. Has no connection with electron transport chain
4. Reduces two molecules of NAD⁺ for every glucose molecule processed

Correct option is (4)**Q121.** Total number of all species of organisms in a given region is known as the region's

1. Biota
2. Flora
3. Fauna
4. Diversity

Correct option is (4)**Q122.** The arthropod exoskeleton is composed of:

1. Several kinds of polysaccharides
2. Layers of proteins and a polysaccharide called chitin
3. Several kinds of proteins
4. Single complex protein called arthropodin

Correct option is (2)**Q123.** Which of the following groups is absolutely essential functional component of the ecosystem?

1. Producers
2. Producers and herbivores

3. Producers and detritivores

4. Detritivores

Correct option is (3)**Q124.** Phagocytosis and pinocytosis are collectively termed as:

1. Endocytosis
2. Suspension feeding
3. Omnivores
4. Mucous trap

Correct option is (1)**Q125.** PCR proceeds in three distinct steps governed by temperature, they are in order of:

1. Denaturation, Annealing, Synthesis
2. Synthesis, Annealing, Denaturation
3. Annealing, Synthesis, Denaturation
4. Denaturation, Synthesis, Annealing

Correct option is (1)**Q126.** Corpus luteum releases:

1. Estrogen
2. Progesterone
3. Estrogen and progesterone
4. Androgen

Correct option is (3)**Q127.** Which of the following organs is devoid of glands?

1. Uterus
2. Vagina
3. Vulva
4. Oviduct

Correct option is (4)**Q128.** Primary spermatocyte differs from spermatogonium in:

1. Number of chromosomes
2. Size and volume
3. DNA content
4. Size of chromosomes

Correct option is (2)**Q129.** In human, cleavage divisions are:

1. Slow and synchronous
2. Fast and synchronous
3. Slow and asynchronous
4. Fast and asynchronous

Correct option is (3)**Q130.** The basic unit of study in Ecology is:

1. Population
2. Organism

3. Community

4. Species

1. Homozygotes

2. Heterozygotes

Correct option is (2)

3. Polyploids

4. Recessive traits

Q131. Chimera is produced due to:

1. Somatic mutations

2. Reverse mutations

3. Lethal mutations

4. Pleiotropic mutations

Correct option is (1)**Q132.** Maltose gives rise to 2 molecules of:

1. Fructose

2. Lactose

3. Glucose

4. Sucrose

Correct option is (3)**Q133.** In a lake, phytoplankton grow in abundance in:

1. Littoral zone

2. Limnetic zone

3. Profundal zone

4. Benthic region

Correct option is (2)**Q134.** Sigmoid growth curve is represented by:1. $dN/dt = rN$ 2. $dN/dt = rN(1-N/K)$ 3. $N_t = N_0 + B + I - D - E$ 4. $dN/dt = 1 - N/K$ **Correct option is (2)****Q135.** Beadle and Tatum showed that each kind of mutant bread mould they studied lacked a specific enzyme. Their experiments demonstrated that:

1. Cells need specific enzymes in order to function

2. Genes are made of DNA

3. Genes carry information for making proteins

4. Enzymes are required to repair damaged DNA information

Correct option is (3)**Q136.** DNA has equal number of adenine and thymine residues ($A=T$) and equal number of guanine and cytosine ($G=C$).

These relationships are known as:

1. Chargaff's rule

2. Coulomb's law

3. Le Chatelier's principle

4. Van't Hoff plot

Correct option is (1)**Q137.** 'Balancing selection' promotes:

1. Homozygotes

2. Heterozygotes

3. Polyploids

4. Recessive traits

Correct option is (2)**Q138.** Vomiting centre is located in the:

1. Medulla oblongata

2. Stomach and sometimes in duodenum

3. GI tract

4. Hypothalamus

Correct option is (1)**Q139.** How many bio-geographical regions are present in India?

1. 3

2. 4

3. 7

4. 10

Correct option is (4)**Q140.** Vital stains are employed to study:

1. Living cells

2. Frozen tissues

3. Fresh tissues

4. Preserved tissues

Correct option is (1)**Q141.** Which of the following organs in earthworm neutralizes humic acid present in humus?

1. Typhosole

2. Calciferous glands

3. Intestinal caecum

4. Gizzard

Correct option is (1)**Q142.** Fertilized eggs of *P. americana* are encased in:

1. Ootheca

2. Cocoon

3. Genital chamber

4. Phallomere

Correct option is (1)**Q143.** Insufficient quantities of antidiuretic hormone in blood lead to:

1. Diabetes mellitus

2. Glycosuria

3. Diabetes insipidus

4. Uremia

Correct option is (3)**Q144.** Sphincter of Oddi guards:

1. Hepato-pancreatic duct

2. Common bile duct

- 3. Pancreatic duct
- 4. Cystic duct

Correct option is (1)

Q145. Graveyard for RBCs is:

- 1. Liver
- 2. Spleen
- 3. Kidney
- 4. Lymph glands

Correct option is (2)

Q146. Blood cells involved in inflammatory reactions are:

- 1. Basophils
- 2. Neutrophils
- 3. Eosinophils
- 4. Monocytes

Correct option is (4)

Q147. To obtain a standard ECG, a patient is connected to the machine with three electrodes:

- 1. One to each wrist and to the left ankle
- 2. One to each ankle and to the left wrist
- 3. One to each wrist and to the left chest region
- 4. One to each ankle and to the left chest region

Correct option is (3)

Q148. The clavicle articulates with of scapula

- 1. Acromion process
- 2. Glenoid cavity
- 3. Acetabulum cavity
- 4. Ball and socket joint

Correct option is (1)

Q149. The age of pyramid with broad base indicates “

- 1. High percentage of young individuals
- 2. Low percentage of young individuals
- 3. High percentage of old individuals
- 4. Low percentage of old individuals

Correct option is (1)

Q150. Thymosin hormone is secreted by:

- 1. Thyroid gland
- 2. Parathyroid gland
- 3. Thymus gland
- 4. Hypothalamus

Correct option is (3)

PHYSICS

Q151. Which of the following principles is being used in Sonar Technology?

- 1. Reflection of ultrasonic waves
- 2. Newton’s laws of motion
- 3. Reflection of electromagnetic waves
- 4. Laws of thermodynamics

Correct option is (1)

Sonar uses ultrasonic waves for applications like detection of bodies, distance determination etc.

Q152. What is the dimension of surface tension?

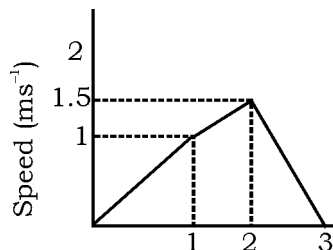
- 1. $[ML^1L^0]$
- 2. $[ML^1L^{-1}]$
- 3. $[ML^0L^{-2}]$
- 4. $[M^1L^0T^{-2}]$

Correct option are (3, 4)

Hints : Surface Tension $\frac{\text{Force}}{\text{Length}}$

$$= \frac{MLT^{-2}}{L} = [M^1L^0T^{-2}]$$

Q153. The speed-time graph of a particle moving along a solid curve is shown below. The distance traversed by the particle from $t = 0$ to $t = 3$ is



- 1. $\frac{10}{2}$ sec
- 2. $\frac{10}{4}$ sec
- 3. $\frac{10}{3}$ sec
- 4. $\frac{10}{5}$ sec

Correct option is (2)

Distance = area under speed –time graph
 $= \frac{10}{4}$ metre

Q154. Which of the following is correct relation between an arbitrary vector \vec{A} and null vector \vec{O} ?

- 1. $\vec{A} + \vec{O} + \vec{A} \times \vec{O} = \vec{A}$
- 2. $\vec{A} + \vec{O} + \vec{A} \times \vec{O} \neq \vec{A}$
- 3. $\vec{A} + \vec{O} + \vec{A} \times \vec{O} \neq \vec{O}$
- 4. none of these

Correct option is (1)

Q155. An object is being thrown at a speed of 20 m/s in a direction 45° above the horizontal. The time taken by the object to return to the same level is

1. $20/g$
2. $20 g$
3. $20\sqrt{2} /g$
4. $20\sqrt{2} g$

Correct option is (3)

$$T = \frac{2u \sin \theta}{g} = \frac{2 \times 20 \times \sin 45}{g} = \frac{20\sqrt{2}}{g}$$

Q156. An object is moving on a plane surface with uniform velocity 10 ms^{-1} in presence of a force 10 N. The frictional force between the object and the surface is

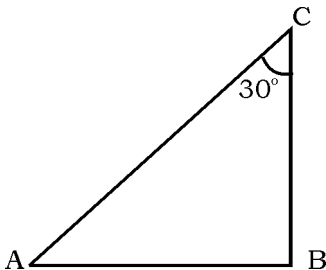
1. 1 N
2. -10 N
3. 10 N
4. 100 N

Correct option is (2)

$$\text{Net force} = 0 \Rightarrow F + F_r = 0$$

$$\text{So } f_r = -\bar{F} = -10\text{N}$$

Q157. A body of mass M starts sliding down on the inclined plane where the critical angle is $\angle ACB = 30^\circ$ as shown in figure. The coefficient of kinetic friction will



1. $Mg/\sqrt{3}$
2. $\sqrt{3} Mg$
3. $\sqrt{3}$
4. None of these

Correct option is (3)

$$\cot \theta = \mu_k \quad \text{So } \cot 30^\circ = \mu_k$$

$$\Rightarrow \mu_k = \sqrt{3}$$

Q158. In non-inertial frame, the second law of motion is written as

1. $F = ma$
2. $F = ma + F_p$
3. $F = ma - F_p$
4. $F = 2ma$

where F_p is pseudo-force while a is the acceleration of the body relative to non-inertial frame.

Correct option is (3)

" $\bar{F} + \bar{F}_p = ma$ " is the correct form of Newton's II Law in non-inertial frame.

Q159. The work done by an applied variable force $F = x + x^3$ from $x = 0$ to $x = 2$ m, where x is displacement, is

1. 6 J
2. 8 J
3. 10 J
4. 12 J

Correct option is (1)

$$w = \int F dx = \int_0^2 (x + x^3) dx = \left[\frac{x^2}{2} + \frac{x^4}{4} \right]_0^2$$

$$6\text{J}$$

Q160. The coefficient of restitute, e , for a perfectly elastic collision is

1. 0
2. -1
3. 1
4. ∞

Correct option is (3)

$$e = 1 \text{ for elastic collision}$$

Q161. A particle of mass m_1 moves with velocity v_1 and collides with another particle at rest of equal mass. The velocity of the second particle after the elastic collision is

1. $2v_1$
2. v_1
3. $-v_1$
4. 0

Correct option is (2)

Velocities get interchanged in elastic collision

Q162. The centre of mass of a solid cone along the line from the centre of the base to the vertex is at

1. One-fourth of the height
2. One-third of the height
3. One fifth of the height
4. None of these

Correct option is (1)

CM of a cone is at $\frac{h}{4}$ from base or $\frac{3h}{4}$ from vertex.

Q163. A solid cylinder is rolling without slipping on a plane having inclination θ and the coefficient of static friction μ_s . The relation between θ and μ_s is

1. $\tan \theta > 3\mu_s$
2. $\tan \theta \leq 3\mu_s$
3. $\tan \theta > 3\mu_s$
4. none of these

Correct option is (2)

For pure rolling on inclined plane

$$\mu_s \geq \frac{\tan \theta}{1 + \frac{R^2}{K^2}} = \frac{\tan \theta}{1 + 2} = \frac{\tan \theta}{3}$$

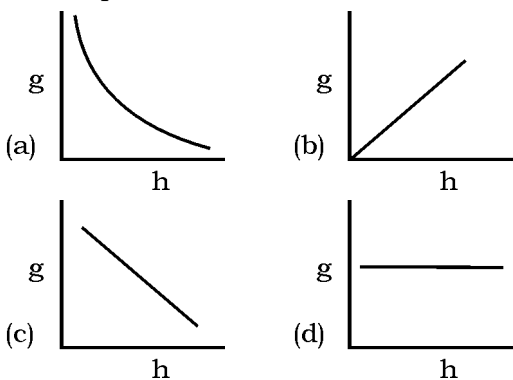
Q164. The reduced mass of two particles having masses m and $2m$ is

1. $2m$
2. $3m$
3. $2m/3$
4. $m/2$

Correct option is (3)

$$\text{reduced mass} = \frac{m_1 m_2}{m_1 + m_2} = \frac{m \cdot 2m}{m + 2m} = \frac{2m}{3}$$

Q165. Which of the following graphs shows the variation of acceleration due to gravity g with depth h from the surface of the earth?



1. (a)
2. (b)
3. (c)
4. (d)

Correct option is (3)

$g' = g \left(1 - \frac{2h}{R}\right)$, hence linear relation of g' and h with g' decreasing when h increases.

Q166. At what altitude (h) above the earth's surface would the acceleration due to gravity be one fourth of its value at the earth's surface?

1. $h = R$
2. $h = 4R$
3. $h = 2R$
4. $h = 16R$

where, R is the radius of the earth

Correct option is (1)

$$g' = g \left(\frac{R}{r}\right)^2$$

As $\frac{g'}{g} = \frac{1}{4}$, So $r = 2R$, So $h = r - R = R$

Q167. According to C.E. van der Waal, the interatomic potential varies with the average interatomic distance (R) as

1. R^{-1}
2. R^{-2}
3. R^{-4}
4. R^{-6}

Correct option is (1) Knowledge Based

Q168. A sphere of radius 3 cm is subjected to a pressure of 100 atm. Its volume decreases by 0.3 cc. What will be its bulk modulus?

1. $4\pi \times 10^5$ atm
2. $4\pi \times 10^4$ atm
3. $4\pi \times 10^6$ atm
4. $4\pi \times 10^8$ atm

$$K = \frac{P}{\Delta V/V} = \frac{100 \text{ atm}}{0.3 \text{ cm}^3 / \frac{4}{3} \pi (3 \text{ cm})^3}$$

$$= 4\pi \times 3 \times 10^3 \text{ atm}$$

Q169. A vertical tank with depth H is full with water. A hole is made on one side of the walls at a depth h below the water surface. At what distance from the foot of the wall does the emerging stream of water strike the foot?

1. $\sqrt{h(H-h)}$
2. $\sqrt{h/(H-h)}$
3. $2(H-h)\sqrt{h/(H-h)}$
4. $\sqrt{2h(H-h)}$

Correct option is (3)

$$V = \sqrt{2gh} \text{ and time of fall} = \sqrt{2(H-h)g}$$

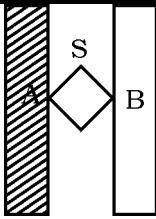
$$\text{So } X = vt = 2(H-h)\sqrt{h/(H-h)}$$

Q170. The mean free path of collision of gas molecules varies with its diameter (d) of the molecules as

1. d^{-1}
2. d^{-2}
3. d^{-3}
4. d^{-4}

Correct option is (2)

Q171. Consider two insulated chambers (A, B) of same volume connected by a closed knob, S . 1 mole of perfect gas is confined in chamber A . What is the change in entropy of gas when knob S is opened? $R = 8.31 \text{ J mol}^{-1}\text{K}^{-1}$



1. 1.46 J/K
2. 3.46 J/K
3. 5.46 J/K
4. 7.46 J/K

Correct option is (3)

Q172. A Carnot engine has efficiency 25%. It operates between reservoirs of constant temperatures with temperature difference of 80°C. What is the temperature of the low temperature reservoir?

1. -25°C
2. 25°C
3. -33°C
4. 33°C

Correct option is (3)

$$\frac{T_1 - T_2}{T_1} = 25\% = \frac{1}{4} \quad \text{and}$$

$$T_1 - T_2 = 80^\circ\text{C} = 80\text{K}$$

$$\text{So } T_2 = -33^\circ\text{C}$$

Q173. During the phenomenon of resonance

1. The amplitude of oscillation becomes large
2. The frequency of oscillation becomes large
3. The time period of oscillation becomes large
4. All of the above

Correct option is (1)

During resonance, amplitude increases to very high values.

Q174. The longitudinal wave can be observed in

1. Elastic media
2. Inelastic media
3. Both of the above
4. None of these

Correct option is (1)

Elasticity is essential for wave propagation

Q175. The two waves of the same frequency moving in the same direction given rise to

1. Beats
2. Interference
3. Stationary waves
4. None of these

Correct option is (4)

Sustained interference occurs with 2 waves in same direction.

Q176. Domestic electrical wiring has three wires

1. Positive, negative and neutral
2. Positive, negative and earth
3. Live, neutral and earth
4. Positive, negative and live

Ans (3)

Q177. Which of the following is not true ?

1. For a point charge, the electrostatic potential varies as $1/r$
2. For a dipole, the potential depends on the position vector and dipole moment vector
3. The electric dipole potential varies as $1/r$ at large distance
- (4) For a point charge, the electrostatic field varies as $1/r^2$

Correct option is (3)

At large distance $V \propto \frac{1}{r^2}$ from dipole.

Q178. The mobility of charge carriers increases with

1. Increase in the average collision time
2. Increase in the electric field
3. Increase in the mass of the charge carriers
4. Decrease in the charge of the mobile carriers

Correct option is (1)

Only (1) is possible correct option.

Q179. When an AC voltage is applied to a LCR circuit, which of the following is true?

1. I and V are out of phase with each other in R
2. I and V are in phase L while in C, they are out of phase
3. I and V are out of phase in both, C and L
4. I and V are out of phase in L and in phase in C

Correct option is (3)

Both C and L have phase different of 90° between V and I.

Q180. For a medium with permittivity ϵ and permeability μ , the velocity of light is given by

1. $\sqrt{\frac{\mu}{\epsilon}}$ 2. $\sqrt{\mu\epsilon}$
 3. $\frac{1}{\sqrt{\mu\epsilon}}$ 4. $\sqrt{\frac{\epsilon}{\mu}}$

Correct option is (3)

$$c = \frac{1}{\sqrt{\mu\epsilon}} \text{ for every medium}$$

Q181. In optical fibres, the refractive index of the core is

1. Greater than that of the cladding
2. Equal to that of the cladding
3. Smaller than that of the cladding
4. Independent of that of the cladding

Correct option is (1)

Essential feature of optical fibre is that cladding should have less μ than core

Q182. For a wavelength of light ' λ ' and scattering object of size ' a ', all wavelengths are scattered nearly equally, if

1. $a = \lambda$ 2. $a \gg \lambda$
3. $a \ll \lambda$ 4. $a \geq \lambda$

Correct option is (2) Knowledge based

Q183. For a telescope having f_o as the focal length of the objective and f_e as the focal length of the eyepiece, the length of the telescope tube is

1. f_e 2. $f_o - f_e$
3. f_o 4. $f_o + f_e$

Correct option is (4)

In normal adjustment, $L = f_o + f_e$

Q184. If two sources have a randomly varying phase difference $\phi(t)$, the resultant intensity will be given by

1. $\frac{1}{2I_0}$ 2. $\frac{I_0}{2}$
3. $2I_0$ 4. $\frac{I_0}{\sqrt{2}}$

Correct option is (3)

$I =$ Sum of intensities due to 2 sources $= 2I_0$

Q185. For an aperture of size ' a ' illuminated by a parallel beam of light having wavelength λ , the Fresnel distance is

1. $\approx \frac{a}{\lambda}$ 2. $\approx \frac{a^2}{\lambda}$
3. $\approx a^2\lambda$ 4. $\approx \frac{a}{\lambda^2}$

Correct option is (2)

As per definition of fresnel distance,

$$d = \frac{a^2}{\lambda}$$

Q186. The maximum kinetic energy of the photoelectrons varies

1. Inversely with the intensity and is independent of the frequency of the incident radiation
2. Inversely with the frequency and is independent of the intensity of the incident radiation
3. Linearly with the frequency and the intensity of the incident radiation
4. Linearly with the frequency and is independent of the intensity of the incident radiation

Correct option is (4)

KE_{\max} increases with frequency, but it is independent of intensity.

Q187. The work function for Al, K and Pt is 4.28 eV, 2.30 eV and 5.65 eV respectively. Their respective threshold frequencies would be

1. Pt > Al > K 2. Al > Pt > K
3. K > Al > Pt 4. Al > K > Pt

Correct option is (1)

Higher work function means higher energy needed per photon. So threshold frequency is also high.

Q188. When helium nuclei bombard beryllium nuclei, then

1. Electrons are emitted
2. Protons are emitted
3. Neutrons are emitted
4. Protons and neutrons are emitted

Correct option is (3)

Q189. When two nuclei (with $A = 8$) join to form a heavier nucleus, the binding energy (B.E.) per nucleon of the heavier nuclei is

1. More than the B.E. per nucleon of the light nuclei
2. Same as the B.E. per nucleon of the light nuclei

3. Less than the B.E. per nucleon of the light nuclei
 4. Double the B.E. per nucleon of the light nuclei

Correct option is (1)

More B.E. means a stable product.

- Q190.** In a reverse-biased p - n junction, when the applied bias voltage is equal to the breakdown voltage, then
1. Current remains constant while voltage increases sharply
 2. voltage remains constant while current increases sharply
 3. Current and voltage increase
 4. Current and voltage decreases

Correct option is (2)

At constant breakdown voltage, current increases sharply

- Q191.** A charged cloud system produces an electric field in the air near the earth's surface. A particle of charge $-2 \times 10^{-9}\text{C}$ is acted on by a downward electrostatic force of $3 \times 10^{-6}\text{N}$ when placed in this field. The gravitational and electrostatic force, respectively, exerted on a proton placed in this field are
1. $1.64 \times 10^{-26}\text{N}$, $2.4 \times 10^{-16}\text{N}$
 2. $1.64 \times 10^{-26}\text{N}$, $1.5 \times 10^3\text{N}$
 3. $1.56 \times 10^{-18}\text{N}$, $2.4 \times 10^{-16}\text{N}$
 4. $1.5 \times 10^3\text{N}$, $2.4 \times 10^{-16}\text{N}$

Correct option is (1)

$$E = \frac{3 \times 10^{-6}}{2 \times 10^{-9}} = 1500 \text{ N/C}$$

$$\text{So } F_e = eC = 1.6 \times 10^{-19} \times 1500 = 2.4 \times 10^{-16} \text{ N}$$

$$W = mg = 1.66 \times 10^{-27} \times 9.8 = 1.64 \times 10^{-26} \text{ N}$$

- Q192.** The frequency of oscillation of an electric dipole moment having dipole moment p and rotational inertia I , oscillating in a uniform electric field E is given by

1. $\left(\frac{1}{2\pi}\right)\sqrt{\frac{I}{pE}}$
2. $\left(\frac{1}{2\pi}\right)\sqrt{\frac{pE}{I}}$
3. $(2\pi)\sqrt{\frac{pE}{I}}$
4. $(2\pi)\sqrt{\frac{I}{pE}}$

Correct option is (1)

$$\tau = I\alpha$$

$$\text{Also } \tau = PE \sin \theta = PE\theta \text{ for small } \theta$$

$$\text{So } I\alpha = -PE\theta$$

$$\alpha = -\left(\frac{PE}{I}\right)\theta \Rightarrow \omega^2 = \frac{PE}{I}$$

$$\omega = \sqrt{\frac{PE}{I}}, f = \frac{\omega}{2\pi} = \frac{1}{2\pi} \sqrt{\frac{PE}{I}}$$

- Q193.** What is the net charge on a conducting sphere of radius 10 cm? Given that the electric field 15 cm from the center of the sphere is equal to $3 \times 10^3 \text{ N/C}$ and is directed inward

1. $-7.5 \times 10^{-5}\text{C}$
2. $-7.5 \times 10^{-9}\text{C}$
3. $7.5 \times 10^{-5}\text{C}$
4. $7.5 \times 10^{-9}\text{C}$

Correct option is (2)

Charge is -ve

$$E = \frac{k\theta}{r^2} \Rightarrow \theta = \frac{Er^2}{K} = \frac{(2 \times 10^3) \times (0.15)^2}{9 \times 10^9}$$

$$= -7.5 \times 10^{-9} \text{ C}$$

- Q194.** How many 1 μF capacitors must be connected in parallel to store a charge of 1 C with a potential of 110 V across the capacitors?

1. 990
2. 900
3. 9090
4. 909

Correct option is (3)

$$\theta = nCV$$

$$n = \frac{\theta}{CV} = \frac{1\text{C}}{10^{-6} \times 110} = 9090 \text{ nos}$$

- Q195.** A 1250 W heater operates at 115 V. What is the resistance of the heating coil ?

1. 16 Ω
2. 13.5 Ω
3. 1250 Ω
4. 10.6 Ω

Correct option is (4)

$$R = \frac{V^2}{P} = \frac{(115)^2}{1250} = 10.6 \Omega$$

- Q196.** A proton traveling at 23° w.r.t. the direction of magnetic field of strength 2.6 mT experiences a magnetic force of $6.5 \times 10^{-17}\text{N}$. What is the speed of the proton ?

1. $2 \times 10^5 \text{ m/sec}$
2. $4 \times 10^5 \text{ m/sec}$
3. $6 \times 10^5 \text{ m/sec}$
4. $8 \times 10^5 \text{ m/sec}$

Correct option is (2)

$$F = qVB\sin\theta$$

$$\beta = \frac{D\lambda}{d}, \text{ so } \beta \text{ becomes 4 times}$$

Q197. What uniform magnetic field applied perpendicular to a beam of electrons moving at 1.3×10^6 m/sec, is required to make the electrons travel in a circular arc of radius 0.35 m?

1. 2.1×10^{-5} G
2. 6×10^{-5} T
3. 2.1×10^{-5} T
4. 6×10^{-5} G

Correct option is (3)

$$B = \frac{mV}{qr}$$

$$= \frac{9.1 \times 10^{-31} \times 1.3 \times 10^6}{1.6 \times 10^{-19} \times 0.35}$$

$$= 2.1 \times 10^{-5} \text{ T}$$

Q198. A transformer has 500 primary turns and 10 secondary turns. If the secondary has a resistive load of 15Ω , the currents in the primary and secondary respectively, are

1. 0.16 A, 3.2×10^{-3} A
2. 3.2×10^{-3} A, 0.16 A
3. 0.16 A, 0.16 A
4. 3.2×10^{-3} A, 3.2×10^{-3} A

Correct option is (2)

Only (2) matches $N_1 I_1 = N_2 I_2$

Q199. For a radio signal to travel 150 km from the transmitter to a receiving antenna, it takes

1. 5×10^{-4} sec
2. 4.5×10^{-3} sec
3. 5×10^{-8} sec
4. 4.5×10^{-6} sec

Correct option is (1)

$$t = \frac{\ell}{v} = \frac{150 \times 10^3 \text{ m}}{3 \times 10^8 \text{ m/s}} = 5 \times 10^{-4} \text{ sec}$$

Q200. In Young's double-slit experiment, if the distance between the slits is halved and the distance between the slits and the screen is doubled, the fringe width becomes

1. Half
2. Double
3. Four times
4. Eight times

Correct option is (3)