



IIT-JEE (MAIN/ADVANCED) • NEET • BOARDS • NTSE • KVPY

## CHEMISTRY QUESTION PAPER WITH SOLUTION (CODE – X6)



Address - Near Himfed Building, BCS Chowk, New Shimla (HP) - 171009  
[www.radianceiit.in](http://www.radianceiit.in) | Phone: +91 8091157087 | E-mail: [er.j.k.tiwari@gmail.com](mailto:er.j.k.tiwari@gmail.com)

1. Which of the following statement is NOT true about acid rain?

- (1) It is due to reaction of  $\text{SO}_2$ ,  $\text{NO}_2$  and  $\text{CO}_2$  with rain water
- (2) Causes no damage to monuments like Taj Mahal.
- (3) It is harmful for plants.
- (4) Its pH is less than 5.6

Ans. (2)

Acid rain causes to damage to monuments like Tajmahal.

2. The oxidation number of the underlined atom in the following species

- (1)  $\text{Cu} \underline{\text{O}}$  is -1
- (2)  $\underline{\text{Cl}}\text{O}^-$  is +5
- (3)  $\text{K}_2 \underline{\text{Cr}}_2\text{O}_7$  is +6
- (4)  $\text{H} \underline{\text{Au}}\text{Cl}_4$  is +3

Ans. (1)

Ox. state of "O" in  $\text{Cu}_2\text{O}$  2

Ox. state of "Cl" in  $\text{ClO}_3^-$  5

Ox. state of "Cr" in  $\text{K}_2\text{Cr}_2\text{O}_7$  6

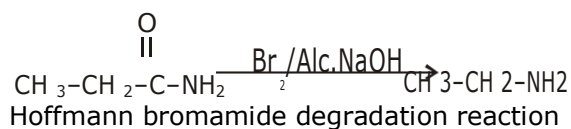
Ox. state of "Au" in  $\text{HAuCl}_4^-$  3

(1) is incorrect

3. Reaction of propanamide with ethanolic sodium hydroxide and bromine will give

- (1) Ethylamine
- (2) Methylamine
- (3) Propylamine
- (4) Aniline

Ans. (1)



4. A liquid compound (x) can be purified by steam distillation only if it is

- (1) Steam volatile, immiscible with water
- (2) Not steam volatile, miscible with water
- (3) Steam volatile, miscible with water
- (4) Not steam volatile, immiscible with water

Ans. (1)

Compounds purified by steam distillation which are immiscible in water but steam volatile.

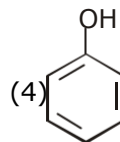
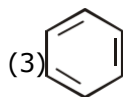
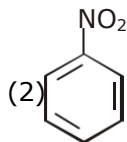
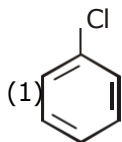
5. Among the compounds shown below which one revealed a linear structure ?

- (1)  $\text{NO}_2$
- (2)  $\text{HOCl}$
- (3)  $\text{O}_3$
- (4)  $\text{N}_2\text{O}$

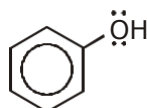
Ans. (4)

$:\text{N} \equiv \text{N} \text{--} \text{O}:$  (Linear)

6. Which of the following compound is most reactive in electrophilic aromatic substitution?



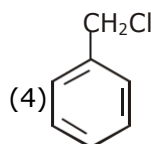
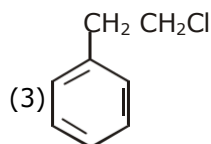
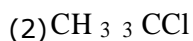
Ans. (4)



Phenol

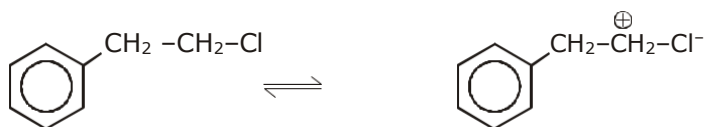
+ R effect of -OH group enhances the reactivity in aromatic electrophilic substitution reaction.

7. Which of the following will NOT undergo  $S_N1$  reaction with  $\text{OH}^-$ ?



Ans. (3)

Reactivity in case of  $S_N1$  reaction depends upon formation of carbocation.



Primary carbocation  
is less likely to be formed  
(due to unstability)

8. Which of the following is not true about chloramphenicol?

- (1) It inhibits the growth of only gram positive bacteria.
- (2) It is a broad spectrum antibiotic.
- (3) It is not bactericidal.
- (4) It is bacteriostatic.

Ans. (1)

Chloramphenicol is a broad spectrum antibiotic which can inhibit the growth of gram positive bacteria and gram negative bacteria.

9. Which of the following statement is correct about Bakelite?

- (1) It is a cross linked polymer.
- (2) It is an addition polymer.
- (3) It is a branched chain polymer.
- (4) It is a linear polymer.

Ans. (1)

Bakelite is an example of cross-linked polymer.

10. If for a certain reaction,  $\Delta H$  is  $30 \text{ kJ mol}^{-1}$  at  $450 \text{ K}$  the value of  $\Delta S$  (in  $\text{JK}^{-1} \text{ mol}^{-1}$ ) for which the same reaction will be spontaneous at the same temperature is

- (1) 70
- (2) -33
- (3) 33
- (4) -70

Ans. (1)

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

For spontaneous,  $\Delta G < 0$

$$\Delta H < T\Delta S \quad \Delta S > \frac{\Delta H}{T} \quad \Delta S > \frac{30 \times 10^3 \text{ J mol}^{-1}}{450 \text{ K}}$$

$$\Delta S > 66.6 \text{ J mol}^{-1} \text{ K}^{-1} \quad (\text{Check by options})$$

11. Match the element in column I with that in column II.

Column-I

Column-II

- (a) Copper
- (b) Fluorine
- (c) Silicon
- (d) Cerium

- (i) Non-metal
- (ii) Transition metal
- (iii) Lanthanoid
- (iv) Metalloid

(1) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

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

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

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

Ans. (2)

Copper - Transition metal

Fluorine - Non metal

Silicon - Metalloids

Cerium - Lanthanoid

12. Which of the following is a free radical substitution reaction?

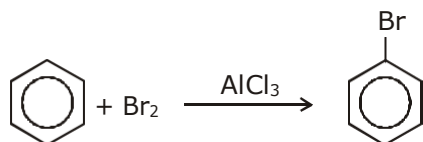
(1) Benzene with  $\text{Br}_2 / \text{AlCl}_3$

(2) Acetylene with  $\text{HBr}$

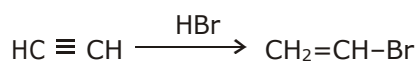
(3) Methane with  $\text{Br}_2/h\nu$

(4) Propene with  $\text{HBr} / \text{C}_6\text{H}_5\text{COO}_2$

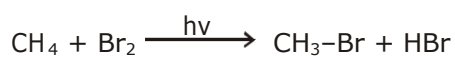
**Ans. (3)**



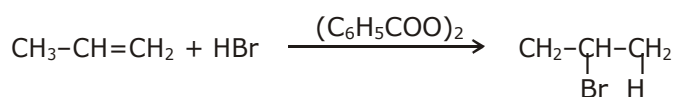
(Aromatic electrophilic substitution)



(Electrophilic addition)



(Free radical substitution)

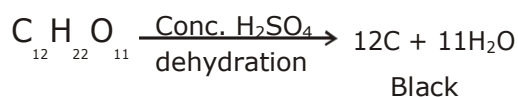


(Free radical addition)

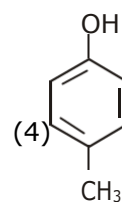
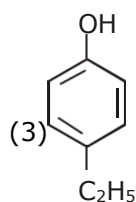
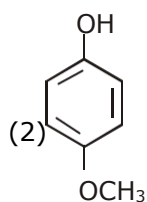
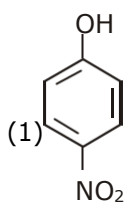
**13.** The reaction of concentrated sulphuric acid with carbohydrates  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$  is an example of

(1) Dehydration      (2) Oxidation      (3) Reduction      (4) Sulphonation

**Ans. (1)**



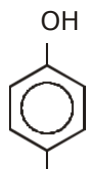
**14.** Which of the following substituted phenols is the strongest acid?



**Radiance**<sup>®</sup>  
spreading the fragrance of knowledge

Address - Near Himfed Building, BCS Chowk, New Shimla (HP) - 171009  
www.radianceit.in | Phone: +91 8091157087 | E-mail: er.j.k.tiwari@gmail.com

Ans. (1)



$\text{NO}_2$  (–R effect)

–NO<sub>2</sub> group is electron withdrawing group. Which increases the acidic strength of phenol

15. Match the compounds of Xe in column I with the molecular structure in column II.

**Column-I**

**Column-II**

(a) XeF<sub>2</sub>

(i) Square planar

(b) XeF<sub>4</sub>

(ii) Linear

(c) XeO<sub>3</sub>

(iii) Square pyramidal

(d) XeOF<sub>4</sub>

(iv) Pyramidal

(1) (a)-(ii) (b)-(i) (c)-(iii) (d) – (iv)

(2) (a)-(ii) (b)-(iv) (c)-(iii) (d) – (i)

(3) (a)-(ii) (b)-(iii) (c)-(i) (d) – (iv)

(4) (a)-(ii) (b)-(i) (c)-(iv) (d) – (iii)

Ans. (4)

XeF<sub>2</sub>    Linear    XeF<sub>4</sub>    Square planar

XeO<sub>3</sub>    Pyramidal

XeOF<sub>4</sub>    Square pyramidal

16. The half-life for a zero order reaction having 0.02 M initial concentration of reactant is 100s The rate constant (in mol L<sup>–1</sup>s<sup>–1</sup>) for the reaction is

(1)  $1.0 \times 10^{-4}$

(2)  $2.0 \times 10^{-4}$

(3)  $2.0 \times 10^{-3}$

(4)  $1.0 \times 10^{-2}$

Ans. (1)

$$t_{1/2 \text{ zero}} = \frac{[A]}{2K}$$

$$100\text{s} = \frac{0.02\text{M}}{2K}$$

$$K = \frac{0.02\text{M}}{2 \times 100} = 1 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

- 17.** Identify the incorrect statement from the following:
- (1) Zirconium and Hafnium have identical radii of 160pm and 159pm, respectively as a consequence of lanthanoid contraction.
  - (2) Lanthanoids reveal only +3 oxidation state.
  - (3) The lanthanoid ions other than the  $f_0$  type and the  $f_{14}$  type are all paramagnetic.
  - (4) The overall decrease in atomic and ionic radii from lanthanum to lutetium is called lanthanoid contraction.

**Ans. (2)**

Lanthanoids shows general oxidation state +3 but some elements can shows +2 as well as +4 .

- 18.** Match the following aspects with the respective metal.

Aspects	Metal
(a) The metal which reveals a maximum number of oxidation states	(i) Scandium
(b) The metal although placed in 3d block is considered not as a transition element	(ii) Copper
(c) The metal which does not exhibit variable oxidation states	(iii) Manganese
(d) The metal which in +1 oxidation state in aqueous solution undergoes disproportionation	(iv) Zinc

Select the correct option :

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

**Ans. (2)**

In the given options

The metal which reveals a maximum number of oxidation state Mn

The metal although placed in 3d block is considered not as a transition element is Zn

The metal which does not exhibit variable oxidation state is Sc (only +3)

The metal which in +1 oxidation state in aqueous solution undergoes disproportionation is Cu

- 19.** If 8g of a non-electrolyte solute is dissolved in 114g of n -octane to reduce its vapour pressure to 80%, the molar mass (in  $\text{gmol}^{-1}$ ) of the solute is [Given that molar mass of n-octane is

$114\text{gmol}^{-1}$  ]

- (1) 40
- (2) 60
- (3) 80
- (4) 20

**Ans. (1)**

Assuming dilute solution,

$$\frac{P_0 - P_s}{P_0} = \frac{n_{\text{solute}}}{n_{\text{solvent}}}$$

$$\frac{100 - 80}{100} = \frac{8}{m} \times \frac{114}{114}$$

Let  $P_0 = 100$ , V.P. reduced to 80%,  $P_s = 80$  ,  
 $m = 40$

- 20.** Match the coordination number and type of hybridisation with distribution of hybrid orbitals in space based on Valence bond theory.

**Coordination number and type of hybridisation**

**Distribution of hybrid orbitals in space**

(1) 4,  $sp^3$

(i) trigonal bipyramidal

(2) 4,  $dsp^2$

(ii) octahedral

(3) 5,  $sp^3d$

(iii) tetrahedral

(4) 6,  $d^2sp^3$

(iv) square planar

Select the correct option :

(1) (a)-(ii) (b)-(iii) (c)-(iv) (d)-(i)

(2) (a)-(iii) (b)-(iv) (c)-(i) (d)-(ii)

(3) (a)-(iv) (b)-(i) (c)-(ii) (d)-(iii)

(4) (a)-(iii) (b)-(i) (c)-(iv) (d)-(ii)

**Ans. (2)**

$sp^3$  – tetrahedral,  $dsp^2$  – square planar

$sp^3d$  – trigonal bipyramidal,  $d^2sp^3$  – octahedral

- 21.** The number of angular nodes and radial nodes in 3s orbital are

(1) 0 and 2, respectively

(2) 1 and 0, respectively

(3) 3 and 0, respectively

(4) 0 and 1, respectively

**Ans. (1)**

Sol. No. of angular nodes

No. of Radial nodes  $n-1$

For 3s ;  $n = 3$  and  $l = 0$

No. of angular nodes 0

No. of radial nodes 2

- 22.** Identify the correct statement from the following.

(1) The order of hydration enthalpies of alkaline earth cations

$Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$

(2) Lithium and Magnesium show some similarities in their physical properties as they are diagonally placed in periodic table.

(3) Lithium is softer among all alkali metals.

(4) Lithium chloride is deliquescent and crystallises as a hydrate,  $LiCl \cdot H_2O$ .

**Ans. (2)**

Li & Mg shows diagonal relationship that's why they show similarity in their physical properties.

- 23.** Deficiency of which vitamin causes osteomalacia ?

(1) Vitamin A

(2) Vitamin D

(3) Vitamin K

(4) Vitamin E



**Ans. (2)**

Deficiency of vitamin D causes osteomalacia  
(soft bones and joint pain in adults)

**24.** Identify the wrongly matched pair.

<b>Molecule</b>	<b>Shape or geometry of molecule</b>
-----------------	--------------------------------------

- |                     |                    |
|---------------------|--------------------|
| (1) $\text{PCl}_5$  | Trigonal planar    |
| (2) $\text{SF}_6$   | Octahedral         |
| (3) $\text{BeCl}_2$ | Linear             |
| (4) $\text{NH}_3$   | Trigonal pyramidal |

**Ans. (1)**

$\text{PCl}_5$  - Trigonal bipyramidal

**25.**  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 \xrightarrow{\text{H}_2\text{O}, \text{H}_2\text{O}_2, \text{OH}^-} \text{Z}$   
What is Z ?

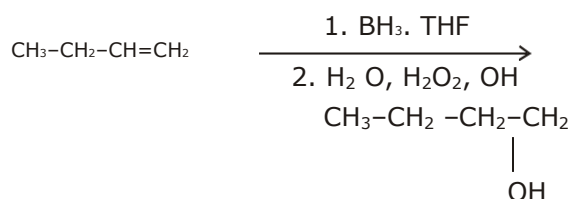
(1)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

(2)  $\text{CH}_3\text{CH}_2\underset{\text{OH}}{\text{CH}}\text{CH}_3$

(3)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$

(4)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

**Ans. (1)**



(Hydroboration-oxidation)

**26.** Identify the reaction from following having top position in EMF series (Std. red. potential) according to their electrode potential at 298K .

(1)  $\text{Mg}^{2+} + 2e^- \rightarrow \text{Mg(s)}$

(2)  $\text{Fe}^{2+} + 2e^- \rightarrow \text{Fe(s)}$

(3)  $\text{Au}^{3+} + 3e^- \rightarrow \text{Au(s)}$

(4)  $\text{K}^+ + e^- \rightarrow \text{K(s)}$

**Ans. (3)**

According to electrode potential series,

$\text{Au}^{3+} + 3e^- \rightarrow \text{Au(s)}$  (has topmost position max. SRP)

27. Match the elements in Column I with methods of purification in Column II.

**Column I**

- (a) Boron  
(b) Tin  
(c) Zirconium  
(d) Nickel  
(1) (a)-(iv) (b)-(iii) (c)-(i) (d)-(ii)  
(3) (a)-(ii) (b)-(i) (c)-(iv) (d)-(iii)

**Column II**

- (i) Van Arkel method  
(ii) Mond's process  
(iii) Liquation  
(iv) Zone refining  
(2) (a)-(iv) (b)-(iii) (c)-(ii) (d)-(i)  
(4) (a)-(iii) (b)-(iv) (c)-(i) (d)-(ii)

Ans. (1)

B - Purified by Zone Refining  
Sn - Liquation  
Zr - Van arkel method  
Ni - Mond's process

28. Which among the following salt solutions is basic in nature ?

- (1) Ammonium chloride (2) Ammonium sulphate  
(3) Ammonium nitrate (4) Sodium acetate

Ans. (4)

$\text{CH}_3\text{COONa}$  Salt of  $\text{CH}_3\text{COOH}$ (WA) +  $\text{NaOH}$  (SB)  
Solution of  $\text{CH}_3\text{COONa}$  shows basic nature.

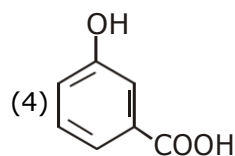
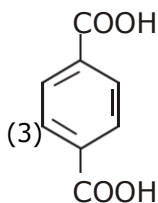
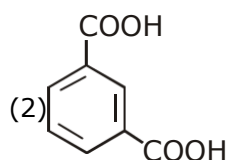
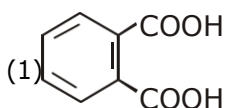
29. In which of the sols, the colloidal particles are with negative charge ?

- (1)  $\text{TiO}_2$  (2) Haemoglobin  
(3) Starch (4) Hydrated  $\text{Al}_2\text{O}_3$

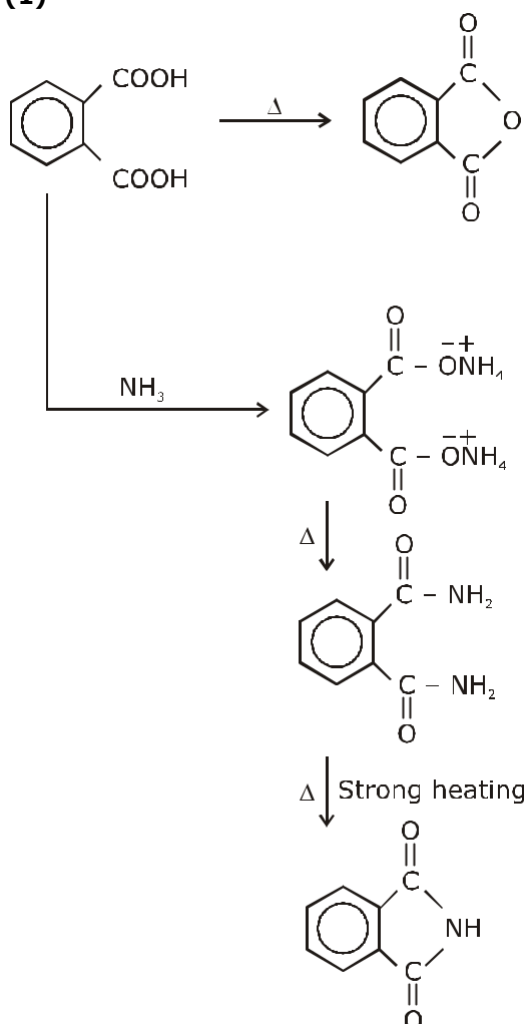
Ans. (3)

Starch is example of negative sol.

30. Which of the following acid will form an (a) Anhydride on heating and (b) Acid imide on strong heating with ammonia ?



**Ans. (1)**



**31.** In a typical fuel cell, the reactants (R) and product (P) are :-

- (1)  $\text{R } \text{H}_{2(\text{g})}, \text{O}_{2(\text{g})}; \text{P } \text{H}_2\text{O}_{2(\text{l})}$       (2)  $\text{R } \text{H}_{2(\text{g})}, \text{O}_{2(\text{g})}; \text{P } \text{H}_2\text{O}_{(\text{l})}$   
 (3)  $\text{R } \text{H}_{2(\text{g})}, \text{O}_{2(\text{g})}, \text{Cl}_{2(\text{g})}; \text{P } \text{HClO}_{4(\text{aq})}$       (4)  $\text{R } \text{H}_{2(\text{g})}, \text{N}_{2(\text{g})}; \text{P } \text{NH}_{3(\text{aq})}$

**Ans. (2)**

In typical fuel cell  
 Reactants =  $\text{H}_2, \text{O}_2$   
 Products =  $\text{H}_2\text{O}$

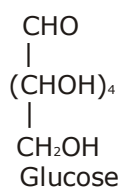
- 32.** In collision theory of chemical reaction,  $Z_{AB}$  represents
- (1) the fraction of molecules with energies greater than  $E_a$
  - (2) the collision frequency of reactants, A and B
  - (3) steric factor
  - (4) the fraction of molecules with energies equal to  $E_a$

**Ans. (2)**

$Z_{AB}$  = Collision frequency

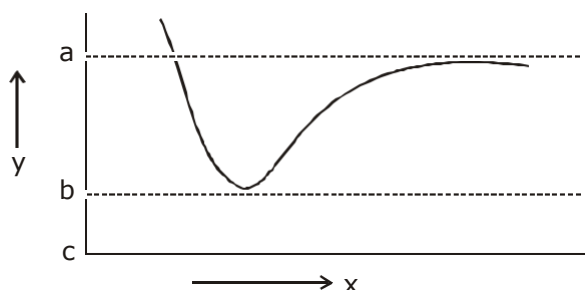
- 33.** Which of the following statement is not true about glucose ?
- (1) It is an aldohexose.
  - (2) It contains five hydroxyl groups.
  - (3) It is a reducing sugar.
  - (4) It is an aldopentose.

**Ans. (4)**



It is an aldohexose sugar.

- 34.** The potential energy (y) curve for  $\text{H}_2$  formation as a function of internuclear distance (x) of the H atoms is shown below.



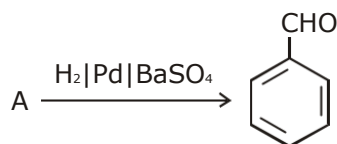
The bond energy of  $\text{H}_2$  is :

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

**Ans. (1)**

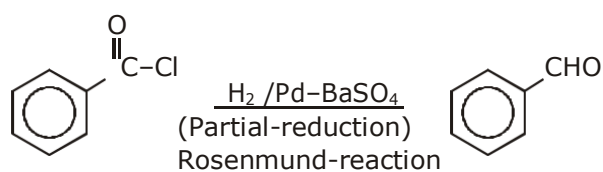
As per the given curve bond energy is the amount of energy is released during the bond formation is i.e. = Final - Initial =  $b - a$

35. Identify compound (A) in the following reaction :

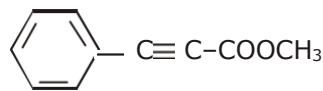


- (1) Benzoyl chloride (2) Toluene (3) Acetophenone (4) Benzoic acid

Ans. (1)

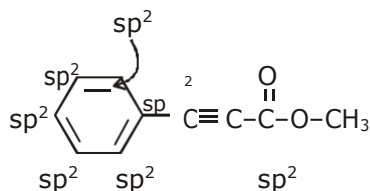


36. How many (i)  $sp^2$  hybridised carbon atoms and (ii) bonds are present in the following compound ?



- (1) 7, 5 (2) 8, 6 (3) 7, 6 (4) 8, 5

Ans. (3)



7- $sp^2$  carbons, 6 bonds

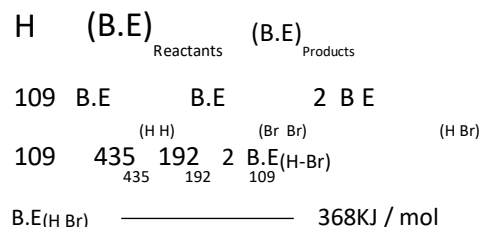
37. At standard conditions, if the change in the enthalpy for the following reaction is  $-109 \text{ kJ mol}^{-1}$

$$H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$$

Given that bond energy of  $H_2$  and  $Br_2$  is  $435 \text{ kJ mol}^{-1}$  and  $192 \text{ kJ mol}^{-1}$ , respectively, what is the bond energy (in  $\text{kJ mol}^{-1}$ ) of  $HBr$ ?

- (1) 368 (2) 736 (3) 518 (4) 259

Ans. (1)



- 38.** The minimum pressure required to compress  $600\text{dm}^3$  of a gas at 1 bar to  $150\text{dm}^3$  at  $40^\circ\text{C}$  is  
 (1) 4.0 bar (2) 0.2 bar (3) 1.0 bar (4) 2.5 bar

**Ans. (1)**  
 By Boyle's law

$$P_1 V_1 = P_2 V_2$$

$$1 \text{ bar} \times 600\text{dm}^3 = P_2 \times 150\text{dm}^3$$

$$P_2 = 4 \text{ bar}$$

- 39.** What is the role of gypsum,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  in setting of cement? Identify the correct option from the following :

- (1) to fasten the setting process  
 (2) to provide water molecules for hydration process  
 (3) to help to remove water molecules  
 (4) to slow down the setting process

**Ans. (4)**  
 The purpose of adding gypsum is only to slow down the process of setting of cement so that it gets sufficiently hardened

- 40.** Which of the following oxide is amphoteric in nature?

- (1)  $\text{SnO}_2$  (2)  $\text{SiO}_2$  (3)  $\text{GeO}_2$  (4)  $\text{CO}_2$

**Ans. (1)**  
 $\text{SnO}_2$  - amphoteric

- 41.** Which one of the following reactions does not come under hydrolysis type reaction?

- (1)  $\text{SiCl}_4(l) + 2\text{H}_2\text{O}(l) \rightarrow \text{SiO}_2(s) + 4\text{HCl}(aq)$   
 (2)  $\text{Li}_3\text{N}(s) + 3\text{H}_2\text{O}(l) \rightarrow \text{NH}_3(g) + 3\text{LiOH}(aq)$   
 (3)  $2\text{F}_2(g) + 2\text{H}_2\text{O}(l) \rightarrow 4\text{HF}(aq) + \text{O}_2(g)$   
 (4)  $\text{P}_4\text{O}_{10}(s) + 6\text{H}_2\text{O}(l) \rightarrow 4\text{H}_3\text{PO}_4(aq)$

**Ans. (3)**  

$$2\text{F}_2(g) + 2\text{H}_2\text{O}(l) \rightarrow 4\text{HF}(aq) + \text{O}_2(g)$$
  
 It's a type of Redox reaction.

- 42.** Which one of the following compounds shows both, Frenkel as well as Schottky defects ?  
 (1) AgBr (2) AgI (3) NaCl (4) ZnS

**Ans. (1)**  
 AgBr shows both schottky and frenkel defect

- 43.** One mole of carbon atom weighs 12g , the number of atoms in it is equal to, (Mass of carbon - 12 is  $1.9926 \times 10^{-23}$  g)

(1)  $1.2 \times 10^{23}$  (2)  $6.022 \times 10^{22}$  (3)  $12 \times 10^{22}$  (4)  $6.022 \times 10^{23}$

**Ans. (4)**  
 1 mole of carbon  $6.022 \times 10^{23}$  atoms

- 44.** Isotonic solutions have same

(1) vapour pressure (2) freezing temperature  
 (3) osmotic pressure (4) boiling temperature

**Ans. (3)**  
 Isotonic solutions have same osmotic pressure.

- 45.** The solubility product for a salt of the type AB is  $4 \times 10^{-8}$ . What is the molarity of its standard solution ?

(1)  $2 \times 10^{-4}$  mol / L (2)  $16 \times 10^{-16}$  mol / L  
 (3)  $2 \times 10^{-16}$  mol / L (4)  $4 \times 10^{-4}$  mol / L

**Ans. (1)**

$$K_{sp} \text{ for } AB = s^2 = 4 \times 10^{-8}$$

$$\text{Molarity of solution} = \text{solubility} = \sqrt{K_{sp}}$$

$$\sqrt{4 \times 10^{-8}}$$

$$2 \times 10^{-4} \text{ mol / L}$$