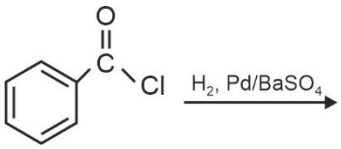
CHEMISTRY

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. What is the name of given reaction?



(1) Etard reaction

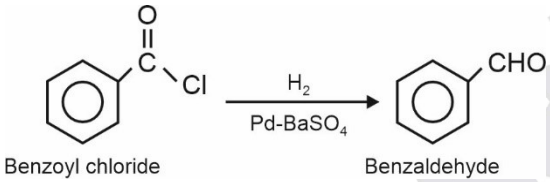
(2) Stephen's reaction

(3) Wolff Kishner reduction

(4) Rosenmund reaction

Answer (4)

Sol. Acyl chloride is hydrogenated over catalyst, palladium or barium sulphate. This reaction is called Rosenmund reaction.



2. Which of the given compound will not give Fehling test?

(1) Lactose

(2) Maltose

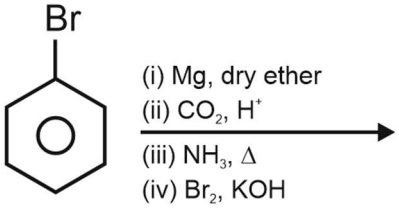
(3) Sucrose

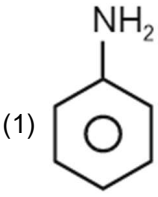
(4) Glucose

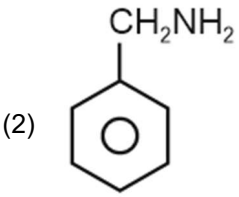
Answer (3)

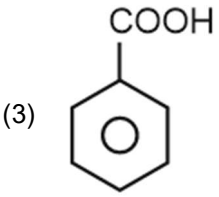
Sol. Sucrose is non-reducing sugar. It does not reduce Fehling solution.

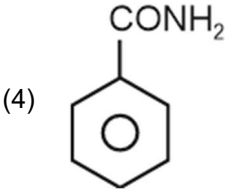
3. Find final product of reaction given below



(1) 

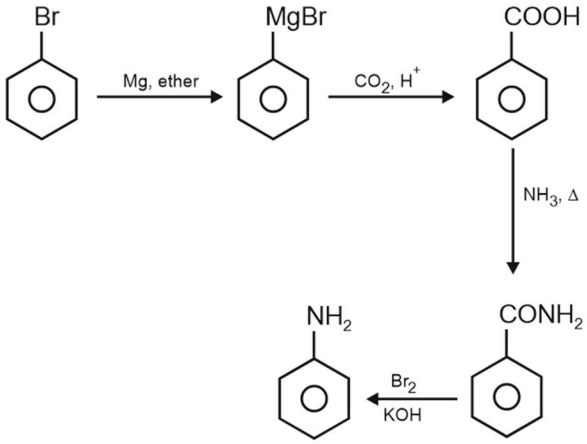
(2) 

(3) 

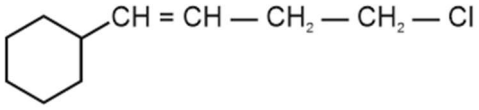
(4) 

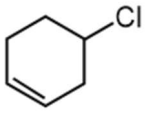
Answer (1)

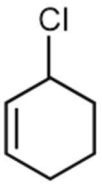
Sol.

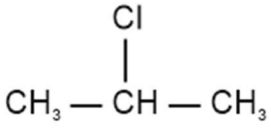


4. Which of the following has allylic halogen?

(1) 

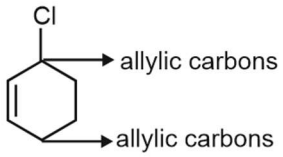
(2) 

(3) 

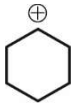
(4) 

Answer (3)

Sol. The carbon next to an alkene is known as allylic carbon and halogen attached to allylic carbon is known as allylic halogen.

e.g. 

5. Which of the following compound or ion is most stable?

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

Answer (3)

Sol.  is most stable due to aromatic character. It has $2\pi e^-$ and follow $(4n + 2)\pi e^-$ Huckel rule.

6. Which of the following set contains both diamagnetic ions?

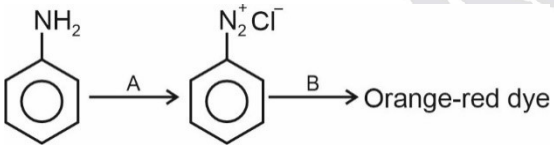
(1) Ni^{2+}; Cu^{2+}
(2) Eu^{3+}; Gd^{3+}
(3) Cu^{+}; Zn^{2+}
(4) Ce^{4+}; Pm^{3+}

Answer (3)

Sol. Cu : $4s^1 3d^{10}$; Cu^+ : $4s^0 3d^{10}$

Zn : $4s^2 3d^{10}$; Zn^{2+} : $4s^0 3d^{10}$

7. Consider the following sequence of reactions

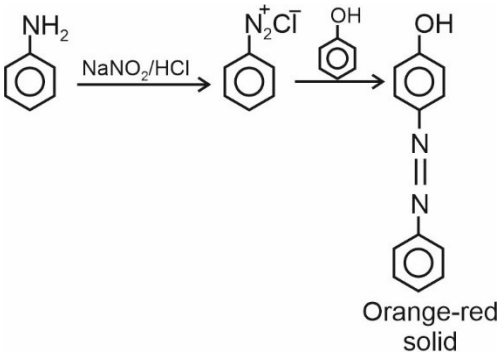


Select the option with correct A and B respectively.

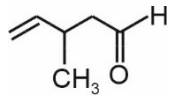
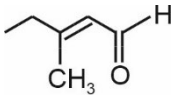
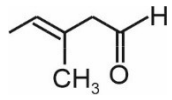
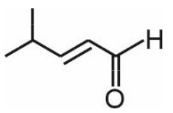
(1) HNO_3, Phenol
(2) $NaNO_2$/HCl, Phenol
(3) HNO_3, Aniline
(4) $NaNO_2$/HCl, Aniline

Answer (2)

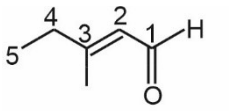
Sol.



8. Which of the following is the correct structure for the given IUPAC name "3-Methylpent-2-enal"

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

Answer (2)

Sol. 

3-Methylpent-2-enal

Functional group should get lowest possible number.

9. The group number of Unununium is

(1) 11
(2) 12
(3) 6
(4) 14

Answer (1)

Sol. Group number = 11 (Atomic number = 111)

10. What is the Geometry of Aluminium chloride in aqueous solution?

(1) Square planar
(2) Octahedral
(3) Tetrahedral
(4) Square pyramidal

Answer (2)

Sol. $AlCl_3$ exists as

$[Al(H_2O)_6]Cl_3$ in aqueous solution.

11. **Statement-I:** For hydrogen atom, 3*p* and 3*d* are degenerate.

Statement-II: Degenerate orbitals have same energy.

(1) Both statement-I and II are correct
(2) Both statement-I and II are incorrect
(3) Statement-I is correct, statement-II is incorrect
(4) Statement-I is incorrect, statement-II is correct

Answer (1)

Sol. For hydrogen atom energy of orbitals only depends on value of principal quantum number

$1s < 2s = 2p < 3s = 3p = 3d < 4s = 4p = 4d = 4f$

Degenerate orbitals have same energy.

12. Consider the following sequence of reactions

$CH_3 - C \equiv CH \xrightarrow{Na} A \xrightarrow{B} CH_3 - C \equiv C - CH_2 - CH_2 - CH_3$

Select A and B respectively

(1) $CH_3 - CH = CH_2$, $CH_3 - CH_2 - Cl$

(2) $CH_3 - C \equiv CNa$, $CH_3 - CH_2 - Cl$

(3) $CH_3 - C \equiv CNa$, $CH_3 - CH_2 - CH_2 - Cl$

(4) $CH_3 - C \equiv C - CH_3$, $CH_3 - CH_2 - CH_2 - Cl$

Answer (3)

Sol. $CH_3 - C \equiv CH \xrightarrow{Na} \underset{(A)}{CH_3 - C \equiv CNa} + H_2(g)$

$\downarrow CH_3 - CH_2 - CH_2 - Cl$ (B)

$CH_3 - C \equiv C - CH_2 - CH_2 - CH_3$

13. Choose the correct option.

	Column-I (Molecule)		Column-II (Shape)
a.	BrF_5	(i)	See-saw
b.	H_2O	(ii)	T-shape
c.	ClF_3	(iii)	Bent
d.	SF_4	(iv)	Square pyramidal

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

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

Answer (1)

Sol. BrF_5 – Square pyramidal

H_2O – Bent

ClF_3 – T-shape

SF_4 – See-saw

14. Assertion (A) : While moving from N to P covalent radius increases significantly but from As to Bi only a small increase is observed.

Reason (R) : For a particular oxidation state covalent radii and ionic generally radii increases down the group.

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(3) (A) is correct but (R) is incorrect

(4) (A) is incorrect but (R) is correct

Answer (2)

Sol. Covalent and ionic (in a particular state) radii increases in size down the group. There is a considerable increase in covalent radius from N to P. However, from As to Bi only a small increase in covalent radii is observed. This is due to the presence of completely filled *d* and *f*-orbitals in heavier elements. (lanthanoid contraction)

15. Match the following and select the correct option.

	List I		List II
a.	Mn^{2+}	(i)	$3d^3\ 4s^1$
b.	V^+	(ii)	$3d^5\ 4s^0$
c.	Cr^+	(iii)	$3d^6\ 4s^0$
d.	Fe^{2+}	(iv)	$3d^4\ 4s^1$

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

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

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

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

Answer (3)

Sol. Mn^{2+} : $3d^5\ 4s^0$

V^+ : $3d^3\ 4s^1$

Cr^+ : $3d^5\ 4s^0$

Fe^{2+} : $3d^6\ 4s^0$

16. What happen to freezing point of benzene, when small amount of naphthalene is added to benzene?

(1) Increases

(2) Decreases

(3) Remains unchanged

(4) First decreases and then increases

Answer (2)

Sol. When small amount of naphthalene is added to benzene, depression in freezing point takes place and freezing point of benzene decreases.

17. A mixture is heated with dilute H_2SO_4 and the lead acetate paper turns black by the evolved gas. The mixture contains

(1) Sulphite (2) Sulphide

(3) Sulphate (4) Thiosulphate

Answer (2)

Sol. Sulphide $\xrightarrow{\text{dil } H_2SO_4} H_2S(g)$

$Pb(CH_3CO_2)_2 \xrightarrow{H_2S} \underset{\text{Black}}{PbS} + CH_3CO_2H$

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. Find out sum of coefficients of all the species involved in balance equation

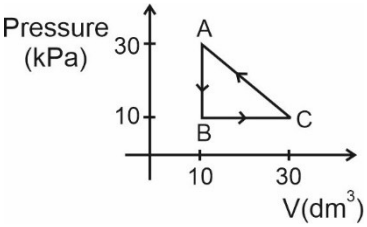
$2MnO_4^- + I^- \xrightarrow[\text{Medium}]{\text{Alkaline}}$

Answer (9)

Sol. $I^- + H_2O + 2MnO_4^- \rightarrow 2MnO_2 + 2OH^- + IO_3^-$

Sum of coefficients = 9

22. Find work done in following cyclic process (in J).



Answer (200)

Sol. Work done in cyclic process

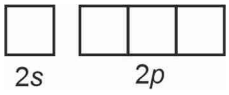
= area inside the figure

$= \frac{1}{2} \times 20 \times 20 = 200$ J

23. Maximum number of hybrid orbitals formed when 2*s* and 2*p* orbitals of a single atom are mixed.

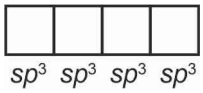
Answer (4)

Sol. When 2*s* and 2*p* orbitals are mixed, maximum 4 hybrid orbitals are formed



mixed together

to form



4 sp^3 hybrid orbitals are formed of same energy.

24. The rate of first order reaction is 0.04 mol lit^{-1} sec^{-1} at 10 sec and 0.03 mol lit^{-1} sec^{-1} at 20 sec. Calculate half-life of first order reaction (in sec).

Answer (24)

Sol. $\frac{0.04}{0.03} = \frac{k \times C_0 e^{-k(10)}}{k \times C_0 e^{-k(20)}} = e^{10k}$

$10k = \ln\left(\frac{4}{3}\right)$

$k = \frac{1}{10}\ln\left(\frac{4}{3}\right)$

$t_{\frac{1}{2}} = \frac{\ln 2}{k}$

$= \frac{\ln 2}{\ln\left(\frac{4}{3}\right)} \times 10$

= 24 sec.

25. The number of atoms in a silver plate having area 0.05 cm^2 and thickness 0.05 cm is _____ $\times 10^{19}$

Density of silver is 7.9 g/cm^3

Answer (11)

Sol. Volume = Area × Thickness

$= 0.05 \times 0.05\ cm^3$

$= 0.0025\ cm^3$

Mass of silver = 7.9 × 0.0025 g

Moles of silver = $\frac{7.9 \times 0.0025}{108}$

Number of silver atoms

$= \frac{7.9 \times 0.0025}{108} \times 6.022 \times 10^{23}$

$\Rightarrow$ Number of silver atoms $= 0.001101 \times 10^{23}$

$= 11.01 \times 10^{19}$

26. The ratio of magnitude of potential energy and kinetic energy for 5th excited state of hydrogen atom is

Answer (2)

Sol. According to Bohr model, PE = –2KE

27. 250 mL solution of CH_3COONa of molarity 0.35 M is prepared. What is the mass of CH_3COONa required in grams? (Nearest integer)

Answer (7)

Sol. Molarity = $\frac{\text{Number of moles of solute}}{\text{Volume of solution in litre}}$

Moles of solute = $\frac{\text{Weight}}{\text{Molecular weight}}$

$0.35 = \frac{W}{MW(CH_3COONa)} \times \frac{1000}{25}$

$W = \frac{0.35 \times 82 \times 250}{1000}$

$W = \frac{7175}{1000} = 7.175$ g

Mass of CH_3COONa required to prepare 250 mL of 0.35 M solution is 7.175 g.

28. The K_{sp} of $Mg(OH)_2$ is 1×10^{-12}, 0.01 M Mg^{2+} ion will precipitate at the limiting pH equal to _____ (at 25°C).

Answer (9)

Sol. $Mg(OH)_2(s) \rightleftharpoons Mg^{2+}(aq) + 2OH^-(aq)$

$K_{sp} = [Mg^{2+}](OH^-]^2$

$K_{sp} = 0.01\ [OH^-]^2$

$\frac{1 \times 10^{-12}}{0.01} = [OH^-]^2$

$[OH^-] = \sqrt{1 \times 10^{-10}}$

$[OH^-] = 10^{-5}$

pOH = 5

pH = 14 –5 = 9

29.

30.