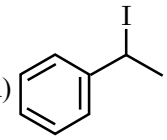
JEE Main Online Exam 2019

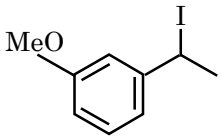
Questions & Solutions

10th April 2019 | Shift - I

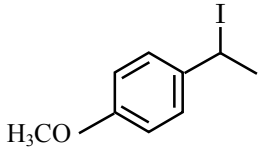
Chemistry

Q.1 Increasing rate of S_N1 reaction in the following compounds is :

(A) 

(B) 

(C)

(D) 

(1) (B) < (A) < (D) < (C)

(2) (A) < (B) < (C) < (D)

(3) (A) < (B) < (D) < (C)

(4) (B) < (A) < (C) < (D)

Ans. **[4]**

Sol. Rate of S_N1– reaction $\propto$ stability of $C^{\oplus}$ – I.m.

Q.2 Amylopectin is compound of :

(1) α-D-glucose, $C_1 - C_4$ and $C_1 - C_6$ linkages

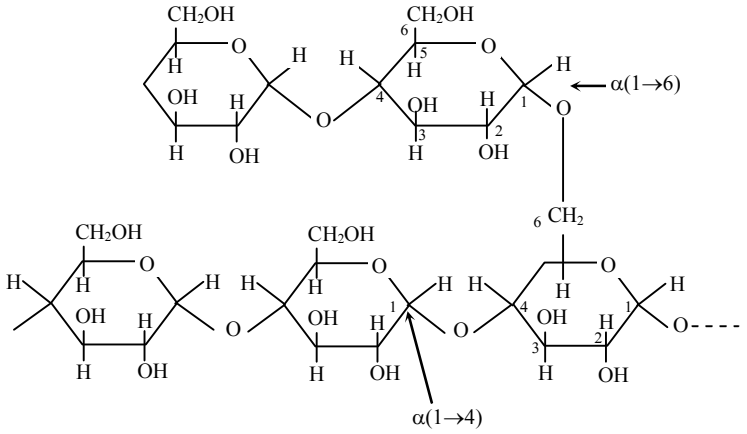
(2) β-D-glucose, $C_1 - C_4$ and $C_1 - C_6$ linkages

(3) β-D-glucose, $C_1 - C_4$ and $C_2 - C_6$ linkages

(4) α-D-glucose, $C_1 - C_4$ and $C_1 - C_6$ linkages

Ans. **[1]**

Sol.

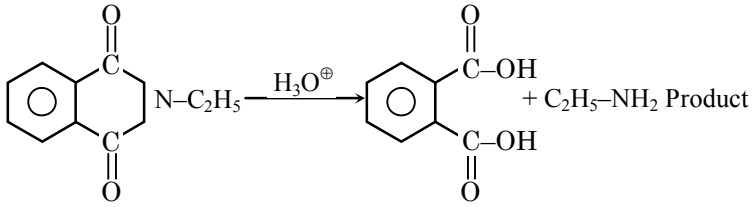


Q.3 Ethylamine ($C_2H_5NH_2$) can be obtained from N-ethylphatalimide on treatment with :

(1) CaH_2 (2) H_2O (3) $NaBH_4$ (4) NH_2NH_2

Ans. **[4]**

Sol. It is the final step of Galbriel phatalimide synthesis reaction



Q.4 The isoelectronic set of ions is :

(1) F^-, Li^+, Na^+ and Mg^{2+} (2) Li^+, Na^+, O^{2-} and F^-

(3) N^{3-}, O^{2-}, F^- and Na^+ (4) N^{3-}, Li^+, Mg^{2+} and O^{2-}

Ans. **[3]**

Sol. In this we have to choose isoelectronic set of ions

Isoelectronic species are those which have same no. of electron in total.

So option 3 : is correct.

Q.5 The regions of the atmosphere, where clouds form and where we live, respectively, are :

(1) Stratosphere and Stratosphere (2) Stratosphere and Troposphere

(3) Troposphere and Stratosphere (4) Troposphere and Troposphere

Ans. **[4]**

Sol. From Theory

Q.6 Consider the hydrated ions of Ti^{2+}, V^{2+}, Ti^{3+}, and Sc^{3+}. The correct order of their spin-only magnetic moments is :

(1) $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$ (2) $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$

(3) $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$ (4) $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

Ans. **[2]**

Sol. As we know that

$\mu = \sqrt{n(n+2)}$

where n = no. of impaired electrons i.e. greater the no. of impaired electron more will be the spin-only magnetic moments.

$Ti^{2+} = 3d^2 \quad \therefore n = 2$

$Ti^{3+} = 3d^1 \quad \therefore n = 1$

$V^{2+} = 3d^3 \quad \therefore n = 3$

$Sc^{3+} = 3d^0 \quad \therefore n = 0$

The correct order of spin only magnetic moments is

$V^{2+} > Ti^{2+} > Ti^{3+} > Sc^3$

So option 2 is correct.

Q.7 Consider the statements S1 and S2

S1 : Conductivity always increases with decrease in the concentration of electrolyte.

S2 : Molar conductivity always increases with decrease in the concentration of electrolyte.

The correct option among the following is :

(1) Both S1 and S2 are wrong

(2) S1 is correct and S2 is wrong

(3) Both S1 and S2 are correct

(4) S1 is wrong and S2 is correct

Ans. **[4]**

Sol. We know that Here λ_m = molar conductivity

$\lambda_m = \frac{k}{c}$ k = conductivity

c = concentration

We the increase in the concentration conductivity always increase the molar conduction always increases with the decrease in the concentration

So option 4 is correct

Q.8 Consider the following table :

Gas	a/(k Pa dm^6 mol^{-1})	b/(dm^3 mol^{-1})
A	642.32	0.05196
B	155.21	0.04136
C	431.91	0.05196
D	155.21	0.4382

a and b are vander Waals constants. The correct statement about the gases is :

(1) Gas C will occupy more volume than gas A; gas B will be more compressible than gas D

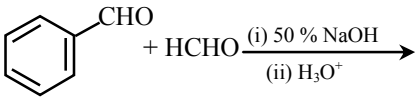
(2) Gas C will occupy lesser volume than gas A; gas B will be more compressible than gas D

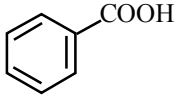
(3) Gas C will occupy lesser volume than gas A; gas B will be lesser compressible than gas D

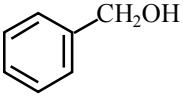
(4) Gas C will occupy more volume than gas A; gas B will be lesser compressible than gas D

Ans. **[1]**

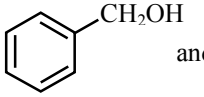
Q.9 Major products of the following reaction are :

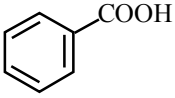


(1) CH_3OH and 

(2) HCOOH and 

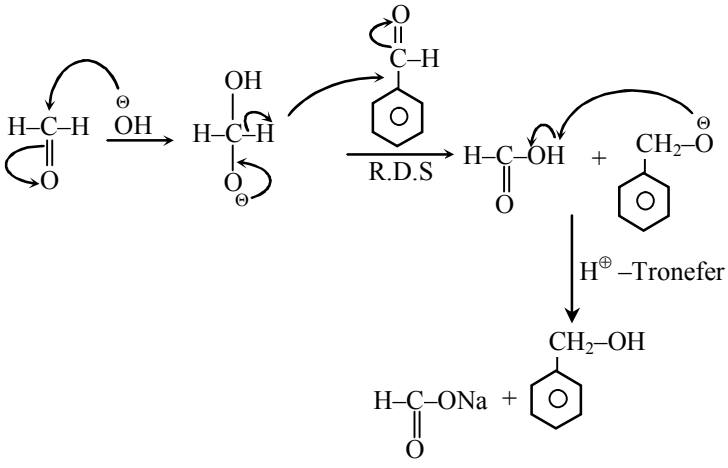
(3) CH_3OH and HCO_2H

(4) 

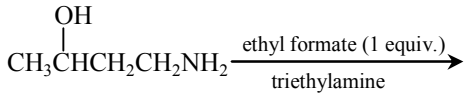
and 

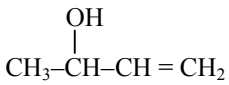
Ans. **[2]**

Sol. It is eg. of cross cannizaro reaction

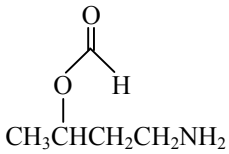


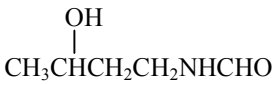
Q.10 The major product of the following reaction is :



(1) 

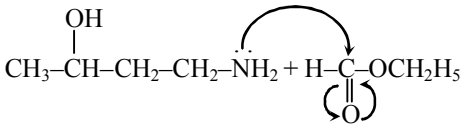
(2) $CH_3CH=CH-CH_2NH_2$

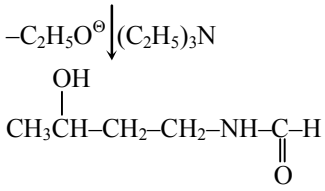
(3) 

(4) 

Ans. **[4]**

Sol. It is eg. of S_N2 Th– reaction





Q.11 The correct order of catenation is :

(1) C > Sn > Si ≈ Ge (2) Si > Sn > C > Ge (3) C > Si > Ge ≈ Sn (4) Ge > Sn > Si > C

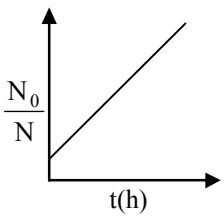
Ans. **[3]**

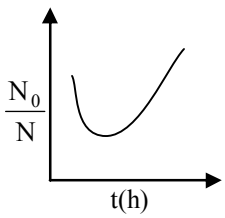
Sol. in this order of catenation is asked. catenation is a self-linking property here and for group 14 : self -linking is through covalent bonding.

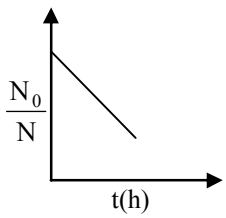
C > Si > Ge ≈ Sn

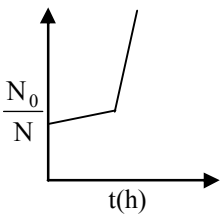
in ethene is 2p-2p ouerlapping further 3p-3p, 4p – 4p and soon and the extent of overlapping is more in 2p-2p > 3p-3p >. 4p–4p ≈ 5p-5p.

Q.12 A bacterial infection in an internal wound grows as $N'(t) = N_0 \exp(t)$, where the time t is in hours. A does of antibiotic, taken orally, needs 1 hour to reach the wound. Once it reaches there, the bacterial population goes down as $\frac{dN}{dt} = -5N^2$. What will be the plot of $\frac{N_0}{N}$ vs. t after 1 hour ?

(1) 

(2) 

(3) 

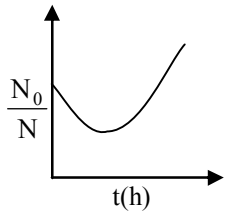
(4) 

Ans. **[1]**

Sol. Initially

$N > N_0$

and N" is increasing through first -order kinetics. So $\frac{N_0}{N}$ in initial time decrease.



But after 1 hour the value of N decrease with a faster rate. So $\frac{N_0}{N}$ will increase.

Q.13 Consider the following statements

(a) The pH of a mixture containing 400 mL of 0.1 M H_2SO_4 and 400 mL of 0.1 M NaOH will be approximately 1.3

(b) Ionic product of water is temperature dependent.

(c) A monobasic acid with $K_a = 10^{-5}$ has pH = 5. The degree of dissociation of this acid is 50 %.

(d) The Le Chatelier's principle is not applicable to common-ion effect.

The correct statements are :

(1) (a) and (b) (2) (a), (b) and (c) (3) (a), (b) and (d) (4) (b) and (c)

Ans. **[2]**

Sol. (a) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

Initially 40 m mole 40 m mole

Finally 20 m mole 0 20 m mole

$$[H^+] = \frac{20\times10^{-3}\times10^{3}\times2}{800}$$

$$[H^+] = \frac{1}{20}$$

$$-\log [H^+] = \text{.....} \qquad \text{.....}-\log \frac{1}{20}$$

pH = log 20

pH = 1.3 approximately

(b) kw depends on temperature kw ↑ with temperature ↑

(c) pH = 5

$\therefore [H^+] = c\,\alpha = 10^{-5}$

$$K_a = \frac{c\alpha^2}{(1-\alpha)}$$

$$k_a = \frac{[H^+]\alpha}{(1-\alpha)}$$

$$10^{-5} = \frac{10^{-5}\times\alpha}{1-\alpha}$$

$\Rightarrow 1 = 2\,\alpha$

$\therefore\ \alpha = 0.5$

(d) Le Chatelier's principle is applicable to common-ion effect because commonion effect is itself depend on le chatelier's principle

So option-2 is correct

Q.14 The alloy used in the construction of aircrafts is :

(1) Mg-Zn (2) Mg-Al (3) Mg-Sn (4)Mg-Mn

Ans. **[2]**

Sol. It is completely memory based question for air-craft construction aluminum and its alloy is used because these are lighter

Q.15 A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation

$$\frac{x}{m} = kp^{0.5}$$

Adsorption of the gas increase with :

(1) Decrease in p and increase in T (2) Increase in p and decrease in T

(3) Decrease in p and decrease in T (4) Increase in p and increase in T

Ans. **[2]**

Sol. Increase in Pressure leads to the increase in adsorption capacity

And the physical adsorption is an exothermic process with the increase in temperature adsorption decrease

Q.16 A process will be spontaneous at all temperatures if :

(1) $\Delta H < 0$ and $\Delta S > 0$ (2) $\Delta H < 0$ and $\Delta S < 0$

(3) $\Delta H > 0$ and $\Delta S < 0$ (4) $\Delta H > 0$ and $\Delta S > 0$

Ans. **[1]**

Sol. At constant P and T and for the process to be spontaneous.

We should have $\Delta G = -ve$

and we know that

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

If $\Delta H = -ve$ and $\Delta S = +$ ve then at all the temperature the process will be spontaneous

Q.17 At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion, and 40 mL of CO_2 is formed. The formula of the hydrocarbon is :

(1) C_4H_7Cl (2) C_4H_6 (3) C_4H_8 (4) C_4H_{10}

Ans. **[2]**

Sol. $$C_x^0H_4(g) + \left(x + \frac{y}{4}\right) O_2 \longrightarrow x\,CO_2(g) + \frac{4}{2} H_2O\,(l)$$

10 mL 55 mL 40

Hence.

1 mL of hydrocarbon = x mL of CO_2 is produced

According to question

10 mL ... . = 10 x mL of CO_2

$\therefore$ 10 x = 40 mL

x = 4

$\left(\frac{x+y}{4}\right)$ mL of O_2 is required = x mL of CO_2

55mL mL .. .. .. $= \frac{x}{\left(x+\frac{y}{4}\right)} \times 55$ mL of CO_2

According to question.

$\Rightarrow \frac{x}{\left(x+\frac{y}{4}\right)} \times 55 = 40$

$\Rightarrow$ 55 x = 40 x + 10 y

$\Rightarrow$ 15 x = 10 y

15 × 4 = 10 y

$\Rightarrow \frac{60}{10} = y$

6 = y

Hence the compound is C_4H_6

Q.18 The principle of column chromatography is

(1) Gravitational force.

(2) Capillary action.

(3) Differential adsorption of the substances on the solid phase.

(4) Differential absorption of the substances on the solid phase.

Ans. **[3]**

Sol. The principle of column chromatography is differential adsorption of substance and hence option on 3 is correct.

Q.19 At room temperature, a dilute solution of urea is prepared by dissolving 0.60 of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mm Hg, lowering of vapour pressure will be. (molar mass of urea = 60 g mol^{-1})

(1) 0.031 mmHg (2) 0.017 mmHg (3) 0.028 mmHg (4) 0.027 mmHg

Ans. **[2]**

Sol. As we that relative lowering concept

i.e. $\frac{\Delta p}{p^0} = \frac{n}{N+n}$

or $\Delta p = p^0 \times \frac{n}{(N+n)}$

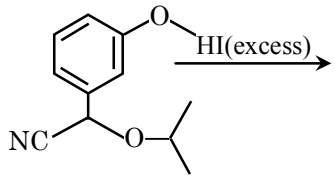
$\Delta p = \frac{35 \times \frac{0.6}{60}}{\left(\frac{360}{18}+\frac{0.6}{60}\right)}$

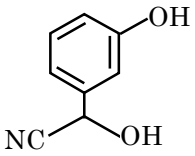
$$\Delta p = \frac{\frac{35\times 06}{600}}{\left(20+\frac{1}{100}\right)}$$

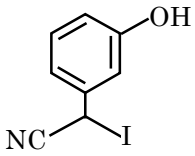
$$= \frac{35\times 100}{2001\times 100}$$

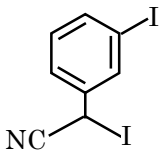
$$= 0.017 \text{ mm Hg}$$

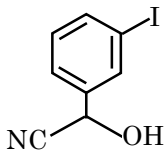
Q.20 The major product of the following reaction is :



(1) 

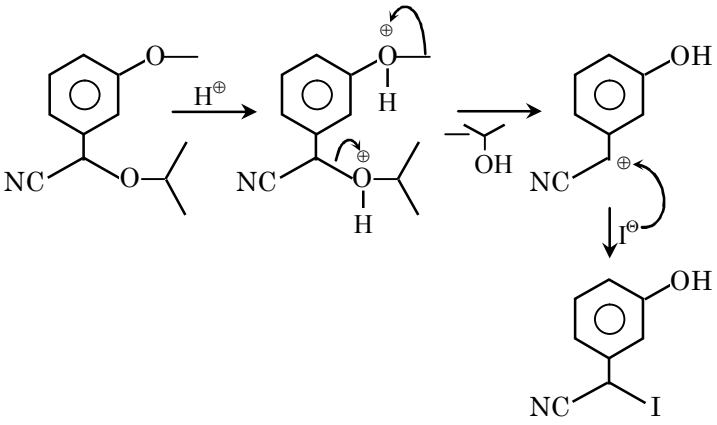
(2) 

(3) 

(4) 

Ans. **[1]**

Sol.



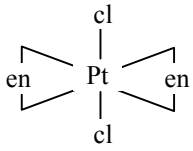
Q.21 The species that can have a trans-isomer is:

(en = ehane-1, 2-diamine, ox = oxalate)

(1) $[Cr(en)_2(ox)]^+$ (2) $[Pt(en)Cl_2]$ (3) $[Pt(en)_2Cl_2]^{2+}$ (4) $[Zn(en)C1_2]$

Ans. **[3]**

Sol. The trans-isomer of $[Pt(en)_2Cl_2]^{2+}$



Q.22 Three complexes,
$[CoCl(NH_3)_5]^{2+}$(I),
$[Co(NH_3)_5H_2O]^{3+}$ (II) and
$[Co(NH_3)_6]^{3+}$(III)
absorb light in the visible region. The correct order of the wavelength of light absorbed by them is :
(1) (III) > (I) > (II) (2) (III) > (II) > (I) (3) (I) > (II) > (III) (4) (II) > (I) > (III)

Ans. **[3]**

Sol. As we know that

strong lightnd α C.F.S.E. α $E_{absorbed} \propto \frac{1}{\lambda_{absorbed}}$

we have

$[CoCl(NH_3)_5]^{2+}$, $[Co(NH_3)_5H_2O]^{3+}$ and $[Co(NH_3)_6]^{3+}$
(I) (II) (III)

$\therefore$ III > II > I [as per the $E_{absorbed}$]

$\therefore$ $\lambda_{absorbed}$

I > II > III

Q.23 Match the refining methods (Column I) with metals (Column II).

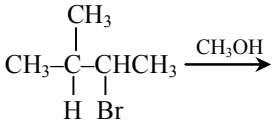
Column I (Refining methods)	**Column II (Metals)**
(I) Liquation	(a) Zr
(II) Zone Refining	(b) Ni
(III) Mond Process	(c) Sn
(IV) Van Arkel Method	(d) Ga

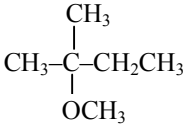
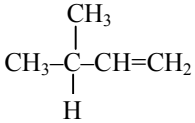
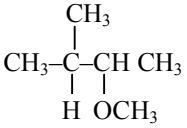
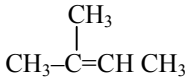
(1) (I)-(c) ; (II)-(a) ; (III)-(b) ; (IV)-(d) (2) (I)-(c) ; (II)-(d) ; (III)-(b) ; (IV)-(a)
(3) (I)-(b) ; (II)-(d) ; (III)-(a) ; (IV)-(c) (4) (I)-(b) ; (II)-(c) ; (III)-(d) ; (IV)-(a)

Ans. **[2]**

Sol. Here we known that from metallurgy for Ni monds process is done for Zr Van Arkel method, for Sn liquation is done and for "Ga" Zone Refining is done.

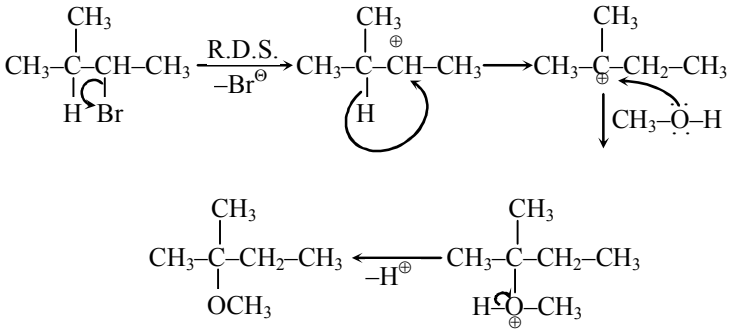
Q.24 The major product of the following reaction is :



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

Ans. **[1]**

Sol. It is SN'–Reaction



Q.25 During the change of O_2 to O_2^-, the incoming electron goes to the orbital :

(1) σ^*2p_z (2) $\pi 2p_y$ (3) π^*2p_x (4) $\pi\ 2p_x$

Ans. **[3]**

Sol. A/c to MOT

For O_2 and O_2^- we follow this

$O_2 \rightarrow\ \sigma/S^2\ ,\ \sigma/1S^2,\ \sigma^*2S^2,\ \sigma 2p_z^2,\ \pi 2p_x^2\ =\ \pi 2p_y^2$

$\pi^*2p_x^1\ =\ \pi^*2p_y^1\ \ \sigma^*2p_z$

$O_2^- \rightarrow \sigma/S^2,\ \sigma^*/S^2\ \ \sigma 2S^2\ \ \sigma^*2S^2\ \ \sigma 2S_z^2\ \ \pi 2p_z^2\ \ \pi 2p_x^2\ =\ \pi 2p_y^2$

$\pi^*2p_x^2\ =\ \pi^*2p_y^1\ \ \sigma^*2p_z$

Q.26 The synonym for water gas when used in the production of methanol is :

(1) fuel gas (2) laughing gas (3) syn gas (4) natural gas

Ans. **[3]**

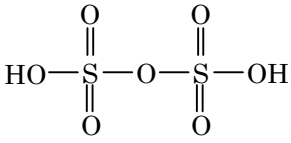
Sol. The synonym for water gas is syn gas.

Q.27 The oxoacid of sulphur that does not contain bond between sulphur atoms is :

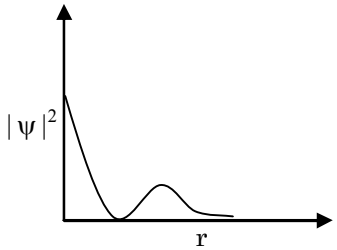
(1) $H_2S_2O_7$ (2) $H_2S_2O_3$ (3) $H_2S_4O_6$ (4) $H_2S_2O_4$

Ans. **[1]**

Sol.



Q.28 The graph between $|\psi|^2$ and r (radial distance) is shown below. This represents :



(1) 3s orbital (2) 2s orbital (3) 2p orbital (4) 1s orbital

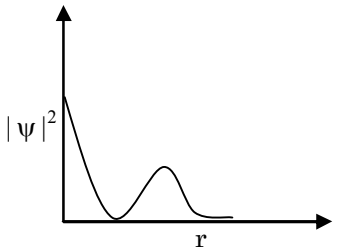
Ans. **[2]**

Sol. We know that for s-orbital graph starts from top and no. of radial mode = $n - \ell - 1$

$\therefore$ for 2 s orbital it will = $2 - 0 - 1$

$= 1$

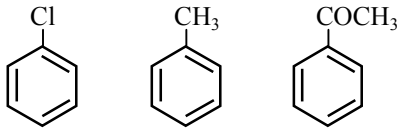
$\therefore$ the graph will be



is of 2 s

Hence option 2 is correct

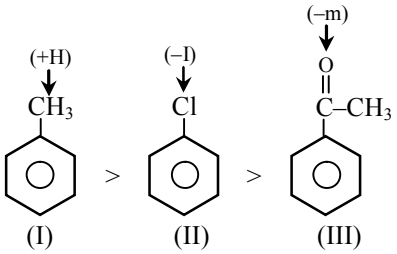
Q.29 The increasing order of the reactivity of the following compounds towards electrophilic aromatic substitution reactions is :



(1) III < II < I (2) III < I < II (3) II < I < III (4) I < III < II

Ans. **[2]**

Sol. Reactivity for electrophilic α $e^{\oplus}$–density aromatic substitution reaction in aromatic ring



Q.30 Which of the following is a condensation polymer ?

(1) Neoprene (2) Buna-S (3) Nylon 6, 6 (4) Teflon

Ans. **[3]**

Sol. $H_2N-(CH_2)_6NH_2 + HOOC-(CH_2)_4-COOH$

Hexamethylene diomine

Adipic acid

$\Delta \downarrow$ $-n.\ H_2O$

$$\left\{ NH-(CH_2)_6NH-\underset{\underset{O}{\|}}{C}-(CH_2)_4-\underset{\underset{O}{\|}}{C} \right\}_n$$