1. The compound that does not produce nitrogen gas by thermal decomposition is:

    A. $(NH_4)_2SO_4$

    B. $Ba(N_3)_2$

    C. $(NH_4)_2Cr_2O_7$

    D. NH_4NO_2

2. The half life period $(t_{1/2})$ of a reaction is halved as the initial concentration of the reactant is doubled. What is the order of the reaction ?

    A. Zero

    B. First

    C. Second

    D. Pseudo first

3. Match the Xenon compound in Column-I with its structure in Column-II and assign the correct code:

Column - I	Column - II
1. XeF_4	a. Pyramidal
2. XeF_6	b. Square planar
3. $XeOF_4$	c. Distorted octahedral
4. XeO_3	d. Square pyramidal

    A. 1-b, 2-c, 3-d, 4-a

    B. 1-a, 2-d, 3-b, 4-c

    C. 1-b, 2-d, 3-c, 4-a

    D. 1-b, 2-d, 3-c, 4-a

4. Which of the statements for a catalyst is correct?

   A. Catalyst may form intermediates with the reactants

   B. The surface of a catalyst adsorbs reactants

   C. It does not alter energy of activation

   D. Action of enzyme catalyst is always specific

5. In a first order reaction, if the time taken for completion of 50 percent of the reaction is t seconds, then the time required for completion of 99.9 percent of the reaction is

   A. $2\,t$

   B. $10\,t$

   C. $4\,t$

   D. $3\,t$

6. The rate of a chemical reaction doubles for every $10^{\circ}C$ rise of temperature. If the temperature is raised by $50^{\circ}C$, the rate of the reaction increases by about:

   A. 64 times

   B. 10 times

   C. 24 times

   D. 32 times

7. A solution containing $62\ g$ ethylene glycol in $250\ g$ water is cooled to $-10°C$. If K_f for water is $1.86\ K\ kg\ mol^{-1}$, the amount of water $(in\ g)$ separated as ice is

   A. 64

   B. 32

   C. 16

   D. 48

8. A set of solutions is prepared using $180\ g$ of water as a solvent and $10\ g$ of different non-volatile solutes $A,\ B\ and\ C$. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of $A = 100\ g\ mo1^{-1};\ B = 200\ g\ mol^{-1};\ C = 10,000\ g\ mol^{-1}$]

   A. $A > C > B$

   B. $C > B > A$

   C. $A > B > C$

   D. $B > C > A$

9. Given that the standard potentials (E^0) of Cu^{2+}/Cu and Cu^+/Cu are $0.34\ V$ and $0.522\ V$ respectively, the E^0 of Cu^{2+}/Cu^+ is-

   A. $+0.158\ V$

   B. $0.182\ V$

   C. $-0.158\ V$

   D. $-0.182\ V$

10. The parameters of the unit cell of a substance are,
    $a = 2.5$, $b = 3.0$, $c = 40$, $\alpha = 90°$, $\beta = 120°$, $\gamma = 90°$
    The crystal system of the substance is:

    A. Monoclinic

    B. Hexagonal

    C. Orthorhombic

    D. Triclinic

11. $CsCl$ crystallises in body centred cubic lattice. If $'a'$ is its edge length then which of the following expressions is correct?

    A. $r_{Cs^+} + r_{Cl^-} = 3a$

    B. $r_{Cs^+} + r_{Cl^-} = \dfrac{3a}{2}$

    C. $r_{Cs^+} + r_{Cl^-} = \dfrac{\sqrt{3}}{2}a$

    D. $r_{Cs^+} + r_{Cl^-} = \sqrt{3}a$

12. Consider the follwoing reduction processes :
    $Zn^{2+} + 2e^- \rightarrow Zn(s);\ E^0 = -0.76\ V$
    $Ca^{2+} + 2e^- \rightarrow Ca(s);\ E^0 = -2.87\ V$
    $Mg^{2+} + 2e^- \rightarrow Mg(s);\ E^0 = -2.36\ V$
    $Ni^{2+} + 2e^- \rightarrow Ni(s); E^0 = -0.25\ V$

    The reducing power of the metals increases in the order :

    A. $Ca < Zn < Mg < Ni$

    B. $Ni < Zn < Mg < Ca$

    C. $Zn < Mg < Ni < Ca$

    D. $Ca < Mg < Zn < Ni$

13. The rate of a certain biochemical reaction at physiological temperature (T) occurs 10^6 times faster with enzyme than without. The change in the activation energy upon adding enzyme is

    A. $-6RT$

    B. $+6RT$

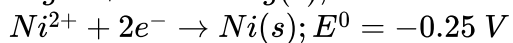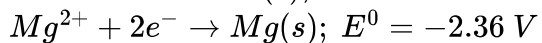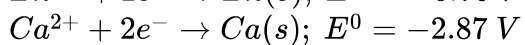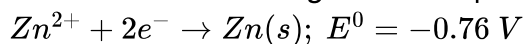   C. $+6(2.303)RT$

    D. $-6(2.303)RT$

14. Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. Which of the following orders is correct for the activation energies of these reactions?
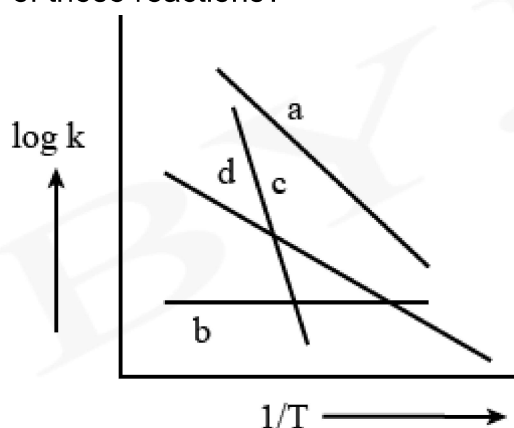
    A. $E_b > E_a > E_d > E_c$

    B. $E_c > E_a > E_d > E_b$

    C. $E_a > E_c > E_d > E_b$

    D. $E_b > E_d > E_c > E_a$

15. Which of the following statement is correct?

    A. Nature of the gases affect adsorption of gases on solids.

    B. Nature of adsorbent do not affect adsorption of gases on solids

    C. Nature of adsorbent affects adsorption of gases on solids

    D. Both (a) and (c)

16. Consider the follwoing reduction processes :
$Zn^{2+} + 2e^- \rightarrow Zn(s);\ E^0 = -0.76\ V$
$Ca^{2+} + 2e^- \rightarrow Ca(s);\ E^0 = -2.87\ V$
$Mg^{2+} + 2e^- \rightarrow Mg(s);\ E^0 = -2.36\ V$
$Ni^{2+} + 2e^- \rightarrow Ni(s);\ E^0 = -0.25\ V$

The reducing power of the metals increases in the order :

A. $Ca < Zn < Mg < Ni$

B. $Ni < Zn < Mg < Ca$

C. $Zn < Mg < Ni < Ca$

D. $Ca < Mg < Zn < Ni$

17. Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as shown below. The radius of atom B is twice that of atom A. The unit cell edge length is $50\ \%$ more in solid 2 than in 1. What is the approximate packing efficiency in solid 2?
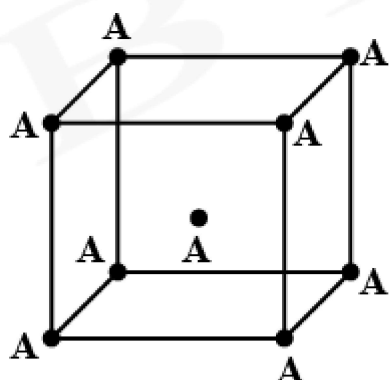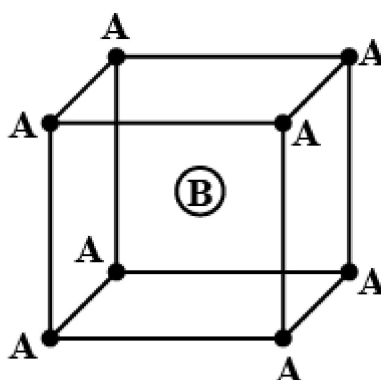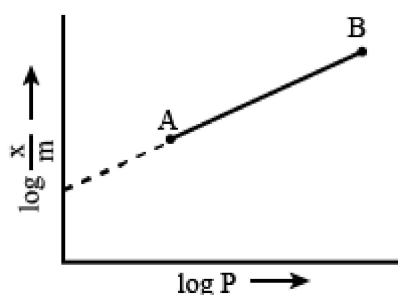

Solid 1   Solid 2

A. $45\ \%$

B. $65\ \%$

C. $75\ \%$

D. $90\ \%$

18. In Freundlich adsorption isotherm, slope of AB line is :

A. n with $(n = 0.1 \ to \ 0.5)$

B. $\dfrac{1}{n}$ with $\left(\dfrac{1}{n} = 0 \ to \ 1\right)$

C. log n with $(n > 1)$

D. $log \ \dfrac{1}{n}$ with $(n < 1)$

19. The set having ions which are coloured and paramagnetic both is

A. Cu^{2+}, Cr^{3+}, Sc^{+}

B. Cu^{+}, Zn^{2+}, Mn^{4+}

C. Sc^{3+}, V^{5+}, Ti^{4+}

D. $Ni^{2+}, Mn^{7+}, Hg^{2+}$

20. The correct order of following $3d$ metal oxides, according to their oxidation number is

$(a) \ CrO_3$
$(b) \ Fe_2O_3$
$(c) \ MnO_2$
$(d) \ V_2O_5$
$(e) \ Cu_2O$

A. (a) > (d) >(c)>(b)>(e)

B. (d) >(a)>(b)>(c)>(e)

C. (a)>(c)>(d)>(b)>(e)

D. (c)>(a)>(d)>(e)>(b)

21. A copper complex crystallising in a CCP lattice with a cell edge of $0.4518\ nm$ has been revealed by employing X-ray diffraction studies. The density of a copper complex is found to be $7.62\ g\ cm^{-3}$.
    The molar mass of copper complex is _____
    $g\ mol^{-1}$. (Nearest integer) [Given : $N_A = 6.022 \times 10^{23}\ mol^{-1}$]

22. C_6H_6 freezes at $5.5^0 C$. The temperature at which a solution of 10 g of C_4H_{10} in 200 g of C_6H_6 freeze in ^0C is (nearest integer)
    (The molal freezing point depression constant of C_6H_6 is $5.12^0 C/m$)

23. The magnitude of the change in oxidising power of the MnO_4^-/Mn^{2+} couple is $x \times 10^{-4}V$, if the H^+ concentration is decreased from $1\ M$ to $10^{-4}M\ 25^oC$. (Assume concentration of MnO_4^- and Mn^{2+} to be same on change in H^+ concentration) . The value of x is: (Rounded off to the nearest integer)
    $$\left[\text{Given;} \frac{2.303RT}{F} = 0.059\right]$$

24. The number of 4f electrons in the ground state electronic configuration of Gd^{2+} is _____.
    [Atomic number of Gd $= 64$]

25. How many structures are correct from below
    (i) In diborane 12 valence e^- are involved in bonding
    (ii) In diborane, two boron and four terminal hydrogen, lie in the same plane.
    (iii) Diborane has ethane-like structure
    (iv) In diborane, bridging bonds are 3-centre 2- electron bond

26. 1 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised . The boiling point of the solution at 1 atm in K is (Rounded -off to the nearest integer)

    $$\left[K_b\ for\ (H_2O) = 0.53\ K\ mol^{-1}\right]$$

27. CO_2 gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO_2 adsorbed becomes 64 times when the pressure of CO_2 is doubled. the value of n in the Freundlich isotherm equation is $x \times 10^{-2}$. The value of x (Round off to the Nearest integer)

28. The molar conductivities at infinite dilution of barium chloride, sulphuric acid and hydrochloric acid are 280, 860 and 426 S $cm^{(2)}$ mol^{-1} respectively. The molar conductivity at infinite dilution of barium sulphate is ___ S cm^2 mol^{-1}. (Round off to the Nearest Integer)

29. A copper complex crystallising in a CCP lattice with a cell edge of $0.4518\ nm$ has been revealed by employing X-ray diffraction studies. The density of a copper complex is found to be $7.62\ g\ cm^{-3}$.
The molar mass of copper complex is _____
$g\ mol^{-1}$. (Nearest integer) [Given : $N_A = 6.022 \times 10^{23}\ mol^{-1}$]

30. In the ground state of atomic $Fe(Z = 26)$, the spin-only magnetic moment is $x \times 10^{-1} BM$.
(Round off to the Nearest Integer).