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SESSION ENDING EXAMINATION 2022-23 SET-2

CLASS XI

CHEMISTRY (043)

TIME : 3 HOURS

MM: 70

GENERAL INSTRUCTIONS

Read the following instructions carefully :

- There are 35 questions in this question paper with internal choice.
- SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 7 very short answer questions carrying 2 marks each.
- SECTION C consists of 5 short answer questions carrying 3 marks each.
- SECTION D consists of 2 case- based questions carrying 4 marks each.
- SECTION E consists of 3 long answer questions carrying 5 marks each.
- All questions are compulsory.
- Use of log tables and calculators is not allowed

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. Percentage of calcium in calcium carbonate (CaCO_3) is (Ca-40, C-12, O-16) [1]

- a) 40 b) 30 c) 48 d) 36

2. If 500 mL of a 5M solution is diluted to 1500 mL, what will be the molarity of the solution obtained? [1]

- a) 1.5 M b) 1.66 M c) 0.017 M d) 1.59 M

3. The period number in the long form of the periodic table is equal to - [1]

- (a) Magnetic quantum number of any element of the period.
(b) Atomic number of any element of the period.
(c) Maximum Principal quantum number of any element of the period.
(d) Maximum Azimuthal quantum number of any element of the period.

4. The size of isoelectronic species — F^- , Ne and Na^+ is affected by [1]

- (a) Nuclear charge (Z) (b) valence principal quantum number (n)
(c) electron-electron interaction in the outer orbitals (d) none of the factors because their size is the same

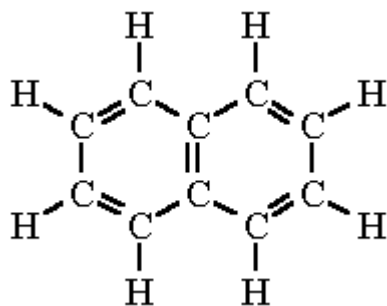
5. What is the change in the hybridisation of B atom as a result of the following reaction? [1]



- (a) sp^3 to sp^2 (b) sp to sp^2 (c) sp^2 to sp^3 (d) sp^2 to sp

6. Number of π bonds and σ bonds in the following structure is—

[1]



- (a) 5, 19 (b) 4, 20 (c) 6, 19 (d) 5, 20

7. For the process to occur under adiabatic conditions, the correct condition is:

[1]

- (a) $\Delta T = 0$ (b) $\Delta p = 0$ (c) $q = 0$ (d) $w = 0$

8. Predict in which of the following, entropy increases:

[1]

- (a) A liquid crystallizes into a solid.
(b) Temperature of a crystalline solid is changed from 115 K to 0K.
(c) Formation of ammonia by Haber's process
(d) Sublimation of solid Ammonium Chloride

9. Example of Buffer Solution is

[1]

- (a) NH_4Cl (b) NH_4OH (c) $\text{NH}_4\text{Cl} + \text{NH}_4\text{OH}$ (d) None

10 Which of the following is not an example of redox reaction?

[1]

- (a) $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$
(b) $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
(c) $2\text{K} + \text{F}_2 \longrightarrow 2\text{KF}$
(d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + 2\text{HCl}$

11. Which of the following is the correct IUPAC name?

[1]

- (a) 3-Ethyl-4, 4-dimethylheptane
(b) 4,4-Dimethyl-3-ethylheptane
(c) 5-Ethyl-4, 4-dimethylheptane
(d) 4,4-Bis(methyl)-3-ethylheptane

12. The reaction: $\text{CH}_3\text{CH}_2\text{I} + \text{KOH}(\text{aq}) \longrightarrow \text{CH}_3\text{CH}_2\text{OH} + \text{KI}$ is classified as :

[1]

- (a) electrophilic substitution (b) nucleophilic substitution (c) elimination (d) addition

13. The products obtained on the ozonolysis of 2-Methylbut-2-ene are

[1]

- (a) formaldehyde and propanone (b) propanone and ethanal
(c) 2 moles of propanone (d) 2 moles of ethanol.

14. What is not true for alkanes?

[1]

- (a) The alkanes undergo addition reaction generally.
(b) The carbon –carbon bond in alkanes is capable of free rotation.
(c) The carbon in alkane is sp^3 hybridised.
(d) the hybridisation in cycloalkanes is sp^3 .

15. **Assertion(A)** : The position of an electron can be determined exactly with the help of an electron microscope.

Reason(R) : The product of uncertainty in the measurement of its momentum and the uncertainty in the measurement of the position cannot be less than a finite limit.

Select the most appropriate answer from the options given below: [1]

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

16. **Assertion(A)** : The most electronegative element of the periodic table is Chlorine. [1]

Reason(R) : The atomic size of the chlorine atom is large enough to accommodate the incoming electron and the inter electronic repulsion is less, than experienced in fluorine.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

17. **Assertion(A)** : Energy of resonance hybrid is lower than that of any of its canonical form. [1]

Reason(R) : Resonance hybrid cannot be represented by a single structure.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

18. **Assertion(A)**: Nitration of Benzene with Nitric acid required the use of concentrated Sulphuric Acid [1]

Reason(R): The Mixture of concentrated Sulphuric Acid and concentrated Nitric Acid produces the Electrophile, NO_2^+

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A
- (c) A is true but R is false.
- (d) A is false but R is true.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type questions and carry 2 marks each.

19. The density of 3M solution of NaCl is 1.25 gm /ml. Calculate the molality of the solution. [2]

20. Identify the state functions and path functions out of the following: [2]
Enthalpy, Entropy, heat, temperature, work, free energy.

21. Explain the terms Inductive and Electromeric effects with examples.

[2]

Or

Which electron displacement effect explains the following correct orders of acidity of the carboxylic acids? Explain.

(a) $\text{Cl}_3\text{CCOOH} > \text{Cl}_2\text{CHCOOH} > \text{ClCH}_2\text{COOH}$ (b) $\text{CH}_3\text{CH}_2\text{COOH} > (\text{CH}_3)_2\text{CHCOOH} > (\text{CH}_3)_3\text{C.COOH}$

22. In the given reaction, $\text{Cl}-\text{Cl} \longrightarrow \text{Cl}^+ + \text{Cl}^-$

[2]

(a) Which type of bond cleavage is taking place?

(b) What factor will facilitate the bond to be cleaved in that way?

23. Write Short Note on (Chemical Reaction is Compulsory)

[2]

(a) Wurtz Reaction (b) Friedal Craft alkylation Reaction.

24. What is Le Chatelier's principle? What is the effect of addition of inert gas at constant volume and constant pressure to the given equilibrium? $\text{PCl}_5(\text{g}) \longrightarrow \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$

[2]

Or

Calculate the pH Value of $2 \times 10^{-6} \text{ M}$ HCl solution if HCl ionise completely. (Given $\log 2 = 0.301, \log 10 = 1$)

25. Use the following data to calculate $\Delta_{\text{lattice}} H^\ominus$ for NaBr.

[2]

$\Delta_{\text{sub}} H^\ominus$ for sodium metal = $108.4 \text{ kJ mol}^{-1}$

Ionization enthalpy of sodium = 496 kJ mol^{-1}

Electron gain enthalpy of bromine = -325 kJ mol^{-1}

Bond dissociation enthalpy of bromine = 192 kJ mol^{-1}

$\Delta_{\text{form}} H^\ominus$ for NaBr (s) = $-360.1 \text{ kJ mol}^{-1}$

SECTION C

This Section contains 5 questions with internal choice in two questions. The following questions are short answer types and carry 3 marks each.

26. An ideal gas is allowed to expand against a constant pressure of 2 bar from 10 L to 50 L in one step. Calculate the amount of work done by the gas. If the same expansion were carried out reversibly, will the work done be higher or lower than the earlier case?

[3]

(Given that 1 L bar = 100 J)

27. In the given reaction, 12 grams of carbon and 16 grams of oxygen were made to react to form carbon dioxide according to the equation:

[3]

$\text{C}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$

a) Identify the limiting reagent?

b) What weight of carbon dioxide will be formed?

c) What amount of excess reagent will be left over?

28. Give reason

[3]

(a) First ionization enthalpy of boron is less than beryllium, though the ionization energies increase on moving left to right in a period.

(b) The ionic radii of the anion are greater than that of the neutral atom.

(c) Nitrogen is unwilling to give away its valence electron as compared to oxygen atom.

29. Balance the following equation by oxidation number or ion electron method:

[3]

(i) $\text{MnO}_4^- (\text{aq}) + \text{SO}_2(\text{g}) \longrightarrow \text{Mn}^{++}(\text{aq}) + \text{HSO}_4^- (\text{aq})$ in acidic medium (Balance by ion electron method)

OR

What are the oxidation numbers of the underlined elements in each of the following?

(a) H_2S (b) Na_3PO_4 (c) NO_3^- (d) $\text{Na}_2\text{S}_2\text{O}_8$ (e) S_8 (f) Fe_3O_4

30. According to de Broglie, matter should exhibit dual behaviour that is both particle and wave like properties.

However, a cricket ball of mass 100 g does not move like a wave when it is thrown by a bowler at a speed of 100 km/h.

Calculate the wavelength of the ball and explain why it does not show wave nature.

[3]

Or

(a) What are limitations of Bohr's Model of atom.

[2]

(b) Find out the number of unpaired electron in Phosphorus atom ($Z=15$)

[1]

SECTION D

The following questions are case-based questions. Each question carries 4 marks. Read the passage carefully and answer the questions that follow.

31. According to Arrhenius, acids give H^+ ions while bases produce OH^- ions in their aqueous solutions. Bronsted-Lowry defined an acid as a proton donor and a base as a proton acceptor. When a Bronsted – Lowry acid reacts with a base, it produces its conjugate base and a conjugate acid corresponding to the base with which it reacts. Thus, a conjugate pair of acid - base differs only by a proton. Lewis further generalized the definition of an acid as an electron pair acceptor and a base as an electron pair donor. The strength of acids and bases can be measured in terms of their dissociation constants K_a (or pK_a) and K_b (or pK_b). Larger value of K_a or lower value of pK_a corresponds to greater strength of acids. Similarly, larger value of K_b or lower value of pK_b corresponds to stronger base.

a. Write the conjugate acid -base pair for the following

[1]

i) NH_3 ii) HSO_4^-

b. How is strength of acid related to pK_a value?

[1]

c. Dissociation constant for two different acids are 1×10^{-5} and 3.6×10^{-10} . Which one is the stronger acid?

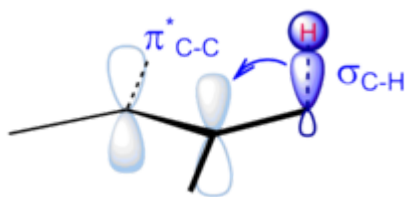
[1]

d. Classify the following as Lewis acid and base. NH_3 , BF_3 , $AlCl_3$, CH_3NH_2

[1]

Case based question II

32. Hyperconjugation effect is a permanent effect in which localization of σ electrons of C-H bond of an alkyl group directly attached to an atom of the unsaturated system or to an atom with an unshared p orbital takes place.



From the above figure, we observe that one of the three C-H bonds of the methyl group can align in the plane of the empty p orbital and the electrons constituting the C-H bond in a plane with this p orbital can then be delocalized into the empty p orbital.

We also observe that the hyperconjugation stabilizes the carbocation as it helps in the dispersal of positive charges. Thus, we can say that the greater the number of alkyl groups attached to a positively charged carbon atom, the greater is the hyperconjugation interaction and stabilization of the carbocation.

Now answer the following questions:

1. Compare the stability of ethyl carbocation, isopropyl carbocation and tertiary butyl carbocation and explain their relative stability using hyperconjugation.

2. Which of the following alkene is most stable and why?

But-1-ene, but-2-ene, 2-methylbut-2-ene or pent-2-ene.

3. Does carbanion show hyperconjugation? Give reason.

(2+1+1)

SECTION E

The following questions are long answer type and carry 5 marks each. All the questions have an internal choice.

33. a) Distinguish between Orbit and Orbital.

b) Write Electronic Configuration of Chromium atom (atomic Number 24)

c) Table Tennis ball has a mass 10gm and a speed of 90 m/s. If speed can be measured with an accuracy of 4%. What will be the uncertainty in speed and position ($h = 6.6 \times 10^{-34}$ J s) (2+1+2)

Or

(A) Write Short Note on:-

(i) Aufbau Rule.

(ii) Hund's Rule

(iii) Pauli's Exclusion Law

(B) Find out all four quantum numbers of the unpaired electron of chlorine. ($Z=17$)

(C) Find out the atomic number of the element whose all four quantum numbers of last electron given below:
 $n=3, l=1, m=+1, s=-1/2$

34. (a) Discuss the significance/ applications of dipole moment.

(b) Represent diagrammatically the bond moments and the resultant dipole moment in CO_2 , NF_3 and CHCl_3 .

(c) Which out of NH_3 and NF_3 has higher dipole moment and why? (1+3+1)

Or

(a) What do you understand by Hybridisation?

(b) Why bond formed by the hybrid orbital are stronger as compared to that formed by pure atomic orbital?

(c) Predict the hybridization and shape in the following molecule

(i) BCl_3

(ii) CH_4

(iii) SF_6

(1+1+3)

35. An alkyl halide $\text{C}_5\text{H}_{11}\text{Br}$ (A) reacts with ethanolic KOH to give an alkene 'B', which reacts with Br_2 to give a compound 'C', which on dehydrobromination gives an alkyne 'D'. On treatment with sodium metal in liquid ammonia one mole of 'D' gives one mole of the sodium salt of 'D' and half a mole of hydrogen gas. Complete hydrogenation of 'D' yields a straight chain alkane. Identify A, B, C and D. Give the reactions involved. (5)

Or

Write the Major Product of the following reaction:

