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. The molarity of NaCl solution is 3 M. Calculate the molality of the solution. [Given density of the solution = 1.25 g/mL]

   (1) 2.9 (2) 2.79

   (3) 1.85 (4) 3.85

Answer (2)

Sol. Given molarity of solution = 3 M means 3 moles of NaCl is present in 1000 mL of solution.

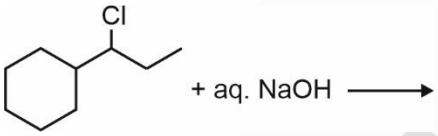
Mass of solution = d × v

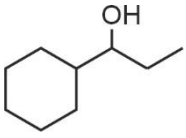
= 1.25 × 1000

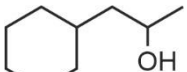
= 1250 g

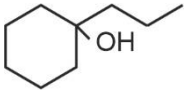
Mass of solute = 3 × 58.5 = 175.5 g

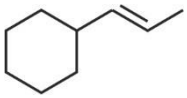
2. Identify the major product formed in the following reaction.



(1) 

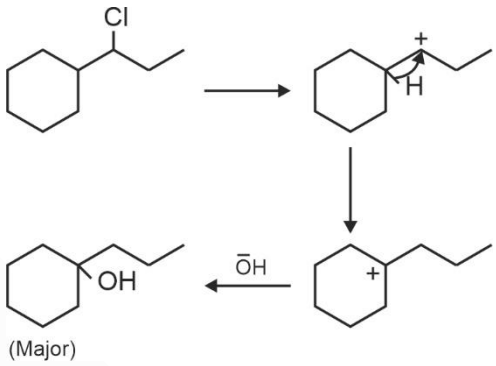
(2) 

(3) 

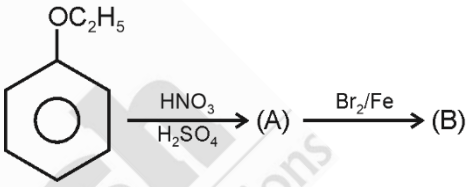
(4) 

Answer (3)

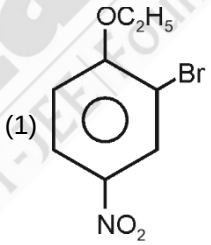
Sol.

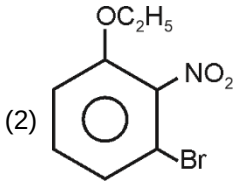


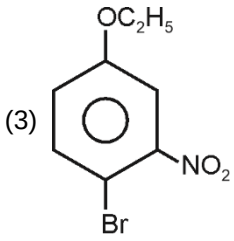
(Major)

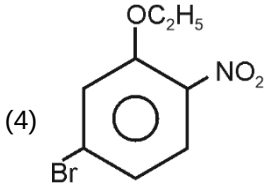
3. 

Product B is:

(1) 

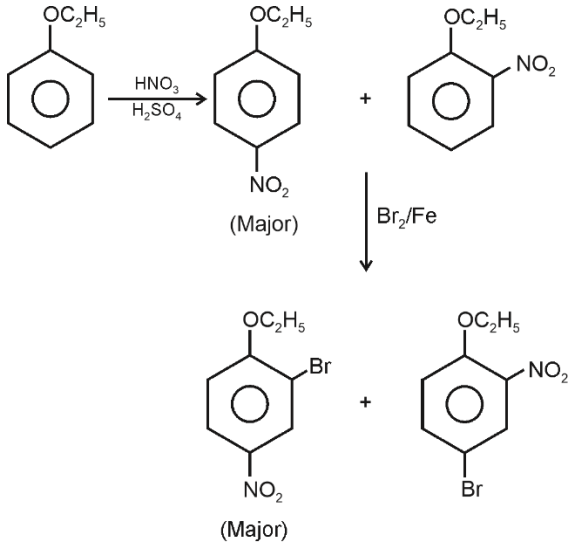
(2) 

(3) 

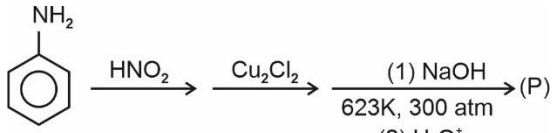
(4) 

Answer (A)

Sol.



4.



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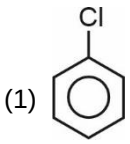
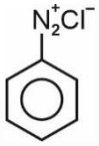
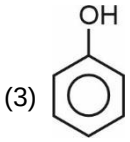
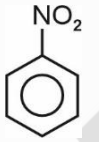
(1) 

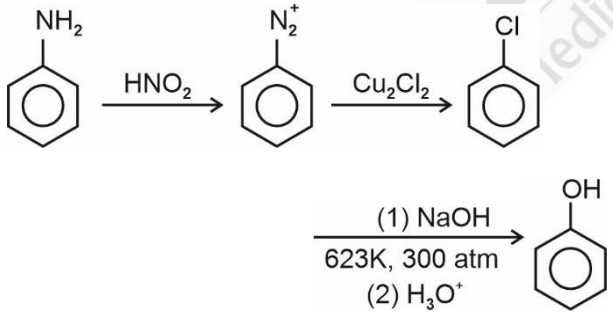
(2) 

(3) 

(4) 

Answer (3)

Sol.



5. Which of the following *d*-block elements has maximum unpaired electron in ground state electronic configuration?

(1) Ti(22) (2) V(23)

(3) Mn(25) (4) Cr(24)

Answer (4)

Sol. Ti(22) = [Ar] $3d^2 4s^2$ n = 2

V(23) = [Ar] $3d^3 4s^2$ n = 3

Mn(25) = [Ar] $3d^5 4s^2$ n = 5

Cr(24) = [Ar] $3d^5 4s^1$ n = 6

Cr(24) has maximum unpaired electron i.e., 6.

6. Find out shortest wavelength of Paschen series for H-atom.

(1) $\frac{9}{R}$ (2) $\frac{16}{R}$

(3) $\frac{144}{7R}$ (4) $\frac{7R}{144}$

Answer (1)

Sol. $\frac{1}{\lambda} = R(1)^2\left(\frac{1}{9} - \frac{1}{\infty}\right)$

$\frac{1}{\lambda} = R\left(\frac{1}{9}\right)$

$\boxed{\lambda = \frac{9}{R}}$

7. Match the column.

	Column-I (Compounds)		Column-II (Configurations)
A.	$TiCl_4$	(1)	$e^3t_2^3$
B.	FeO_4^{2-}	(2)	$e^2t_2^0$
C.	$FeCl_4^{2-}$	(3)	$e^2t_2^3$
D.	$MnCl_4^{2-}$	(4)	$e^0t_2^0$

(1) A(4), B(2), C(1), D(3)

(2) A(4), B(3), C(2), D(1)

(3) A(1), B(2), C(3), D(4)

(4) A(2), B(4), C(3), D(1)

Answer (1)

Sol. $TiCl_4 \Rightarrow Ti^{4+} \Rightarrow e^0t_2^0$

$FeO_4^{2-} \Rightarrow Fe^{6+} \Rightarrow e^2t_2^0$

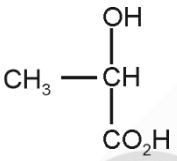
$FeCl_4^{2-} \Rightarrow Fe^{2+} \Rightarrow e^3t_2^3$

$MnCl_4^{2-} \Rightarrow Mn^{2+} \Rightarrow e^2t_2^3$

8. $CH_3COOH \xrightarrow{LiAlH_4} A \xrightarrow{PCC} B \xrightarrow[(ii)\ H^+]{(i)\ CN^-} C \xrightarrow{Hydrolysis} D$

Select the correct option

(1) A is CH_3CHO

(2) D is 

(3) B is CH_3CH_2OH

(4) C is $CH_3CH_2CO_2H$

Answer (2)

Sol. $CH_3COOH \xrightarrow{LiAlH_4} \underset{(A)}{CH_3CH_2OH} \xrightarrow{PCC} \underset{(B)}{CH_3CHO}$

$\xrightarrow[(ii)\ H^+]{(i)\ CN^-}$

$\underset{(C)}{CH_3-CH(OH)-CN} \xrightarrow{Hydrolysis} \underset{(D)}{CH_3-CH(OH)-CO_2H}$

9. Which of the following statement is incorrect-

(1) Enzymes are biocatalyst

(2) Enzymes are not specific

(3) Enzymes are globular protein

(4) Oxidase enzymes catalyse the oxidation of C-N and C-O bonds

Answer (2)

Sol. (1) Enzymes are biocatalyst that catalyse numerous biological process.

(2) They are very specific in nature

(3) Enzymes are mainly globular proteins

(4) Oxidase are enzymes specific to oxidation – reduction reactions involving oxidation of C-N and C-O bonds

10. Find relation between K_P and K_C for given reaction :

$$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g)$$

(1) $K_P = K_C(RT)^1$

(2) $K_P = K_C(RT)^{-1}$

(3) $K_P = K_C(RT)^{1/2}$

(4) $K_P = K_C(RT)^{-1/2}$

Answer (3)

Sol. $K_P = K_C(RT)^{\Delta n_g}$

$$\Delta n_g = \frac{1}{2}$$

$K_P = K_C(RT)^{1/2}$

11. Given for two first order reactions $\frac{t^1_{1/2}}{t^2_{1/2}} = \frac{2}{5}$.

Then $\frac{t^1_{2/3}}{t^2_{4/5}} = ?$

(1) 0.273

(2) 0.468

(3) 0.318

(4) 2.55

Answer (1)

Sol. $\frac{K_2}{K_1} = \frac{2}{5}$

$$t^1_{2/3} = \frac{2.303}{K_1}\log 3$$

$$t^2_{4/5} = \frac{2.303}{K_2}\log 5$$

$$\frac{t^1_{2/3}}{t^2_{4/5}} = \frac{K_2}{K_1}\frac{\log 3}{\log 5}$$

$$= \frac{2}{5} \times \frac{0.477}{0.699}$$

$$= 0.273$$

12. Among the following anions, identify the anion which gives pale yellow precipitate with aq. $AgNO_3$. The precipitate is partially soluble in aq. NH_4OH solution.

(1) I^- (2) Cl^-

(3) Br^- (4) NO_2^-

Answer (3)

Sol. $I^- + Ag^+ \longrightarrow AgI$ (Yellow ppt.)

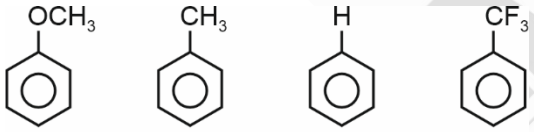
$Cl^- + Ag^+ \longrightarrow AgCl$ (White ppt.)

$Br^- + Ag^+ \longrightarrow AgBr$ (Pale yellow ppt.)

$NO_2^- + Ag^+ \longrightarrow AgNO_2$ (White ppt.)

AgBr is partially soluble in aq. NH_4OH solution whereas AgI is insoluble in aq. NH_4OH solution.

13. Arrange the following compounds in increasing order of electrophilic aromatic substitution.



(i) (ii) (iii) (iv)

(1) (iv) < (iii) < (ii) < (i)

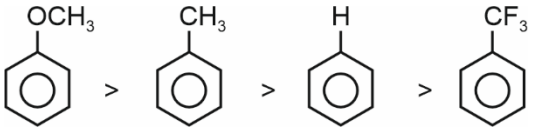
(2) (ii) < (iii) < (iv) < (i)

(3) (iv) < (ii) < (iii) < (i)

(4) (i) < (ii) < (iii) < (iv)

Answer (1)

Sol. Rate of EAS is



(i) is activated due to resonance and (ii) due to hyperconjugation, (iv) is deactivated due to reverse hyperconjugation.

14. IUPAC name of complex compound $[Pt(Br)_2(PPh_3)_2]$.

(1) Dibromido di(triphenyl phosphine) platinum(II)

(2) Dibromido bis(triphenyl phosphine) platinum(II)

(3) bis(triphenyl phosphine) dibromide platinum(II)

(4) bis(triphenyl phosphine) dibromide platinate(II)

Answer (2)

Sol. Dibromido bis(triphenyl phosphine) platinum(II) is the correct IUPAC name of given complex compound.

15.

16.

17.

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 10 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. For a certain reaction. $\Delta_r H$ is 400 kJ/mol and ΔS = 0.2 kJ/mol K. Above what minimum temperature in kelvin, the reaction become spontaneous

Answer (2000)

Sol. For reaction to be spontaneous,

$\Delta G < O$

$\Delta H - T\Delta S < O$

$$T > \frac{\Delta H}{\Delta S} = \frac{400}{0.2} = 2000\ K$$

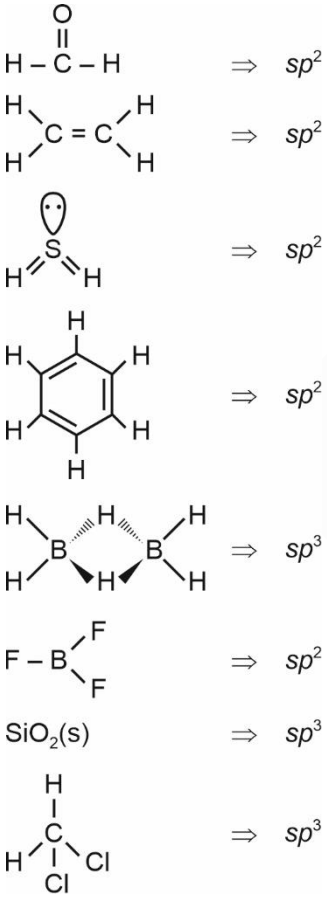
Minimum temperature for spontaneity = 2000 K

22. The number of compounds having central atom is sp^2 hybridised

HCHO, C_2H_4, SO_2, C_6H_6, B_2H_6, BF_3, $SiO_2(s)$, CH_2Cl_2

Answer (5)

Sol.



$SiO_2(s)$ ⇒ sp^3

If steric number is 3, then hybridisation is sp^2.

23. Among the following, how many metal ions act as oxidising agents?

Sn^{2+}, Sn^{4+}, Pb^{4+}, Pb^{2+}, Tl^{+}, Tl^{3+}

Answer (2)

Sol. Due to inert pair effect, Pb^{2+} is more stable than Pb^{4+} and Tl^{+} is more stable than Tl^{3+}. Therefore, Pb^{4+} and Tl^{3+} only will act as oxidising agents

24. Calculate the magnetic moment in B.M. of the one from $VO_2^{\oplus}$, $MnO_4^{\ominus}$ and $Cr_2O_7^{2-}$ which is having least oxidizing property

Answer (0)

Sol. For 3-d transition series,

Oxidizing power $V^{+5} < Cr^{+6} < Mn^{-7}$

μ_{spin} of V^{+5} :

$V^{+5} \rightarrow [Ar]\ 4s^0 3d^0$

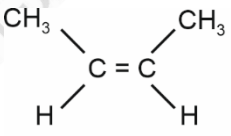
Number of unpaired e^- = 0

μ_{spin} = 0

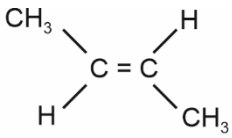
25. How many geometrical isomers are there in but-2-ene?

Answer (2)

Sol. But-2-ene has one stereogenic centre and it has two geometrical isomer as given below.



cis but-2-ene



trans but-2-ene

26.

27.

28.

29.

30.