1. Which of the following statements is incorrect regarding defects in solid.
   (1) In Schottky defect density decreases
   (2) In Frenkel defect density remain unchanged
   (3) In interstitial defect density increases
2. If work function of a metal is $6.63 \times 10^{-19}$ J, minimum wave length of photon which is just sufficient to eject electron from metal surface is ___ nm. (Given $h = 6.63 \times 10^{-34}$ J/sec)

**Ans. 300**

**Sol.**

For just ejection of electron

$$E = \frac{hc}{\lambda}$$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{3 \times 10^{-9}}$$

$$\lambda = 3 \times 10^{-7} \text{ m}$$

$$= 300 \times 10^{-9} \text{ m}$$

$$= 300 \text{ nm}$$

3. What is the correct electronic configuration of an element which is just above 16th group 4th period element

(1) $4s^2 3d^9 4p^4$  
(2) $2s^2 2p^4$  
(3) $3s^2 3p^4$  
(4) $5s^2 5d^10 4p^4$

**Ans. 3**

**Sol.**

16th group  
2nd $\mu O$  
3rd $\mu S$  
4th $\mu Se$  
5th $\mu Te$

4. How many charge in Faraday's is required in conversion of 1 mole $Cr_2O_7^{2-}$ in to $Cr^{3+}$

**Ans. 6**

**Sol.**

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

1 mole 6 mole

Charge = 6F

5. For 2 mole of an ideal mono atomic gas at 300 K calculate internal energy. (Given $R = 8.31$ J/mol x k)

**Ans. 7479**

**Sol.**

$$U = \frac{2}{2}RT$$

$$= \frac{2}{2} \times 2 \times 8.31 \times 300$$

$$= 7479 \text{ J}$$

6. An ideal gas expands isothermally from 4 lit. to 20 lit. against vaccum, then how much amount of heat is absorbed?

**Ans. 0**

**Sol.**

Work done against vaccum = 0

As process is isothermal so $\Delta U = 0$

$$\Delta U = q + w$$

so $q = 0$
7. For a first order reaction \( \ln(\frac{t_{100}}{t_{50}}) = \ln(3) \) then value of \( x \) is ______

(Report your answer to nearest integer)

Ans. (16)

Sol. \( \ln(\frac{t_{100}}{t_{50}}) = \ln(3) \)

\[
\ln(\frac{t_{100}}{t_{50}}) = \ln(3)
\]

\[
\ln(100) - \ln(33) = \ln(2)
\]

\[
\frac{\ln(100)}{\ln(2)} - \frac{\ln(33)}{\ln(2)} = 1.585
\]

So \( x = 15.85 \)

---

8. Dihydrogen react with \( \text{CuO} \) and form:
   (1) \( \text{Cu} \)  (2) \( \text{Cu(OH)}_2 \)  (3) \( \text{CuH}_2 \)  (4) \( \text{Cu}_2\text{O} \)

Ans. (1)

Sol. \( \text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O} \)

9. Vapour pressure of pure \( A \) is 50 mm of Hg and vapour pressure of pure \( B \) is 100 mm of Hg in mixture of
   liquid \( A \) and \( B \) mole fraction of \( A \) is 0.3, then mole fraction of \( B \) in vapour phase is \( \frac{42}{17} \).

Ans. (14)

Sol. \( P_{\text{Total}} = P_{A}x_{A} + P_{B}x_{B} \)

\[
= (50)(0.3) + (100)(0.7) = 15 + 70 = 95 \text{ mm of Hg}
\]

\( P_{A} = (P_{\text{Total}})Y_{A} \)

\( = 70 = (85)Y_{A} \)

\( Y_{A} = \frac{70}{85} = \frac{14}{17} \)

10. Zeta potential is related to:
   (1) Brownian movement  (2) Tyndall effect  (3) Colour  (4) Charge on colloid

Ans. (4)

Sol. This potential difference between the fixed layer and diffused layer of opposite charges is called
   electrokinetic potential or zeta potential.

\[
Z = \frac{4\pi n \mu}{D}
\]

\( n = \text{Viscosity coefficient} \)

\( D = \text{Dielectric constant of medium} \)

\( \mu = \text{Velocity of colloidal particle when an electric field is applied} \)

\[
\text{e.g.} \quad \text{AgNO}_3 + \text{KI} \rightarrow \text{AgI} + \text{KNO}_3
\]

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11. S1: EsO3 is less acidic than EsO5 (element E is belongs to 15th group).
S2: EsO3 acidic strength decreases down the group (element E is belongs to 15th group).
(1) Both S1 & S2 are true
(2) Both S1 & S2 are false
(3) S1 is true & S2 is false
(4) S1 is false & S2 is true
Ans. (1)

Sol. S1: In 15th group oxide higher the oxidation state of element higher is acidic character.
Example: P2O5 less acidic than P2O3.

15th group

N2O5 Acidic
P2O5 Acidic
As2O5 Amphoteric
Sb2O5 Amphoteric
Bi2O3 Basic

12. In how many of the following synergic bonding is present:
(i) [Mn(CO)5] (ii) [Mn(CO)6] (iii) [Cr(CO)6]
Ans. (3)

Sol. The M—Cx bond is formed by the donation of a pair of electrons from a filled d orbital of metal into the vacant antibonding* orbital of carbon monoxide. Thus carbon monoxide acts as a donor (OC → M) and a σ acceptor (OC ← M), with the two interactions creating a synergic effect which strengthens the bond between CO and the metal as shown in figure.

Synergic bonding

13. Assertion: Below 1350°C Mg reduces Al2O3 above 1350°C Al reduces MgO.
Reason: Mg melting point & boiling point is less than Al.
(1) Assertion and reason both are correct and reason is correct explanation of assertion.
(2) Assertion and reason both are correct statements but reason is not correct explanation of assertion.
(3) Assertion is correct but reason is wrong statement.
(4) Assertion is wrong but reason is correct statement.
Ans. (2)
Sol. Below 1350°C graph of ΔGº vs T of MgO is lower than Al₂O₃ while above 1350°C graph of MgO is above than Al₂O₃ so assertion is true.

Mg
M.P. 924 K
B.P. 1363 K

14. Which of the following f block element is most stable in divalent oxidation state?
(1) Sm
(2) Eu
(3) Tb
(4) Ce

Ans. (2)

Sol. Eu³⁺ = [Xe]⁴f¹⁰ ⁶s² ⁶p²
Sm³⁺ = [Xe]⁴f¹⁰ ⁶s² ⁶p²
Tb³⁺ = [Xe]⁴f¹⁴ ⁶s²
Ce³⁺ = [Xe]⁴f¹⁰ ⁵d¹ ⁶s²
Eu⁴⁺ = [Xe]⁴f¹⁰
Sm⁴⁺ = [Xe]⁴f¹⁰
Tb⁴⁺ = [Xe]⁴f⁶
Ce⁴⁺ = [Xe]⁴f⁶

15. Which of the following compound on thermal decomposition gives nitrogen gas.
(1) Ba(NO₃)₂
(2) NaNO₂
(3) Ba(NO₂)₂
(4) NaNO₃

Ans. (1)

Sol. Ba(NO₃)₂ → Ba + NO₂
2NaNO₂ → Na₂O + NO + NO₂
NaNO₂ → NaNO₂ + O₂
Ba(NO₂)₂ → BaO + NO₂ + O₂

16. S₁: Hybridisation of [Ni(CN)₄]²⁻ is dsp² with square planar geometry & diamagnetic character while hydridation of [Ni(CO)₄] is sp³ with tetrahedral geometry and paramagnetic character.
S₂: [NiCl₂]²⁻ and [Ni(CO)₄] have same geometry and hybridisation and both are paramagnetic and have same d orbital configuration.
(1) Both S₁ & S₂ are true
(2) Both S₁ & S₂ are false
(3) S₁ is true & S₂ is false
(4) S₁ is false & S₂ is true

Ans. (2)

Sol. [Ni(CN)₄]²⁻ → Ni²⁻ → 3d⁸ → ⁴s⁰ → dsp² = Square planar = diamagnetic
[Ni(CO)₄] → Ni → 3d⁸ → ⁴s² → sp³ = Tetrahedral = paramagnetic
[NiCl₂]²⁻ → Ni²⁻ → 3d⁸ → ⁴s⁰ → sp² = Tetrahedral = paramagnetic

17. Hybridisation of PF₅ is SP³d₄, then value of Y is:

Ans. (1)

Sol. Hybridisation of PF₅ is sp³d⁴.
So, Y = 1

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18. Which force is responsible for stability of helical structure in α-helix protein.
(1) Vander wall force
(2) Hydrogen bonding
(3) P interaction
(4) Dipole interaction

Ans. (2)

19. Which of the following is aromatic:

(A) [Diagram A]
(B) [Diagram B]
(C) [Diagram C]
(D) [Diagram D]
20. The product of given reaction is:

\[
\begin{align*}
\text{NH}_2\text{H}_2\text{O} & \xrightarrow{1} \text{H}_2\text{O} \\
\text{Br} & \xrightarrow{2} \text{Br} & \text{OH} & \xrightarrow{2} \text{Br}
\end{align*}
\]

Ans. (2)

21. Which of the following does not give SN1 reaction?

\[
\begin{align*}
\text{Cl} & \xrightarrow{2} \text{Cl} & \text{H} & \xrightarrow{3} \text{Cl}
\end{align*}
\]

Ans. (2)

22. Which of the given is not a pesticide.

(1) D.D.T.  (2) Organophosphate  (3) Sodium arsenate  (4) Daidrin

Ans. (3)

23. The violet coloured complex formed in Lassaigne test is:

(1) \(\text{Na}_4[\text{Fe}^3\text{CN}_6]\)  (2) \(\text{Na}_2[\text{Fe}^2\text{CN}_6]\)  (3) \(\text{K}_4[\text{Fe}^3\text{CN}_6]\)  (4) \(\text{Fe}_4[\text{Fe}^3\text{CN}_6]_3\)

Ans. (1)

24. Which is not a copolymer.

(1) PHBV  (2) Neoprene  (3) Buna-S  (4) Butadiene-styrene

Ans. (2)

25. Reaction of 1° aliphatic amine with HNO₃ at 273 K initially gives a product, but if temperature is increased to 298, the product formed is:

(1) Nitrile  (2) Alcohol  (3) Diazonium salt  (4) Secondary amine

Ans. (2)

26. Product of the following reaction is:

\[
\begin{align*}
\text{Ph} & \xrightarrow{2} \text{Br} & \text{Br} & \xrightarrow{2} \text{Ph}
\end{align*}
\]

Ans. (2)

27. 0.5 gram of an organic compound gives 0.4 gram of dry AgBr ppt. % of Br in organic compound is [At. Wt. of Ag = 108, At. Wt. of Br = 80]

Ans. (34)
Sol.
Wt. of AgBr = 0.4 g
Wt. of Ag = 0.4
g
Wt. of Br = \( \frac{0.4}{188} \times 80 \) g
\% of Br = \( \frac{80}{188} \times 100 \) % = 34%

28. In the given reaction, A is:

\[ \text{Ph-CHO} + \text{Ph-CHO} \xrightarrow{1. NaOH, 2. D, O} A + \text{Ph-CH(OH)}_2 \]

(1) \( \text{Ph-C-H} \)  
(2) \( \text{Ph-C-D} \)  
(3) \( \text{Ph-C-H} \)  
(4) \( \text{Ph-C-D} \)

Ans. (1)

29. In thin layer chromatography. Which of the following is not used to visualise the separated layer.

(1) Visualising agent in mobile phase  
(2) Spraying of suitable reagent  
(3) UV light  
(4) Is solid

Ans. (1)

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