CHEMISTRY

SECTION – A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.
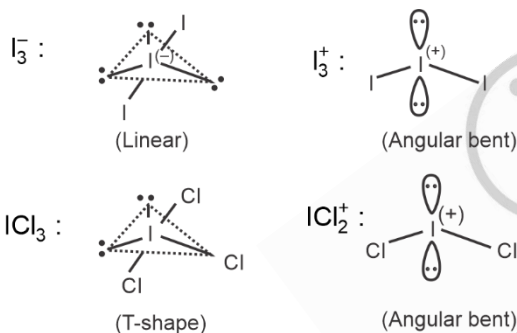
Choose the correct answer :

1. Which one of the following species is linear in shape?

   (1) I_3^- (2) I_3^+
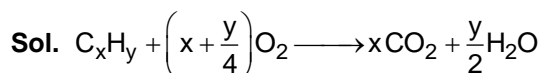
   (3) ICl_3 (4) ICl_2^+

Answer (1)

Sol. The shapes of the given species are

I_3^- :   (Linear) I_3^+ :   (Angular bent)

ICl_3 :   (T-shape) ICl_2^+ :   (Angular bent)

2. For a given hydrocarbon, 11 moles of O_2 is used and produces 4 moles of H_2O. Then the formula of the hydrocarbon is

   (1) $C_{11}H_8$ (2) C_9H_8

   (3) $C_{11}H_{16}$ (4) C_6H_{14}

Answer (2)

Sol. $C_xH_y + \left(x + \dfrac{y}{4}\right)O_2 \longrightarrow x\,CO_2 + \dfrac{y}{2}H_2O$

$\dfrac{y}{2} = 4 \quad \therefore \quad y = 8$

$x + \dfrac{8}{4} = 11$

$\therefore \quad x = 9$

$\therefore$ Hydrocarbon will be = C_9H_8

3. Which of the following plays an important role in neuromuscular functions?

   (1) Ca   (2) Mg

   (3) Be   (4) Li

Answer (1)

Sol. Calcium plays an important role in neuromuscular functions.

4. Which of the following compound contain maximum number of chlorine atoms?

   (1) Chloropicrin

   (2) Chloral

   (3) Gammexane

   (4) Freon-12

Answer (3)

Sol.

Compounds	Number of Chlorine atoms
Chloropicrin	3
Chloral	3
Gammexane	6
Freon-12	2

5. Decreasing order of Lewis acid character is

   (1) $BF_3 > BCl_3 > BBr_3 > BI_3$

   (2) $BI_3 > BBr_3 > BCl_3 > BF_3$

   (3) $BF_3 > BCl_3 > BI_3 > BBr_3$

   (4) $BI_3 > BCl_3 > BF_3 > BBr_3$

Answer (2)

Sol. Extent of back bonding

$$\frac{BF_3}{2p-2p} > \frac{BCl_3}{2p-3p} > \frac{BBr_3}{2p-4p} > \frac{BI_3}{2p-5p}$$

6. pH of acid rain is 5.6. Which of the following reaction is involved in acid rain?

   (1) $H_2O + SO_2 + O_2 \rightarrow H_2SO_4$

   (2) $N_2 + O_2 + H_2O \rightarrow HNO_3$

   (3) $N_2O + O_2 + H_2O \rightarrow HNO_3$

   (4) None of these

Answer (1)

Sol. The correct answer of this equation is option 1

7. Which of the following metals of F-block have half-filled *f*-subshell?

(a) Samarium (Sm)

(b) Gadolinium (Gd)

(c) Europium (Eu)

(d) Terbium (Tb)

(1) (a) and (b)

(2) (b) and (c)

(3) (c) and (d)

(4) (a) and (c)

[Atomic numbers : Sm = 62, Eu = 63, Gd = 64, Tb = 65]

Answer (2)

Sol. The valence shell electronic configuration of the given F-Block metals are

(a) Sm : $4f^6 6s^2$

(b) Gd : $4f^7 sd^1 6s^2$

(c) Eu : $4f^7 6s^2$

(d) Tb : : $4f^9 6s^2$

Therefore, Gd and Eu have half-filled f-subshell.

8. If Ionisation energy of H-atom is 13.6 eV. Find out Ionisation energy of Li^{2+} ions.

(1) 54.4 eV

(2) 122.4 eV

(3) 13.6 eV

(4) 3.4 eV

Answer (2)

Sol. $IE = 13.6 \times Z^2$

$= 13.6 \times (3)^2$

$= 13.6 \times 9$

$= 122.4$ eV

9. Which of the following compound is not a disinfectant?

(1) Chloroxylenol

(2) Bithionol

(3) Terpineol

(4) Peracetic acid

Answer (4)

Sol. Chloroxylenol, bithionol and terpineol are the disinfectants.

10. A reaction follows 1st order kinetics with rate constant (k) = 20 min^{-1}. Calculate the time required to reach to concentration to $\frac{1}{32}$ times of initial concentration

(1) 0.17325 min

(2) 1.7325 min

(3) 17.325 min

(4) 173.25 min

Answer (1)

Sol. $C = \frac{C_O}{(2)^n} = \frac{C_O}{32}$

n = 5

$t = 5t_{1/2}$

$= \frac{5 \times 0.693}{20} = \frac{0.693}{4}$

= 0.17325 min

11. If solubility of AgCl in aqueous solution is 1.434×10^{-3} M, then find the value of $[-\log K_{sp}]$, where K_{sp} is the solubility product of AgCl.

(1) 3.7

(2) 5.7

(3) 6.7

(4) 7.7

Answer (2)

Sol. Solubility of AgCl in water = 1.434×10^{-3} M

Solubility product (K_{sp}) of AgCl = $(1.434 \times 10^{-3})^2$

∴ $K_{sp} = 2 \times 10^{-6}$

$-\log K_{sp} = -\log 2 + 6$

$= 5.7$

12. Consider the following combination of n, l and m values.

(i) n = 3; l = 0; m = 0

(ii) n = 4; l = 0; m = 0

(iii) n = 3; l = 1; m = 0

(iv) n = 3; l = 2; m = 0

The correct order of energy of the corresponding orbitals for multielectron species is

(1) (ii) > (i) > (iv) > (iii)

(2) (iv) > (ii) > (iii) > (i)

(3) (i) > (iii) > (iv) > (ii)

(4) (iv) > (iii) > (i) > (ii)

Answer (2)

Sol. (i) n = 3; l = 0; m = 0 ⇒ 3s orbital

(ii) n = 4; l = 0; m = 0 ⇒ 4s orbital

(iii) n = 3; l = 1; m = 0 ⇒ 3p orbital

(iv) n = 3; l = 2; m = 0 ⇒ 3d orbital

The correct order of energy is $3d > 4s > 3p > 3s$

Hence correct answer is (2)

13. Two metals are given,

Metal – 1 Work function = 4.8 ev

Metal – 2 Work function = 2.8 ev

Photons of wavelength 350 nm are incident on both metals separately which metal will eject electrons at this wavelength?

(1) Metal – 1 only

(2) Metal – 2 only

(3) Both metal – 1 and metal – 2

(4) None of metal – 1 and metal – 2

Answer (2)

Sol. $E_{photon} = \dfrac{12400}{3500} = 3.54$ ev

$W_{metal-1} > E_{photon} > W_{metal-2}$

⇒ Only metal – 2 will emit photons

14. A biomolecule gives following observations

(i) With Br_2/H_2O it gives monocarboxylic acid.

(ii) With acetate it gives tetraacetate.

(iii) With HI/RedP it gives isopentane.

The correct structure of the biomolecule is

(1)
CHO
|
(CH – OH)₄
|
CH₂ – OH

(2)
CH₂ – OH
|
C = O
|
(CH – OH)₃
|
CH₂ – OH

(3)
CH₂ – OH
|
CH – OH
|
C = O
|
CH – OH
|
CH₂ – OH

(4)
CHO
|
CH₃ – C – OH
|
(CH – OH)₂
|
CH₂ – OH

Answer (4)

Sol.
CHO
|
H₃C – C – OH
|
CH – OH
|
CH – OH
|
CH₂ – OH
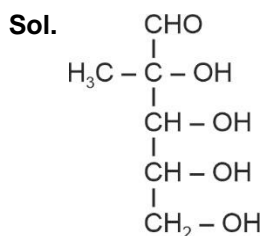
gives monocarboxylic acid with Br_2/H_2O and tetraacetate with acetate and isopentane with RedP/HI.

15. Which of the following has more relative lowering in vapour pressure at the same temperature.

(1) 0.1 M urea

(2) 0.1 M NaCl

(3) 0.1 M sucrose

(4) 0.1 M CaCl₂

Answer (4)

Sol. Relative lowering in vapour pressure is a colligative property and colligative property depends only on the amount of solute from the given, CaCl₂ will have maximum amount, hence its solution will show maximum relative lowering in vapour pressure hence the correct answer is option (4)

16. **Assertion :** First ionisation energy of 4d series elements is always greater than those of 3d series elements.

Reason : 4d series elements have much more nuclear charge than those of 3d series elements.

(1) Assertion is correct but Reason is incorrect.

(2) Assertion is incorrect but Reason is correct.

(3) Both the Assertion and Reason are correct.

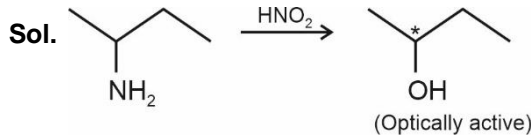(4) Both the Assertion and Reason are incorrect.

Answer (2)

Sol. The first ionisation energy of 4d series elements is not always greater than those of 3d series elements. So Assertion is incorrect. The Reason is correct because 4d series elements have much more nuclear charge than those of 3d series elements.

17. What is the structural formula of compound $C_4H_{11}N$, which reacts with HNO_2 and is optically active?

(1)
H₃C – C – NH₂
with CH₂—CH₃ and H groups

(2)
CH₂—CH₃
|
CH₂
|
CH₂
|
NH₂

(3)
H₃C   CH₂CH₃
    \   /
      N
      |
      CH₃

(4)
H   CH₃
  \   /
    N
    |
    CH₂CH₂CH₃

Answer (1)

Sol.

(Optically active)

18. Energy of a radiation $\varepsilon = \dfrac{hc}{\lambda_{absorb}}$. If $\varepsilon = +96$ kJ/mole thus find $\lambda_{absorbed}$ (in Å)

(1) 12471Å (2) 124.71Å
(3) 1247.1Å (4) 1.2471Å

Answer (1)

Sol. $\dfrac{6.626\times10^{-34}\times3\times10^{8}}{96\times10^{3}}\times6.023\times10^{23} = \lambda$

$\lambda = 1.2471 \times 10^{-6}$ M

$= 12471$ Å

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 10 questions. In Section B, attempt any five questions out of 10. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 06.25, 07.00, –00.33, –00.30, 30.27, –27.30) using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.

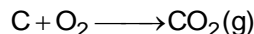21. How many of the following compound(s) can give iodoform test?
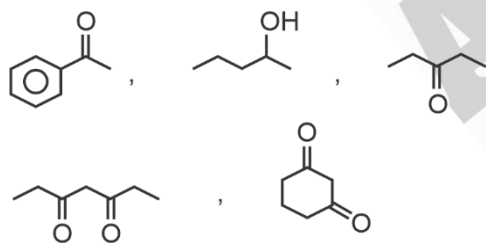
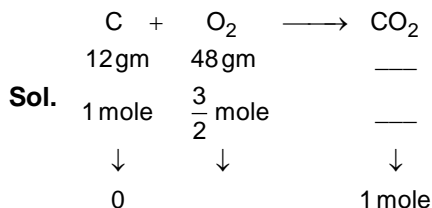**Answer (4)**

Sol.
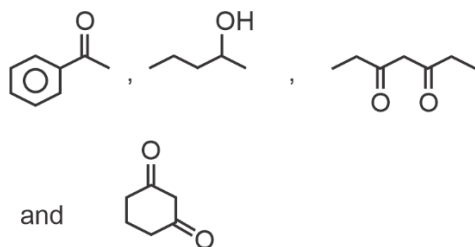
will give iodoform test

22. For the given reaction

$$C + O_2 \longrightarrow CO_2(g)$$

12 gm of C is reacted with 48 gm of O_2 to give CO_2. If volume of CO_2 gas produced at STP is t litre. Find out $2t$ (closest integer).

Given: Molar volume at STP = 22.4 L/mole

Answer (45)

Sol.

	C	+	O_2	$\longrightarrow$	CO_2
	12gm		48gm		___
	1 mole		$\frac{3}{2}$ mole		___
	↓		↓		↓
	0				1 mole

Volume = t = 22.4 litre

$2t$ = 44.8 litre

≈ 45 L

23. The non-stoichiometry compounds $M_{0.83}O$. M exists in 2 states +2 and +3. Calculate the % of M^{2+} ion in the compound. (Round off to nearest integer)

Answer (59)

Sol. Let M^{2+} is x.

Then M^{3+} will be $83 - x$.

$\therefore$ $x + 2 + (83 - x) \times 3 = 200$

$x = 49$

$\therefore$ $M^{2+} = \dfrac{49}{83}\times100 \simeq 59\%$

24. The resistivity of 0.8 M solution of an electrolyte is 5×10^{-3} Ω.cm. If λ_m is 2.5×10^{x}. Find out x.

Answer (05.00)

Sol. $k = \dfrac{10^{3}}{5}$ S cm^{-1}

$\lambda_m = \dfrac{k \times 1000}{m} = \dfrac{\dfrac{10^{3}}{5}\times1000}{0.8}$

$\Rightarrow \dfrac{200\times10^{3}}{0.8}$

$= \dfrac{2}{0.8}\times10^{5} = 2.5\times10^{5}$

x = 5

25.
26.
27.
28.
29.
30.