

## AIPMT 2014

### Chemistry

1. What is the maximum number of orbitals that can be identified with the following quantum numbers?

$$n = 3, l = 1, m = 0$$

- (1) 1 (2) 2  
(3) 3 (4) 4

**Solution:**

3p has  $m = 0$ , so only one orbital is possible i.e.  $3p_z$ .

Hence, the correct option is (1).

2. Calculate the energy in corresponding to light of wavelength 45 nm : (Planck's constant  $h = 6.63 \times 10^{-34}$  Js; speed of light  $c = 3 \times 10^8$  ms<sup>-1</sup>)

- (1) 1 (2) 2  
(3) 3 (4) 4

**Solution:**

Using Planck's quantum theory:

$$E = \frac{hc}{\lambda} = \frac{6.634 \times 10^{-34} \times 3 \times 10^8}{45 \times 10^{-9}} = 4.4 \times 10^{-18} \text{ J}$$

Hence, the correct option is (4).

3. Equal masses of H<sub>2</sub>, O<sub>2</sub> and methane have been taken in a container of volume  $V$  at temperature 27°C in identical conditions. The ratio of the volumes of gases H<sub>2</sub>:O<sub>2</sub>: methane would be

- (1) 8 : 16 : 1 (2) 16 : 8 : 1  
(3) 16 : 1 : 2 (4) 8 : 1 : 2

**Solution:**

Using mole concept

$$x/2 : x/32 : x/16 = 16 : 1 : 2$$

Hence, the correct option is (3).

4. If  $a$  is the length of the side of a cube, the distance between the body centered atom and one corner atom in the cube will be

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

**Solution:**

For bcc arrangement,

$$r = \frac{\sqrt{3}}{4}a$$

And  $d = 2r$  where  $r$  is the radius of the sphere and  $d$  is the distance between the body centered atom and corner atom.

$$\text{So, } d = \frac{\sqrt{3}}{2}a$$

Hence, the correct option is (4).

5. Which property of colloids is not dependent on the charge on colloidal particles?

- (1) Coagulation (2) Electrophoresis  
(3) Electro-osmosis (4) Tyndall effect

**Solution:**

Tyndall effect is due to scattering of light by colloidal particles.

Hence, the correct option is (4).

6. Which of the following salts will give highest pH in water?

- (1) KCl (2) NaCl  
(3)  $\text{Na}_2\text{CO}_3$  (4)  $\text{CuSO}_4$

**Solution:**

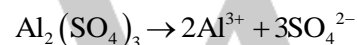
$\text{Na}_2\text{CO}_3$  is a salt of strong base and weak acid.

Hence, the correct option is (3).

7. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression ?

- (1) KCl (2)  $\text{C}_6\text{H}_{12}\text{O}_6$   
(3)  $\text{Al}_2(\text{SO}_4)_3$  (4)  $\text{K}_2\text{SO}_4$

**Solution:**



Here,  $i = 5$

$$\Delta T_f = iK_f m$$

Hence, the correct option is (3).

8. When 22.4 litres of  $\text{H}_2$  (g) is mixed with 11.2 litres of  $\text{Cl}_2$  (g), each at STP, the moles of HCl (g) formed is equal to

- (1) 1 mol of HCl (g) (2) 2 mol of HCl (g)  
(3) 0.5 mol of HCl (g) (4) 1.5 mol of HCl (g)

**Solution:**

1 mol of  $\text{H}_2$  needs 1 mole of  $\text{Cl}_2$

22.4 L needs 22.4 L of  $\text{Cl}_2$

Available volume of  $\text{Cl}_2 = 11.2$  L

So,  $\text{Cl}_2$  is the limiting reagent here.

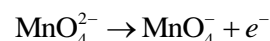
Thus, 1 mol of  $\text{Cl}_2$  will give 1 mol of HCl.

Hence, the correct option is (1).

9. When 0.1 mol  $\text{MnO}_4^{2-}$  is oxidised the quantity of electricity required to completely convert  $\text{MnO}_4^{2-}$  to  $\text{MnO}_4^-$  is

- (1) 96500 C (2)  $2 \times 96500$  C  
(3) 9650 C (4) 96.50 C

**Solution:**



1 mole of  $\text{MnO}_4^{2-}$  requires 1F conversion to  $\text{MnO}_4^-$

1 F = 96500 C

Thus, 0.1 mole requires  $0.1 \times 96500 \text{ C} = 9650 \text{ C}$

Hence, the correct option is (3).

10. Using the Gibbs change,  $\Delta G^\circ = + 63.3 \text{ kJ}$ , for the following reaction,  $\text{Ag}_2\text{CO}_3(\text{g}) \rightleftharpoons 2\text{Ag}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$ , the  $K_{\text{sp}}$  of  $\text{Ag}_2\text{CO}_3(\text{s})$  in water at  $25^\circ\text{C}$  is ( $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ )

- (1)  $3.2 \times 10^{-26}$  (2)  $8.0 \times 10^{-12}$   
(3)  $2.9 \times 10^{-3}$  (4)  $7.9 \times 10^{-2}$

**Solution:**

$$\Delta G^\circ = -2.303RT \log K_{\text{sp}}$$

$$63.3 \times 10^3 = -2.303 \times 8.314 \times 298 \times \log K_{\text{sp}}$$

$$-11.09 = \log K_{\text{sp}}$$

$$K_{\text{sp}} = 8 \times 10^{-12}$$

Hence, the correct option is (2).

11. The weight of silver (at.wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of  $\text{O}_2$  at STP will be

- (1) 5.4 g (2) 10.8 g  
(3) 54.0 g (4) 108.0 g

**Solution:**

According to Faraday's law of electrolysis

$$W_{\text{Ag}} \times \frac{1}{108} = W_{\text{O}_2} \times \frac{4}{M_{\text{O}_2}}$$

$$\text{Given, } \frac{W_{\text{O}_2}}{M_{\text{O}_2}} = n_{\text{O}_2} = \frac{5600}{22400} = \frac{1}{4}$$

$$\therefore W_{\text{Ag}} \times \frac{1}{108} = \frac{1}{4} \times 4 \Rightarrow W_{\text{Ag}} = 108$$

Hence, the correct option is (4).

12. Which of the following statements is correct for the spontaneous adsorption of a gas?

- (1)  $\Delta S$  is negative and therefore,  $\Delta H$  should be highly positive.  
(2)  $\Delta S$  is negative and therefore,  $\Delta H$  should be highly negative.  
(3)  $\Delta S$  is positive and therefore,  $\Delta H$  should be negative.  
(4)  $\Delta S$  is positive and therefore,  $\Delta H$  should also be highly positive.

**Solution:**

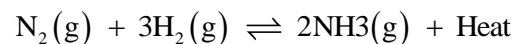
For a spontaneous process,  $\Delta G$  should be negative

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

Thus,  $\Delta G$  will be negative when  $\Delta S$  is negative and therefore,  $\Delta H$  is highly negative.

Hence, the correct option is (2).

13. For the reversible reaction:



The equilibrium shifts in forward direction-

- (1) by increasing the concentration of  $\text{NH}_3(\text{g})$   
(2) by decreasing the pressure

(3) by decreasing the concentrations of  $N_2(g)$  and  $H_2(g)$

(4) by increasing pressure and decreasing temperature

**Solution:**

According to Le-Chatliers principle,

On increasing the pressure, the equilibrium shifts in the direction in which there is decrease in the number of moles.

For an exothermic reaction like this, on increasing the temperature the equilibrium will shift in the backward direction, so temperature should be kept low for facilitating forward direction.

**Hence, the correct option is (4).**

**14.** For the reaction:  $X_2O_4(l) \rightarrow 2XO_2(g)$

$\Delta U = 2.1 \text{ k cal}$ ,  $\Delta S = 20 \text{ cal K}^{-1}$  at 300 K.

Hence,  $\Delta G$  is

(1) 2.7 kcal (2) -2.7 kcal

(3) 9.3 kcal (4) -9.3 kcal

**Solution:**

$$\Delta H = \Delta U + \Delta n_g RT = 2.1 + 2 \times \frac{2}{1000} \times 300 = 3.3 \text{ kcal}$$

$$\Delta G = \Delta H - T\Delta S = 3.3 - 300 \times \frac{20}{1000} = -2.7 \text{ kcal}$$

**Hence, the correct option is (2).**

**15.** For a given exothermic reaction,  $K_p$  and  $K_p'$  are the equilibrium constants at temperatures  $T_1$  and  $T_2$  respectively. Assuming that heat of reaction is constant in temperatures range between  $T_1$  and  $T_2$ , it is readily observation that

(1)  $K_p > K_p'$  (2)  $K_p < K_p'$

(3)  $K_p = K_p'$  (4)  $K_p = 1/K_p'$

**Solution:**

Using Arrhenius equation:

$$\log \frac{K_p'}{K_p} = \frac{E_a}{2.303R} \left[ \frac{1}{T_1} - \frac{1}{T_2} \right]$$

If  $T_1 > T_2$ , then  $K_p >> K_p'$

**Hence, the correct option is (1).**

**16.** Which of the following orders of ionic radii is correctly represented?

(1)  $H^- > H^+ > H$  (2)  $Na^+ > F^- > O^{2-}$

(3)  $F^- > O^{2-} > Na^+$  (4)  $Al^{3+} > Mg^{2+} > N^{3-}$

**Solution:**

The order should be  $O^{2-} > F^- > Na^+$

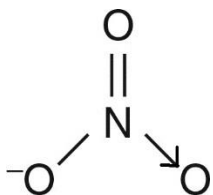
**Hence, the correct option is none.**

**17.** 1.0 g of magnesium is burnt with 0.56 g  $O_2$  in a closed vessel. Which reaction is left in excess and how much? (At. wt. Mg = 24; O = 16)

(1) Mg, 0.16 g (2)  $O_2$ , 0.16 g

(3) Mg, 0.44 g (4)  $O_2$ , 0.28 g





Hence, the correct option is (2).

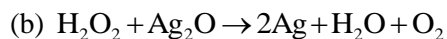
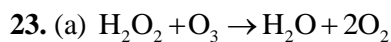
22. Acidity of diprotic acids in aqueous solutions increases in the order:

- (1)  $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$  (2)  $\text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{Te}$   
 (3)  $\text{H}_2\text{Te} < \text{H}_2\text{S} < \text{H}_2\text{Se}$  (4)  $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{S}$

**Solution:**

Because, bond dissociation enthalpy decreases down the group.

Hence, the correct option is (1).



Role of hydrogen peroxide in the above reactions is respectively:

- (1) oxidizing in (a) and reducing in (b)  
 (2) reducing in (a) and oxidizing in (b)  
 (3) reducing in (a) and (b)  
 (4) oxidizing in (a) and (b)

**Solution:**

There is decrease in oxidation number of oxygen from 0 to -2 and +1 to 0.

Hence, the correct option is (3).

24. Artificial sweetner which is stable under cold conditions only is:

- (1) Saccharine (2) Sucralose  
 (3) Aspartame (4) Alitame

**Solution:**

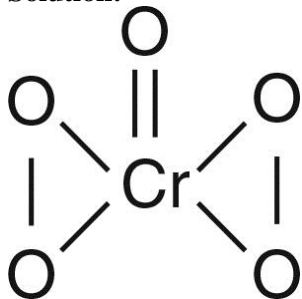
Aspartame is unstable at cooking temperature.

Hence, the correct option is (3).

25. In acidic medium,  $\text{H}_2\text{O}_2$  changes  $\text{Cr}_2\text{O}_7^{2-}$  to  $\text{CrO}_5$  which has two (-O-O-) bonds. Oxidation state of Cr in  $\text{CrO}_5$  is:

- (1) +5 (2) +3  
 (3) +6 (4) -10

**Solution:**



$$x + 4(-1)(\text{O}-\text{O}) + 1(-2)(\text{O}=\text{O}) = 0$$

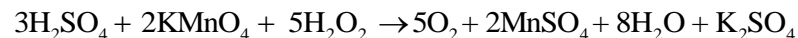
$$x = +6$$

Hence, the correct option is (3).

26. The reaction of aqueous  $\text{KMnO}_4$  with  $\text{H}_2\text{O}_2$  in acidic conditions gives:

- (1)  $\text{Mn}^{4+}$  and  $\text{O}_2$  (2)  $\text{Mn}^{2+}$  and  $\text{O}_2$   
(3)  $\text{Mn}^{2+}$  and  $\text{O}_3$  (4)  $\text{Mn}^{4+}$  and  $\text{MnO}_2$

**Solution:**

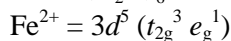
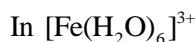


Hence, the correct option is (2).

27. Among the following complexes the one which shows Zero crystal field stabilizations energy (CFSE) is

- (1)  $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$  (2)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$   
(3)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  (4)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

**Solution:**



$$\text{CFSE} = [-0.4 \times 3 + 0.6 \times 2] \Delta_0 = 0$$

Hence, the correct option is (2).

28. Magnetic moment 2.83 BM is given by which of the following ions? (At.nos. Ti = 22, Cr = 24, Mn = 25, Ni = 28)

- (1)  $\text{Ti}^{3+}$  (2)  $\text{Ni}^{2+}$   
(3)  $\text{Cr}^{3+}$  (4)  $\text{Mn}^{2+}$

**Solution:**



$$n = 2$$

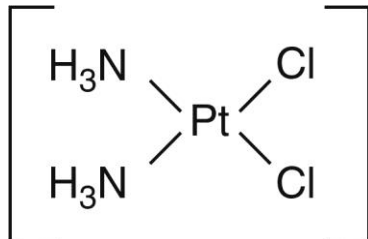
$$\text{Dipole moment} = \mu = \sqrt{n(n+2)} = 2\sqrt{2} \text{ 2.82}$$

Hence, the correct option is (2).

29. Which of the following complexes is used to be as an anticancer agent?

- (1) *mer*- $[\text{Co}(\text{NH}_3)_3\text{Cl}]$  (2) *cis*- $[\text{Pt}.\text{Cl}_2(\text{NH}_3)_2]$   
(3) *cis*- $\text{K}_2[\text{PtCl}_2\text{Br}_2]$  (4)  $\text{Na}_2\text{CoCl}_4$

**Solution:**



*cis*-platin is used as an anticancer agent.

Hence, the correct option is (2).

30. Reason of lanthanide contraction is:

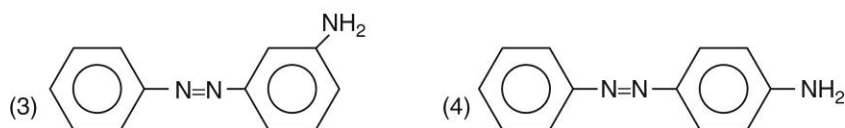
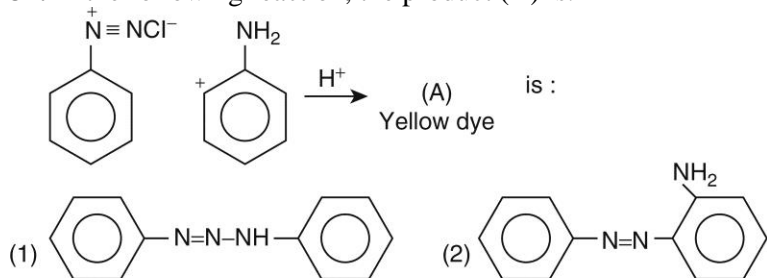
- (1) Negligible screening effect of  $f$  orbitals (2) Decreasing nuclear charge  
 (3) Decreasing nuclear charge (4) Decreasing screening effect

**Solution:**

Poor shielding of  $f$ -orbital due to which the radii of members of third transition series is very similar to that of second transition series.

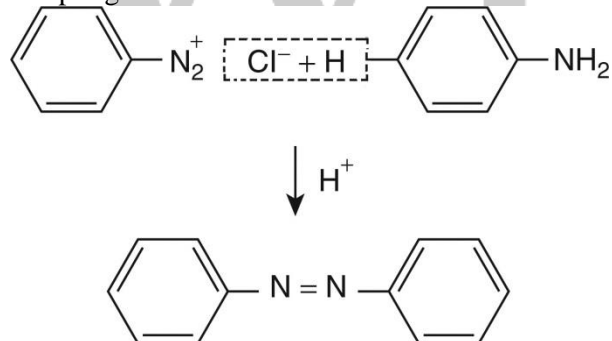
Hence, the correct option is (1).

31. In the following reaction, the product (A) is:



**Solution:**

Coupling reaction



Hence, the correct option is (4).

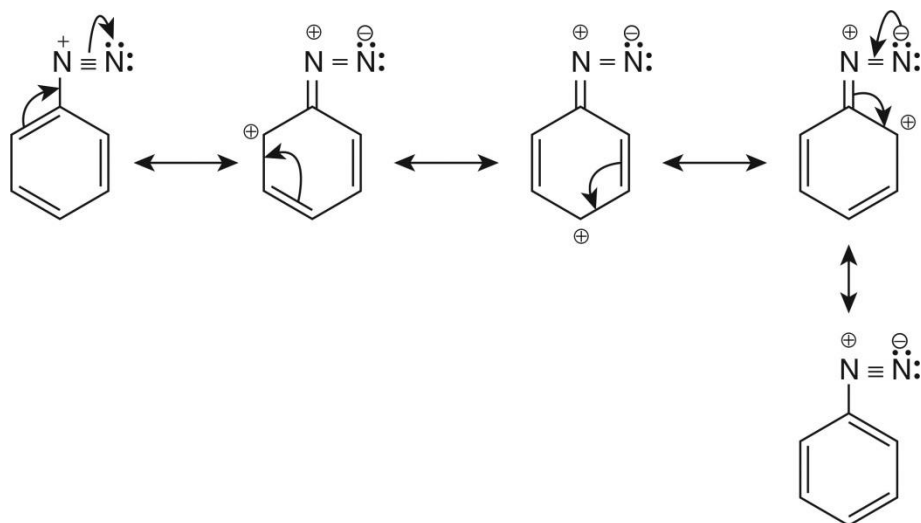
32. Which of the following will be most stable diazonium salt  $RN_2^+X^-$  ?

- (1)  $CH_3N_2^+X^-$  (2)  $C_6H_5N_2^+X^-$   
 (3)  $CH_3CH_2N_2^+X^-$  (4)  $C_6H_5CH_2N_2^+X^-$

**Solution:**

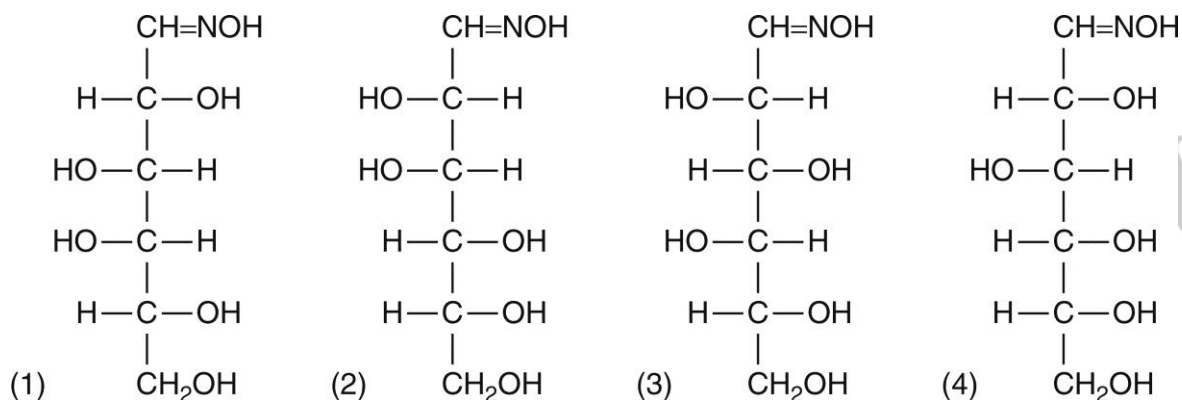
Due to resonance stabilization as shown:



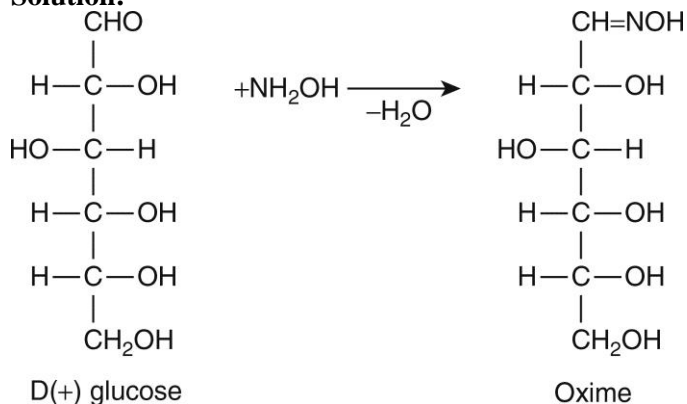


Hence, the correct option is (2).

33. D (+) glucose reacts with hydroxyl amine and yield an oxime. The structure of the oxime would be:



**Solution:**



Hence, the correct option is (2).

34. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human being?

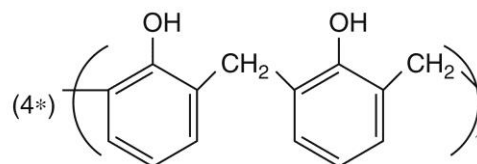
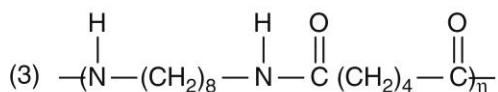
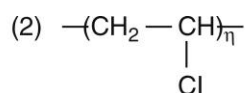
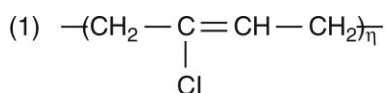
- |                |               |
|----------------|---------------|
| (1) Thyroxin   | (2) Insulin   |
| (3) Adrenaline | (4) Estradiol |

**Solution:**

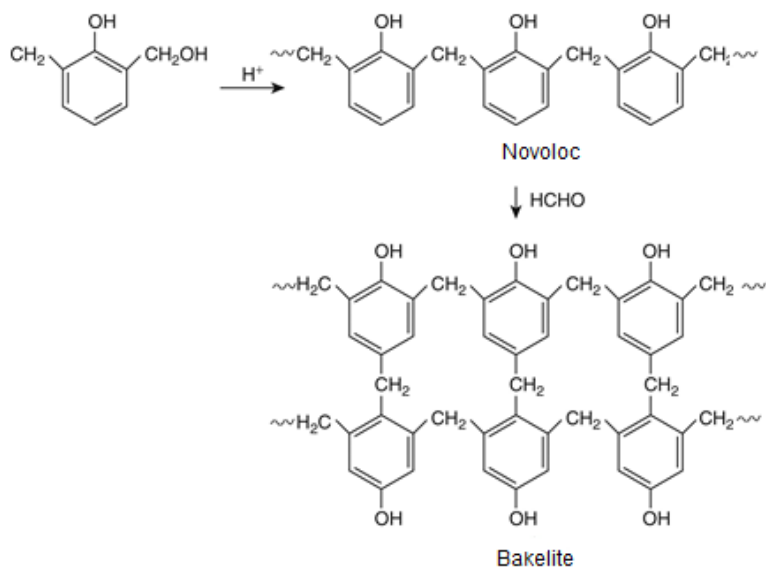
Adrenaline gland is secreted under stressful situations.

Hence, the correct option is (3).

35. Which one of the following is an example of a thermosetting polymer?

**Solution:**

Bakelite is a thermosetting polymer.

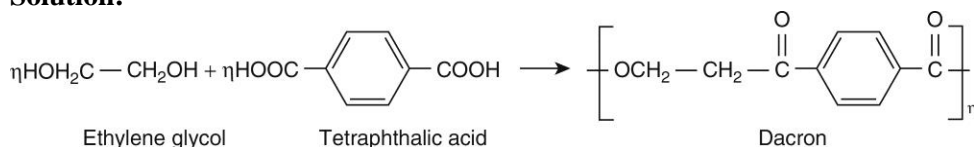


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Hence, the correct option is (4).

36. Which of the following organic compounds polymerizes to form the polyester Dacron?

- (1) Propylene and para  $\text{HO}-(\text{C}_6\text{H}_4)-\text{OH}$
- (2) Benzoic acid and ethanol
- (3) Terephthalic acid and ethylene glycol
- (4) Benzoic acid and para  $\text{HO}-(\text{C}_6\text{H}_4)-\text{OH}$

**Solution:**

Hence, the correct option is (3).

37. Which one of the following is not a common component of Photochemical Smog?

- (1) Ozone (2) Acrolein  
(3) Peroxyacetyl nitrate (4) Chlorofluorocarbons

**Solution:**

Chlorofluorocarbons are responsible for depletion of ozone layer rest all of them are components of photochemical smog.

Hence, the correct option is (4).

38. In the Kjeldahl's method for estimation of nitrogen present in soil sample, ammonia evolved from 0.75g of sample neutralized 10 mL. of 1M H<sub>2</sub>SO<sub>4</sub>. The percentage of nitrogen in the soil is:

- (1) 37.33 (2) 45.33  
(3) 35.33 (4) 43.33

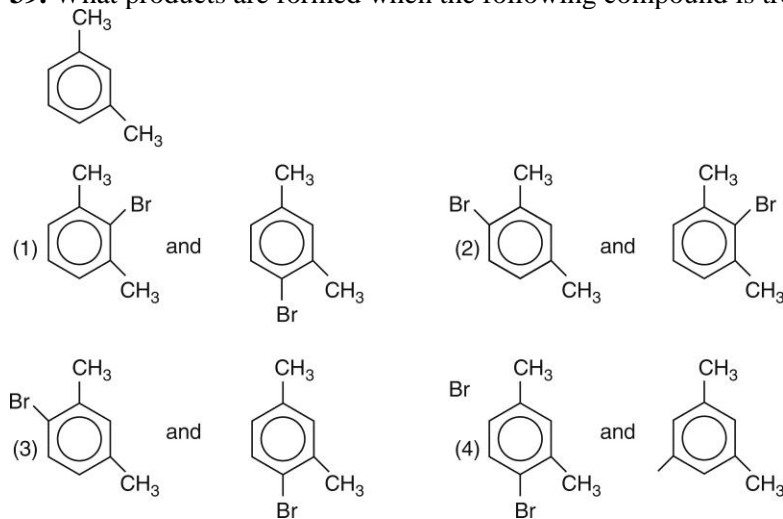
**Solution:**

$$\text{Percentage of nitrogen} = 1.4 \times \text{Molarity of acid} \times \text{Basicity of acid} \times \frac{\text{Volume of acid used}}{\text{Mass of substance taken}}$$

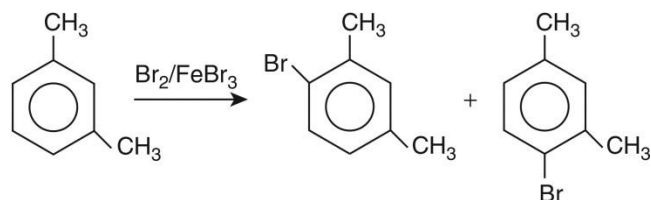
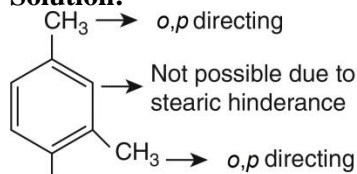
$$= 1.4 \times 1 \times 2 \times \frac{10}{0.75} = 37.33\%$$

Hence, the correct option is (1).

39. What products are formed when the following compound is treated with Br<sub>2</sub> in the presence of FeBr<sub>3</sub>?

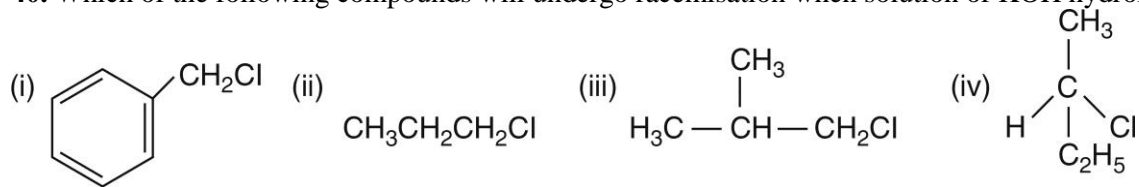


**Solution:**



Hence, the correct option is (3).

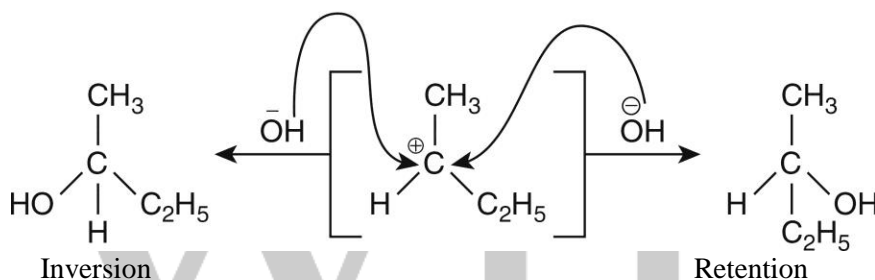
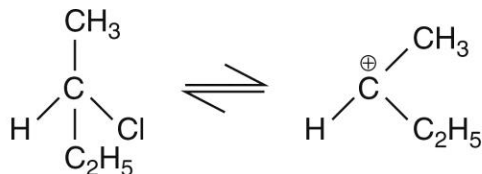
40. Which of the following compounds will undergo racemisation when solution of KOH hydrolysis?



- (1) (i) and (ii)  
(3) (iii) and (iv)

- (2) (ii) and (iv)  
(4) (i) and (iv)

**Solution:**



Hence, the correct option is none.

41. Among the following sets of reaction which one produces anisole?

- (1)  $\text{CH}_3\text{CHO}$ ;  $\text{RMgX}$  (2)  $\text{C}_6\text{H}_5\text{OH}$ ;  $\text{NaOH}$ ;  $\text{CH}_3\text{I}$   
(3)  $\text{C}_6\text{H}_5\text{OH}$ ; neutral  $\text{FeCl}_3$  (4)  $\text{C}_6\text{H}_5-\text{CH}_3$ ;  $\text{CH}_3\text{COCl}$ ;  $\text{AlCl}_3$

**Solution:**

Williamson's synthesis



Hence, the correct option is (2).

42. Which of the following will not be soluble in sodium hydrogen carbonate?

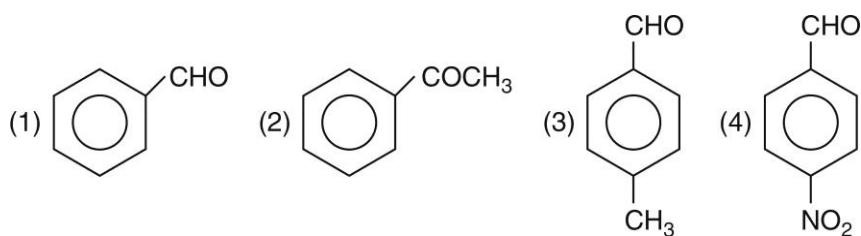
- (1) 2, 4, 6- trinitrophenol (2) Benzoic acid  
(3) *o*- nitro phenol (4) Benzenesulphonic acid

**Solution:**

It is a stronger acid due to the presence of electron withdrawing group i.e.,  $\text{NO}_2$ .

Hence, the correct option is (3).

43. Which one is most reactive towards Nucleophilic addition reaction?

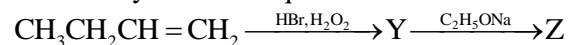


**Solution:**

It is due to the presence of two electron withdrawing groups ( $\text{NO}_2$ ) which increases the polarity of the bond and hence, facilitates the release of proton.

Hence, the correct option is (4).

44. Identify Z in the sequence of reactions:



- (1)  $\text{CH}_3-(\text{CH}_2)_3-\text{O}-\text{CH}_2\text{CH}_3$  (2)  $(\text{CH}_3)_2\text{CH}_2-\text{O}-\text{CH}_2\text{CH}_3$   
 (3)  $\text{CH}_3(\text{CH}_2)_4-\text{O}-\text{CH}_3$  (4)  $\text{CH}_3\text{CH}_2-\text{CH}(\text{CH}_3)-\text{O}-\text{CH}_2\text{CH}_3$

**Solution:**



Hence, the correct option is (1).

45. Which of the following organic compounds has same hybridization as its combustion product  $-\text{CO}$ ?

- (1) Ethane (2) Ethyne  
 (3) Ethene (4) Ethanol

**Solution:**

The hybridisation of both  $\text{CO}_2$  and ethyne is *sp*.

Hence, the correct option is (2).