CBSE POINT, BALASORE

CLASSROOM EXAMINATION (2025-26)

SUBJECT-CHEMISTRY

TIME: 3 HR **CLASS-XI** **FM-60**

General Instructions:

- *There are **32** questions. All questions are compulsory.*
- *This question paper has four sections: Section **A**, Section **B**, Section **C**, Section **D**.*
- ***Section A** consists of **10** multiple-choice questions carrying **1** marks each.*
- ***Section B** consists of **10** very short answer questions carrying **2** marks each.*
- ***Section C** consists of **2** case-based questions carrying **4** marks each.*
- ***Section D** consists of **3** long answer questions carrying **3** marks each.*

Section – A [1×10]

1. If Avogadro number N_A, is changed from 6.022×10^{23} mol^{-1} to 6.022×10^{20} mol^{-1}, this would change

(a) the ratio of chemical species to each other in a balanced equation.
(b) the ratio of elements to each other in a compound.
(c) the definition of mass in units of grams.
(d) the mass of one mole of carbon.

2. Complete the following analogy.

Number of moles of solute in 1L of the solution : A :: Number of gram equivalents of solute present per litre of solution : B

(a) A : Formality, B : Molality
(b) A : Normality, B : Formality
(c) A : Molality, B : Molarity
(d) A : Molarity, B : Normality

3. If the equilibrium constant for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K, the equilibrium constant for $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons NO(g)$ will be:

(a) K (b) K^2 (c) $K^{1/2}$ (d) $\frac{1}{2}K$

4. Which of the following analogies is incorrect:

(a) Acidic buffer : $NH_4Cl + NH_4OH$ :: Basic buffer : $CH_3COOH + CH_3COONa$
(b) pH + pOH : 14 :: Strong acid + Strong base : pH = 7
(c) Weak acid + Weak base : Neutral :: Strong acid + weak base : Acidic
(d) Weak acid : H_2CO_3 :: Strong acid : H_2SO_4

5. Thiosulphate reacts differently with iodine and bromine in the reactions given below:

$$2S_2O_3^{2-} + I^2 \rightarrow S_4O_6^{2-} + 2I^-$$
$$S_2O_3^{2-} + 2Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 2Br^- + 10H^+$$

Which of the following statements justifies the above dual behaviour of thiosulphate?

(a) Bromine is a stronger oxidant than iodine.
(b) Bromine is a weaker oxidant than iodine.
(c) Thiosulphate undergoes oxidation by bromine and reduction by iodine in these reactions.
(d) Bromine undergoes oxidation and iodine undergoes reduction in these reactions.

6. Which of the following arrangements represent increasing oxidation number of the central atom?

(a) $CrO_2^-, ClO_3^-, CrO_4^{2-}, MnO_4^-$ (b) $ClO_3^-, CrO_4^{2-}, MnO_4^-, CrO_2^-$

(c) $CrO_2^-, ClO_3^-, MnO_4^-, CrO_4^{2-}$ (d) $CrO_4^{2-}, MnO_4^-, CrO_2^-, ClO_3^-$

7. Identify the correct statements (s) in relation to the following reaction:

$$\mathbf{Zn + 2HCl \rightarrow ZnCl_2 + H_2}$$

(a) Zinc is acting as an oxidant. (b) Chlorine is acting as a reductant.
(c) Hydrogen ion is acting as an reductant. (d) Zinc is acting as a reductant.

In the following questions, two statements are given – one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) A and R is correct statements, and R are correct statements, and R is the correct explanation.
(b) A and R is correct statements, and R are correct statements, and R is not the correct explanation.
(c) A is correct, but R is incorrect statement.
(d) A is incorrect, but R is correct statement.

8. Assertion **(A):** Simple distillation can help in separating a mixture of propan-l-ol (boiling point 97°C) and propane (boiling point 56°C)
Reason **(R):** Liquids with a difference of more than 20°C in their boiling points can be separated by simple distillation.

9. Assertion **(A):** Energy of resonance hybrid is equal to the average of energies of all canonical forms.
Reason **(R):** Resonance hybrid is equal to the average of energies of all canonical forms.

10. Assertion **(A):** Pent- 1- ene and pent- 2- ene are position isomers.
Reason **(R):** Position isomers differ in the position of functional group or a substituent.

Section – B [$\mathbf{2 \times 10}$]

11. Predict if the solutions of the following salts are neutral, acidic or basic:
NaCl, KBr, NaCN, NH_4NO_3, $NaNO_2$ and KF

12. Give the oxidation number of Cl and I in the following questions:
(a) $8KClO_3 + 24HCl \rightarrow 8KCl + 12H_2O + 9Cl_2 + 6ClO_2$
(b) $3I_2 + 6NaOH \rightarrow NaIO_3 + 5NaI + 3H_2O$

13. Write bond line formulas for : Isopropyl alcohol, 2, 3-dimethylbutanal, Heptan-4-one.

14. Draw formulas for the first five members of each homologous series beginning with the following compounds:
(i) CH_3COCH_3 (ii) $H - CH = CH_2$

15. Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why?

16. Explain, why alkyl groups act as electron donors when attached to a π system.

17. What are electrophiles and nucleophiles? Explain with examples.

18. Predict the product. Balancing is not required.
(i) $SO_2 + MnO_4^- + \ldots\ldots\ldots\ldots\ldots \rightarrow SO_4^{2-} + Mn^{2+} + \ldots\ldots\ldots\ldots$

(ii) $AlBr_3 + K_2Cr_2O_7 + H_3PO_4 \rightarrow K_3PO_4 + AlPO_4 + H_2O + \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots$

19. Write the half reactions for the following redox reactions:
(i) $2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}(aq) + I^2(aq)$
(ii) $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$

20. Ionisation constant of a weak base MOH, is given by the expression

$$K_b = \frac{[M^+][OH^-]}{[MOH]}$$

Values of ionisation constant of some weak bases at a particular temperature are given below:

Base	Dimethylamine	Urea	Pyridine	Ammonia
K_b	5.4×10^{-4}	1.3×10^{-14}	1.77×10^{-9}	1.77×10^{-5}

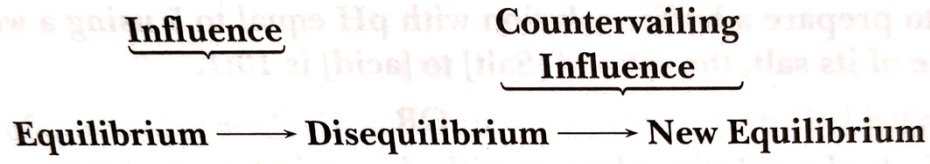
Arrange the bases in decreasing order of the extent of their ionisation at equilibrium. Which of the above base is the strongest?

Section – C [4 × 2]

21. ***Read the given passages and answer the questions that follow.***

PASSAGE – 1

Although usually designated as "Le Chatelier's principle", this concept was, apparently, discovered independently by **Henri Louis Le Chatelier** and **Karl Ferdinand Braun**. Le Chatelier's treatise was published in 1888. The Le Chatelier-Braun principle (LCB principle) states that when a system in dynamic equilibrium is acted on by an external stress, it will adjust in such that when a system in dynamic equilibrium is acted on by an external stress, it will adjust in such a ways as to relieve the stress and establish a new equilibrium. Although this principle was developed through the medium of chemistry, it found expression in many other scientific fields. There is a general tendency for influences that produce changes in an equilibrium state to induce countervailing influences that oppose the changes and establish a new equilibrium. Although this principle was developed through the medium of chemistry, it found expression in many other scientific fields. There is a general tendency for influences that produce changes in an equilibrium state to induce countervailing influences that oppose the changes and establish a new state of equilibrium. Lenz's law in electromagnetism is an example of the extension of the LCB into physics. Graphically we can express a generalised Le Chatelier-Braun principle as shown in figure

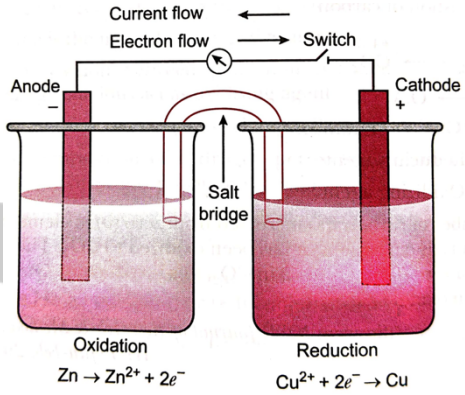


(i) What happens when in the given equation, $C + O_2 \rightleftharpoons CO_2$ if the concentration of O_2 is increased?
(ii) Consider the reaction used in the production of methanol:
$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$
How production of methanol affected by increasing the pressure?
(iii) How is the value of K_c changes with the change in temperature?

(iv) What is catalyst? How addition of a catalyst affect the rate of a reaction?

22. PASSAGE – 2

In the Daniel cell shown below, the transfer of electrons does not take place directly from Zn to Cu^{2+} but through the metallic wire connecting the two roads as is apparent from the arrow which indicates the flow of current. The electricity from solution in one beaker to solution in the other beaker flows by the migration of ions through the salt bridge. We know that the flow of current is possible only if there is a potential difference between the copper and zinc rods known as electrode here.



The potential associated with each electrode is known as electrode potential. If the concentration of each species taking part in the electrode reaction is unity (if any gas appears in the electrode reaction, it is confirmed to 1 atmospheric pressure) and further the reaction is carried out at 298 K, then the potential of each electrode is said to be the Standard Electrode Potential. By convention, the standard electrode potential ($E°$) of hydrogen electrode is 0.00 volts. The electrode potential value for each electrode process is a measure of the relative tendency of the active species in the process to remain in the oxidised/reduced form. A negative E^o means that the redox couple is a stronger reducing agent than the H^+/H_2 couple. A positive E^o means that the redox couple is a weaker reducing agent than the H^+/H_2 couple.

The standard electrode potentials are very important and we can get a lot of other useful information from them.

(i) What is the direction of current in a cell?

(ii) What is the standard electrode potential of hydrogen electrode?

(iii) What are the important information provided by the value of Standard electrode potential?

(iv) (a) If $E^o_{Sn^{2+}/Sn} = -0.41$ V, what would be the value of $E^o_{Sn/Sn^{2+}}$?

(b) If $E^o_{Li^+/Li} = -3.05$ V, and $E^o_{Ca^{2+}/Ca} = -2.87$ V, state which is a better reducing agent Li or Ca?

Section – D [3 × 10]

23. Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction given below:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

What mass of $CaCl_2$ will be formed when 250 mL of 0.76 M HCl reacts with 1000 g of $CaCO_3$? Name the limiting reagent. Calculate the number of moles of $CaCl_2$ forward in the reaction.

24. Derive an expression for the work done in the isothermal and reversible expansion of an ideal gas.

25. The ionization constant of acetic acid is 1.74×10^{-5}. Calculate the degree of dissociation of acetic acid in its 0.05 M solution. Calculate the concentration of acetate ion in the solution and its pH.

26. Calculate the pH of the resultant mixtures:

(i) 10 mL of 0.2 M $Ca(OH)_2$ + 25 mL of 0.1 M HCl

(ii) 10 mL of 0.01 M H_2SO_4 + 10 mL of 0.01 M $Ca(OH)_2$

(iii) 10 mL of 0.1 M H_2SO_4 + 10 mL of 0.1 M KOH

27. Equal volumes of 1×10^{-2} M $CaCl_2$ and 4.0×10^{-4} M sodium sulphate solutions are mixed. Show whether product will be formed or not? $\left(\text{Given: } K_{sp} \text{ of } CaSO_4 = 2.4 \times 10^{-5}\right)$

28. What do you mean by three dimensional representation of organic molecule? Explain with an example.

29. Arrange the following in the order mentioned.

(i) $(CH_3)_3C-$, $(CH_3)_2CH-$, CH_3CH_2-, CH_3- groups in the order of increasing +I effect.

(ii) $-CN$, $-Cl$, $-OH$, $-NO_2$ groups in the order of decreasing -I-effect.

(iii) 1°, 2°, 3° free radicals in the order of decreasing stability.

30. Explain the following:

(i) I-effect leads to the development of partial charges while the E-effect to the full positive and negative charges.

(ii) Hyperconjugation effect is also termed as 'no bond resonance'.

(iii) $\dot{C}H_3$ is more reactive than $CH_3\dot{C}H_2$ free radical.

31. A sample of 0.50 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 mL of 0.5 M H_2SO_4. The residual acid required 60 mL of 0.5 M solution NaOH for neutralization. Find the percentage composition of nitrogen in the compound.

32. Discuss the principle of estimation of halogens, sulphur and phosphorus present in an organic compound.