TOPIC /UNIT	SOME BASIC CONCEPTS OF CHEMISTRY
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	**Student describes and applies the terms mole and molar mass. 1 mol of $ZnCO_3$ contains 1 mol of Zn which is 65.5 g**
CORE CONCEPTS /MAJOR AREA	Mole Concept
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

How many grams of zinc can be obtained from 100g of $ZnCO_3$?

a) 12 g b) 39.81 c) 52.19 g d) 65.5 g

Answer: b) 52.19g

1 mol of $ZnCO_3$ contains 1 mol of Zn.

125.5 g of contains 65.5 g of Zn

Therefore 100 g contains :(65.5 x 100) / 125.5 = 52.19g)

QUESTION NUMBER	2
EXPECTED LEARNING OUTCOMES	**Student understands laws of chemical combinations** **Law of Multiple proportions**
CORE CONCEPTS /MAJOR AREA	Law of chemical combination
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

Which of the following will illustrate the law of multiple proportions?

I) H_2O, H_2O_2 II) NO_2, NO III) SO_2, SO_3 IV) Na Cl, Na Br

a) I only b) I, IV c) I, II, IV d) I, II, III

Answer: d) I, II, III

If two elements can combine to form more than one compound, the masses of one element that combines with a fixed mass of the other element is simple whole number ratio.

In IV) the option Na combines with two different elements, hence not obeying law of multiple proportions

QUESTION NUMBER	3
EXPECTED LEARNING OUTCOMES	**Student Converts physical quantities from one system to another**

	1 L = $10^{-3}m^3$
CORE CONCEPTS /MAJOR AREA	Conversion of units
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

ASSERTION: 2L of Milk in m^3 is equal to **$2 \times 10^{-3} m^3$**
REASONING: 1 L is equal to $1000cm^3$ and 1cm is equal to $10^{-2}m$
Answer : option (a)
(Assertion and Reasoning statements are true and reason is the correct explanation of Assertion).

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	**Student understands the term empirical formula Empirical formula represents the simplest whole number ratio of various atoms present in a compound.**
CORE CONCEPTS /MAJOR AREA	Empirical Formula
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

ASSERTION: The empirical formula of a hydrocarbon which contains 75% by mass Carbon and 25% by mass hydrogen is C_2H_6
REASONING : The number of moles of Carbon: Hydrogen are in the ration 1:4
Answer: option (d)
Assertion is false but reason is true

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	**Student performs Stoichiometric calculations Stoichiometry is the calculation of masses of the reactants and the products involved is a chemical reaction.**
CORE CONCEPTS /MAJOR AREA	Stoichiometric calculations
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Read the passage and answer the questions that follows:
Stoichiometry involves calculation based on chemical equations and mole concept. Mole is a counting unit, equal to 6.023×10^{23} particles. One mole is also equal to molar mass

expressed in grams. In chemical reactions, the reactant which get used up completely is called Limiting Reagent and decides the amount of product formed.

1) $CaCO_3$ on heating produces CaO and CO_2. How many grams of CO_2 is produced? (1)
   Answer: 44 g

2) Calculate the number of moles of C in 96g of C(Atomic mass of C = 12) (1)
   Answer: 8 mol

3) 8.0g of Mg is burnt in 2.0g of O_2. How much of MgO will be formed? (Atomic mass of Mg = 24, O= 16) . Identify the Limiting reagent (2)
   O_2 is the limiting reagent. 5 g of MgO will be produced.

PREPARED BY: R. LALITHA (B V B R Vidyashram)

TOPIC /UNIT	**STRUCTURE OF ATOM (Part 1)**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Students are expected to apply concept of set of Quantum numbers as per the configuration
CORE CONCEPTS /MAJOR AREA	Quantum Numbers
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:of electron.

1.For which of the following sets of quantum numbers, an electron will have the highest energy?

(a) 3, 2, +1, +1/2
(b) 4, 2, -1, +1/2
(c) 4, 1, 0, -1/2
(d) 5, 0, 0, +1/2

Answer: (b) 4, 2, -1, +1/2

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Students are expected to differentiate between the shape of different orbitals.
CORE CONCEPTS /MAJOR AREA	Orbital Shape
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

Which of the following orbitals has dumb-bell shape?
(a) s
(b) p
(c) d
(d) f

Answer: (b) p

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	Students are expected to identify the isoelectronic species.
CORE CONCEPTS /MAJOR AREA	Isoelectronic species.
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 3:

Which of the following atoms or atoms/atom-ion/ions have identical ground state configuration?
(a) Li^+ and He^+
(b) Cl^- and Ar
(c) Na and K
(d) F^+ and Ne

Answer: (b) Cl^- and Ar

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Students are expected to get clarity about isotopes.
CORE CONCEPTS /MAJOR AREA	Isotopes
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion: All isotopes of a given element show the same type of chemical behaviour.

Reason: The chemical properties of an atom are controlled by the number of electrons in the atom.

Answer: (a) [Assertion is correct ,reason is correct, reason is correct explanation for assertion.]

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	**Students are expected to learn basic apply uncertainity principle and de Broglie equation.**
CORE CONCEPTS /MAJOR AREA	Uncertainity principle
CRITERIA/ TYPE OF QUESTION	**CASE STUDYs**

QUESTION 5:

The French physicist, de Broglie, in 1924 proposed that matter, like radiation, should also exhibit dual behaviour i.e., both particle and wavelike properties. This means that just as the photon has momentum as well as wavelength, electrons should also have momentum as well as wavelength, de Broglie, from this analogy, gave the following relation between wavelength (A) and momentum (p) of material particle
$\lambda = h / mv = h/p$

Werner Heisenberg a German physicist in 1927, stated the uncertainty principle which is the consequence of the dual behaviour of matter and radiation. It states that it is impossible to determine simultaneously, the exact position and exact momentum (or velocity)of an electron.

1-Uncertainty principle was given by.
(a) Werner Heisenberg
(b) George Uhlenbeck
(c) Samuel Goudsmit
(d) De Broglie

Ans- a)Werner Heisenberg

2) Quantum mechanics is a theoretical science that deals with the study of the motions of the ..... objects.

(a) Macroscopic
(b) Microscopic
(c) Laparoscopic
(d) All the above

Ans-b) Microscopic

3-George Uhlenbeck and Samuel Goudsmit proposed the presence of the fourth quantum number known as the ...

(a) principal quantum number
(b) electron spin quantum number
(c) Magnetic orbital quantum number.
(d) Azimuthal quantum number

Ans- b) electron spin quantum number.

PREPARED BY: PALLAVI DHIR SINGH

TOPIC /UNIT	**Periodic classification of elements**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Helps to reinforce the relationship between ionization energy and electron configuration, testing the knowledge of both concepts

CORE CONCEPTS /MAJOR AREA	Ionization Enthalpy
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

The values of IE(I), IE(II), IE(III) and IE(IV) of an atom are respectively 7.5 eV, 25.6 eV, 48.6 eV and 170.6 eV. The electronic configuration of the atom would be

a) $1s^2, 2s^2, 2p^6, 3s^1$ b) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$

c) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$ d) $1s^2, 2s^2, 2p^6, 3s^2$

Ans: b

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	To Associate specific electron configurations with the group numbers and to identify elements in the periodic table.
CORE CONCEPTS /MAJOR AREA	Electronic cofiguration
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

The column– I has certain details about the elements of s, p, and d block elements. Match those with the group number of the elements listed in column II

No	Column-I (Element/Elements)	No	Column-II (Group number)
A	An element whose fourth shell contains 3 p-electrons	P	8^{th} group
B	An element whose valence shell contains 2 unpaired p-electrons	Q	13^{th} group
C	An element which receives last electron in (n-1) d-subshell	R	15^{th} group
D	An element with the ground state electronic configuration $[Ar]3d^{10}4s^24p^1$	S	16^{th} group

a) A → P, B → R, C → Q, D → S

b) A → S, B → P, C → R, D → Q

c) A → R, B → S, C → P, D → Q

d) A → Q, B → S, C → R, D → P

QUESTION NUMBER	**3**

EXPECTED LEARNING OUTCOMES	It evaluates the ability to understand the concepts of metallic character and ionization enthalpy and encourages critical thinking
CORE CONCEPTS /MAJOR AREA	Metallic character and ionization enthalpy.
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

(A) Metallic character is highest at the extreme left side of the periodic table
(R) Ionisation enthalpy decreases across the period.

Ans: c. Assertion is correct statement but reason is wrong statement

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	To understand the connection between ionization energy, electronic configurations, and the stability of ions and atoms
CORE CONCEPTS /MAJOR AREA	Ionization energy, electronic configurations
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

(A) First ionization energy of $O^+(g)$ is greater than that of N(g), while the first ionization energy of $N^+(g)$ is lesser than that of N(g).
(R) Electronic configuration of N(g) is more stable than that of $N^+(g)$

Ans: d. Assertion is wrong statement but reason is correct statement

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	i)Gains knowledge of Transition Elements ii)Evaluates knowledge of the various oxidation states exhibited by transition elements and their implications for chemical reactivity. iii)Learn to apply knowledge of trends in the stability of oxidation states down the group in d-block. iv) To understand the organization of the periodic table and predict the general electronic configuration of various blocks
CORE CONCEPTS /MAJOR AREA	Periodic trends
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

"The modern periodic table arranges the elements in the increasing order of atomic number. Elements are divided into four blocks: s-block, p-block, d-block, and f-block based on their electronic configuration. The elements of the d-block are placed between the s-block and p-block. For an element to be called a transition element, it should have an incomplete d shell either in the ground state or in any of the common oxidation states. Except for Scandium, all other transition elements of the 3d series exhibit multiple oxidation states. Scandium exhibits only the +3 oxidation state in its compounds. The last element of the 3d series, Zinc, exhibits only the +2 oxidation state. Unlike p-block elements, the stability of higher oxidation states increases down the group in the case of transition elements. The maximum oxidation state of group VI elements comprising Cr, Mo, W, and Sg is +6. f-block elements are placed as separate series called lanthanides and actinides at the extreme bottom of the periodic table. The chemistry of actinide elements is complicated as the majority of them exhibit a large number of oxidation states and are radioactive in nature."

i) Name the only element which is not a transitional element in the 3d series and substantiate your answer

ii) Name the transition element of the 3d series which exhibit only one oxidation state and write the formula of its oxide

iii) Out of $K_2Cr_2O_7$ and WO_3 which will be a strong oxidation agent and why?

Or

Write down the general electronic configuration of s-block, p-block, d-block and f-block elements

Ans: i) Zinc. Zinc contains fully filled 3d shell in the ground state as well as in its +2 oxidation state

ii) Scandium. Sc_2O_3

iii) $K_2Cr_2O_7$. This is because chromium in $K_2Cr_2O_7$ is in the +6 oxidation state. It will have a tendency to get reduced to its stable oxidation state of +3. Where as in the case of WO3 W is in +6 oxidation state. For transition elements stability of higher oxidation state increases down the group.

OR

s-block: ns^{1-2}

p-block: $ns^2\ np^{1-6}$

d-block: $(n-1)\ d^{1-10}\ ns^{0-2}$

f-block: $(n-2)\ f^{1-14}\ (n-1)\ d^{0-1}\ ns^2$

PREPARED BY: R. LALITHA (B V B R Vidyashram)

XI-Periodic classification of elements- Nisha Santhosh

In the following two questions choose the correct answer

1. The values of IE(I), IE(II), IE(III) and IE(IV) of an atom are respectively 7.5 eV, 25.6 eV, 48.6 eV and 170.6 eV. The electronic configuration of the atom would be

a) $1s^2, 2s^2, 2p^6, 3s^1$ b) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$
c) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$ d) $1s^2, 2s^2, 2p^6, 3s^2$

Ans: b

Learning outcome: Helps to reinforce the relationship between ionization energy and electron configuration, testing the knowledge of both concepts.

2. The column– I has certain details about the elements of s, p, and d block elements. Match those with the group number of the elements listed in column II

No	Column-I (Element/Elements)	No	Column-II (Group number)
A	An element whose fourth shell contains 3 p-electrons	P	8^{th} group
B	An element whose valence shell contains 2 unpaired p-electrons	Q	13^{th} group
C	An element which receives last electron in (n-1) d-subshell	R	15^{th} group
D	An element with the ground state electronic configuration $[Ar]3d^{10}4s^24p^1$	S	16^{th} group

e) A → P, B → R, C → Q, D → S
f) A → S, B → P, C → R, D → Q
g) A → R, B → S, C → P, D → Q
h) A → Q, B → S, C → R, D → P

Ans: c

Learning outcome: To Associate specific electron configurations with the group numbers and to identify elements in the periodic table.

In these following two questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

3. (A) Metallic character is highest at the extreme left side of the periodic table
(R) Ionisation enthalpy decreases across the period.

Ans: c. Assertion is correct statement but reason is wrong statement

Learning outcome: It evaluates the ability to understand the concepts of metallic character and ionization enthalpy and encourages critical thinking

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4. (A) First ionization energy of $O^+(g)$ is greater than that of N(g), while the first ionization energy of $N^+(g)$ is lesser than that of N(g)
(R) Electronic configuration of N(g) is more stable than that of $N^+(g)$

Ans: d. Assertion is wrong statement but reason is correct statement

Learning outcome: To understand the connection between ionization energy, electronic configurations, and the stability of ions and atoms.

Read the following passage and answer the questions below

5. "The modern periodic table arranges the elements in the increasing order of atomic number. Elements are divided into four blocks: s-block, p-block, d-block, and f-block based on their electronic configuration. The elements of the d-block are placed between

the s-block and p-block. For an element to be called a transition element, it should have an incomplete d shell either in the ground state or in any of the common oxidation states. Except for Scandium, all other transition elements of the 3d series exhibit multiple oxidation states. Scandium exhibits only the +3 oxidation state in its compounds. The last element of the 3d series, Zinc, exhibits only the +2 oxidation state. Unlike p-block elements, the stability of higher oxidation states increases down the group in the case of transition elements. The maximum oxidation state of group VI elements comprising Cr, Mo, W, and Sg is +6. f-block elements are placed as separate series called lanthanides and actinides at the extreme bottom of the periodic table. The chemistry of actinide elements is complicated as the majority of them exhibit a large number of oxidation states and are radioactive in nature."

iv) Name the only element which is not a transitional element in the 3d series and substantiate your answer

v) Name the transition element of the 3d series which exhibit only one oxidation state and write the formula of its oxide

vi) Out of $K_2Cr_2O_7$ and WO_3 which will be a strong oxidation agent and why?

Or

Write down the general electronic configuration of s-block, p-block, d-block and f-block elements

Ans: i) Zinc. Zinc contains fully filled 3d shell in the ground state as well as in its +2 oxidation state

Learning outcome: Gains knowledge of Transition Elements

ii) Scandium. Sc_2O_3

Learning outcome: Evaluates knowledge of the various oxidation states exhibited by transition elements and their implications for chemical reactivity

iii) $K_2Cr_2O_7$. This is because chromium in $K_2Cr_2O_7$ is in the +6 oxidation state. It will have a tendency to get reduced to its stable oxidation state of +3. Where as in the case of WO3 W is in +6 oxidation state. For transition elements stability of higher oxidation state increases down the group

Learning outcome: learn to apply knowledge of trends in the stability of oxidation states down the group in d-block

Or

s-block: ns^{1-2}

p-block: $ns^2\ np^{1-6}$

d-block: $(n-1)\ d^{1-10}\ ns^{0-2}$

f-block: $(n-2)\ f^{1-14}\ (n-1)\ d^{0-1}\ ns^2$

Learning outcome: To understand the organization of the periodic table and predict the general electronic configuration of various blocks

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STANDARD OPERATING PROCEDURE FOR THE DEVELOPMENT OF COMPETANCY BASED QUESTION BANK

NAME OF THE TOPIC: CHEMICAL BONDING AND MOLECULAR STRUCTURE

QUESTION:1
MCQ

LEARNING OUTCOME: Children understand the concept and apply it in examples

Unsymmetrical non- linear polyatomic molecules always have a net dipole moment

- Which among the following pairs show zero dipole moment?

a) H_2O and CH_3Cl
b) SF_4 and ClF_3
c) NH_3 and NO_2
d) CH_4 and PCl_5

Answer: d) CH_4 and PCl_5

Explanation: A molecule having two or more polar bonds may have zero dipole moment when the molecule has regular structure as expected from hybridization

QUESTION:2
LEARNING OUT COME: Children understand the definitions, differentiates them and analyse the given examples

Definitions of electrovalent , covalent and coordinate bonds

- Which of the following statement is true about NH_4Cl?

a) It has only electrovalent bond
b) It has only coordinate bonds
c) It has electrovalent as well as covalent bonds
d) It has electrovalent, covalent and coordinate bonds

Answer: d) It has electrovalent, covalent and coordinate bonds

Explanation: Electrovalent bond is formed between NH_4^+ and Cl^- ions, 3 covalent bonds are formed between N and 3 H atoms and one coordinate bond between N and one H atom

QUESTION:3
For question numbers 3-4, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

a) Both A and R are true, and R is correct explanation of the assertion.
b) Both A and R are true, but R is not the correct explanation of the assertion.
c) A is correct, but R is wrong
d) A is wrong , but R is correct

LEARNING OUT COME: Children remember the order of repulsive interaction and apply that knowledge in this context

The magnitude of different types of electron repulsions follows the order LP-LP > LP-BP > BP- BP ; the repulsive forces alter the bond angle and hence distortion in geometry

- Assertion : ClF_3 has T- shape, while NH_3 has pyramidal shape
- Reason : ClF_3 has two lone pairs while NH_3 has no lone pairs

Answer: c) A is correct, but R is wrong

Explanation: Due to the repulsive interaction of 2 lone pairs in ClF_3 ,the shape is distorted to 'T' .The presence of 1 lone pair in NH_3 results in the distortion of shape to pyramidal

QUESTION:4

LEARNING OUTCOME: Children understand the concept of ionic bond and factors affecting it

- Assertion : Halogens generally form ionic compounds
- Reason : Halogens have high electron affinities

e) Answer: a) Both A and R are true, and R is correct explanation of the assertion.

Explanation: Higher electron affinity should favour the formation of an anion. So the elements having higher electron affinity favour the formation of an ionic bond.

QUESTION:5

CASE BASED QUESTION

LEARNING OUT COME: Children recall the common name of nitrous oxide and understand its anaesthetic property

Resonance is the phenomenon by which a molecule can be represented by several electronic structures and actual structure is the hybrid of all structures

Read the given passage and answer the following questions:

In 19^{th} centuary, nitrous oxide called laughing gas was used for anaesthesia by dentists. However, it is very important to know the correct properties and structure of this chemical substance before it is used as anaesthetic agent .It affects the nervous system and our premaxilla bone becomes ineffective. Under this condition, the dentist treats us. Studies proved that nitrous oxide has a resonance structure. The concept of resonance is very useful in explaining the structure of many other molecules or ions also.

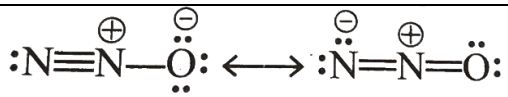
a) What is a resonance?
b) Draw the resonating structure of nitrous oxide
c) All the chlorine-oxygen bond distances in ClO_4^- are of same length. Why?

Or

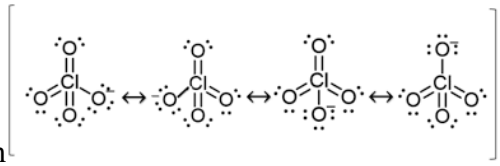
Write two consequences of resonance

Answers : a) Resonance is the phenomenon by which a molecule can be represented by several electronic structures and actual structure is the hybrid of all other canonical structures

b)



c) ClO_4^- is a resonance hybrid of the following structures. So all the Cl-O bond distance are of same length



Or

i) Bond lengths are significantly different from what would be expected without resonance

ii) The resonance hybrid has significantly less energy than any of the canonical forms

TOPIC /UNIT	**CHEMICAL BONDING AND MOLECULAR STRUCTURE-(VBT & MOT)**
QUESTION NUMBER	1
EXPECTED LEARNING OUTCOMES	Students are expected to interpret and analyze hybridization of molecules.
CORE CONCEPTS /MAJOR AREA	Hybridization
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

The type of hybridization of carbon in Carbon dioxide will be…
(a) sp hybridized
(b) sp^3d hybridized
(c) sp^2 hybridized
(d) sp^3 hybridized

Answer: A

QUESTION NUMBER	2
EXPECTED LEARNING OUTCOMES	Students are expected to correlate bond angle with hybridization.
CORE CONCEPTS /MAJOR AREA	Bond angle
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

In which of the following bond angle is maximum?
(a) NH_3
(b) NH_4^+
(c) SF_6
(d) H_2O

Answer: B

QUESTION NUMBER	3
EXPECTED LEARNING OUTCOMES	Students are expected to interrelate and analyze the relationship between bond angle ,bond order, bond energies and bond length,
CORE CONCEPTS /MAJOR AREA	Bond Parameters
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3

Assertion: Bond order can assume any value number including zero.

Reason: Higher the bond order, shorter is bond length and greater is bond energy.

(a) Both A and R are true, and R is a 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

Answer: B

QUESTION NUMBER	4
EXPECTED LEARNING OUTCOMES	Students are expected to interpret and evaluate lattice energy and hydration enthalpy.
CORE CONCEPTS /MAJOR AREA	Lattice energy
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion: Solubility of LiI is more than that of LiBr.
Reason: LiI has more lattice energy and more hydration energy in comparison is LiBr.
(a) Both A and R are true, and R is a 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

Answer: C

QUESTION NUMBER	5
EXPECTED LEARNING OUTCOMES	Students are expected to evaluate enthalpy transitions related to ionic compounds.
CORE CONCEPTS /MAJOR AREA	Ionic compounds
CRITERIA/ TYPE OF QUESTION	CASE STUDY

QUESTION 5:

In ionic solids, the sum of the electron gain enthalpy and the ionization enthalpy may be positive but still the crystal structure gets stabilized due to the energy released in the formation of the crystal lattice. For example: the ionization enthalpy for $Na^+(g)$ formation from Na(g) is 495.8 kJ mol^{-1} ; while the electron gain enthalpy for the change $Cl(g) + e^- \rightarrow Cl^-(g)$ is, – 348.7

kJ mol^{-1} only. The sum of the two, 147.1 kJ mol^{-1} is more than compensated for by the enthalpy of lattice formation of NaCl(s) (–788 kJ mol^{-1}). Therefore, the energy released in the processes is more than the energy absorbed. Thus a qualitative measure of the stability of an ionic compound is provided by its enthalpy of lattice formation and not simply by achieving octet of electrons around the ionic species in gaseous state. This process involves both the attractive forces between ions of opposite charges and the repulsive forces between ions of like charge. The solid crystal being three dimensional; it is not possible to calculate lattice enthalpy directly from the interaction of forces of attraction and repulsion only.

1. Electrovalent compounds are
   (a) low melting
   (b) insoluble in polar solvents
   (c) conductors in the fused state
   (d) none of the above

2. Elements with electro negativities 1.2 and 3.0 form
   (a) electrovalent bond
   (b) covalent bond
   (c) coordinate bond
   (d) metallic bond

3. Ionic compounds don't conduct electricity in
   (a) Aqueous Solution
   (b) fused state
   (c) solid state
   (d) none of the above

4. Which of the following are not ionic compounds?
   (i) KCl (ii) HCl (iii) CCl_4 (iv) NaCl
   (a) (i) and (ii)
   (b) (ii) and (iii)
   (c) (iii) and (iv)
   (d) (i) and (iii)

5. The electronic configuration of three elements X, Y and Z are as follows:
   X = 2, 4, Y = 2, 7, Z = 2,1

Which two elements will combine to form an ionic compound and write the correct formula,

(a) X_2Y
(b) YZ
(c) XZ_3
(d) Y_2Z

Answers: 1 – C, 2- A, 3 –C, 4 – B, 5-B

PREPARED BY: ARUN KUMAR AGNIHOTRI (BVB Prism School Satna)

TOPIC /UNIT	THERMODYNAMICS (PART 1)
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	The student will be able to evaluate and identify that if the reactant and product contain the same number of gaseous molecules, the change in the number of moles will be zero, the change in enthalpy will be equal to the change in internal energy.
CORE CONCEPTS /MAJOR AREA	Enthalpy and Internal Energy
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

For the reaction, $P(g) + Q(g) \rightarrow R(g) + S(g)$.
Which of the following is correct at T = 300K

(a) $\Delta H = \Delta U$
(b) $\Delta H > \Delta U$
(c) $\Delta H < \Delta U$
(d) Insufficient Information

Answer : (a)

QUESTION NUMBER	2
EXPECTED LEARNING OUTCOMES	The student will be able to understand the fact that the enthalpy change is a state function.
CORE CONCEPTS /MAJOR AREA	Enthalpy change as a state function
1:CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

The enthalpy change in a reaction does not depend upon

(a) The state of the reactants and products
(b) The nature of the reactants and products
(c) Different intermediate steps in the reaction
(d) Initial and final enthalpy of reaction

Answer : (c)

QUESTION NUMBER	3
EXPECTED LEARNING OUTCOMES	Student will be able to understand the concept of enthalpy of neutralization of a strong acid and strong base is constant irrespective of the nature of the acid and base because strong acid and strong base undergo complete ionization..
CORE CONCEPTS /MAJOR AREA	Enthalpy of neutralization
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

Examine both the statements and mark the correct choice according to the instructions given below:
a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c)Assertion is true but Reason is false.
d) Assertion is false but Reason is true

Assertion : The enthalpy of neutralization for both HCl and H2SO4 with NaOH is the same.
Reason : Both HCl and H_2SO_4 are strong acids

Answer : (a)

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	The student can gain a comprehensive understanding of the work done during an isothermal irreversible process.
CORE CONCEPTS /MAJOR AREA	Isothermal irreversible process.
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion : Work done in an isothermal irreversible process at constant volume is zero
Reason : Work is assigned a negative sign during expansion and is assigned a positive sign during compression.

Answer : (b)

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	The student will be able to understand and analyse the first Law of Thermodynamics, the concept of a state function, extensive and intensive properties.
CORE CONCEPTS /MAJOR AREA	First Law of Thermodynamics
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Chemical energy stored by molecules can be released as heat during chemical reactions. The chemical energy may also be used to do mechanical work, when a fuel burns in an engine or to provide electrical energy through a galvanic cell. Thus various forms of energy are inter-related under certain conditions. These may be transformed from one to another. Thermodynamics deals with energy changes in chemical or physical processes and enable us to study these changes and to make useful predictions. Chemical or physical processes lead to the evolution or absorption of heat, part of which may be converted into work. These quantities are related through the First Law of Thermodynamics.

(a) State First Law of Thermodynamics
(b) Heat and work done individually are not state functions but their sum is also always a state function. Why?
(c) For the process 2H(g) → H2(g), what is a sign of ΔH and ΔS ? Justify your answer.

OR

Give one point to differentiate the following thermodynamic terms;
(i) Extensive and intensive properties
(ii) Isothermal and isobaric process

Answer : (a) The total energy of the universe is always constant
(b) According to the First Law of Thermodynamics, change in internal energy is a sum of heat and work done and is a state function
(c) Both ΔH and ΔS are -ve.

OR

(i) Properties that depend upon the quantity of the matter are known as extensive properties and those which does not depend upon the quantity of the matter are known as intensive properties. (ii) A process that takes place at constant temperature is known as an isothermal process and at constant pressure is known as isobaric process.
PREPARED BY: MS. SARITHA SUDHIR (BVB V M Public School)

TOPIC /UNIT	**THERMODYNAMICS (PART 2)**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	The student will be able to understand the second law of Thermodynamics.
CORE CONCEPTS /MAJOR AREA	Second law of Thermodynamics.
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question
QUESTION 1: The total entropy changes for a system and its surrounding increases, if the process is (a) reversible (b) Irreversible (c) Exothermic (d) Endothermic Ans- (b) irreversible	
QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	The student will be able to quantify entropy changes using a “statistical” approach.
CORE CONCEPTS /MAJOR AREA	Entropy
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question
QUESTION 2: The correct thermodynamic condition for the spontaneous reaction at all temperature is (a) $\Delta H>0$ and $\Delta S<0$ (b) $\Delta H<0$ and $\Delta S>0$ (c) $\Delta H<0$ and $\Delta S<0$ (d) $\Delta H<0$ and $\Delta S=0$ Ans- (b) $\Delta H<0$ and $\Delta S>0$	
QUESTION NUMBER	**3**

EXPECTED LEARNING OUTCOMES	The student will be able to describe why the entropy of a gas is greater than that of a liquid and a solid, and why the entropy of a liquid is greater than that of a solid
CORE CONCEPTS /MAJOR AREA	Entropy Change
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

Assertion (A): Water in liquid state is more stable than ice at room temperature**.**
Reason (R): Water in liquid form has higher entropy than ice.

Ans- (b)Both Assertion and reason are true but reason is not the correct explanation of Assertion.

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	The student will be able to describe why the entropy of a gas is greater than that of a liquid and a solid, and why the entropy of a liquid is greater than that of a solid.
CORE CONCEPTS /MAJOR AREA	Second Law of Thermodynamics
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion (A): Chlorine when solidifies does not have zero entropy even at absolute zero.
Reason (R): Chlorine is a pungent smelling gas and it is difficult to solidify it.

Ans- (b)Both Assertion and reason are true but reason is not the correct explanation of Assertion

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	The student will be able to describe the change in free energy of the system for a physical or chemical process in terms of the changes in enthalpy and entropy of the system.
CORE CONCEPTS /MAJOR AREA	Gibb's free energy
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION : 5

The study of energy transformations forms the subject matter of thermodynamics. Most of the reactions fall into the category of either closed systems or open systems. For these, neither decrease in enthalpy (ΔH) nor increase in entropy (ΔS) can determine the direction of spontaneous change. Gibb's free energy (ΔG) combines these two factors in one equation as $\Delta G=\Delta H-T\Delta S$.

ΔH_f and S^0 values for N_2, H_2, and NH_3 are given below:

	ΔH_f(KJ/mol)	S^0(JK^{-1}mol^{-1})
N_2	0	192
H_2	0	131
NH_3	-46	193

1. What will be the sign of ΔG for spontaneous process?

Ans-For a spontaneous reaction, ΔG is negative

2. What is the relationship between Gibbs energy change and the equilibrium constant of the reaction?

Ans- $\Delta_r G^0 = -2.303\ RT\ Log\ K$

3. Calculate the ΔH^0_f for the reaction

$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$

Is the reaction $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ at 25^0C is spontaneous or non-spontaneous

Justify your answer.

Ans-As ΔG is negative so the reaction is spontaneous

PREPARED BY: Ms. ANJALI NAIKWAD

TOPIC /UNIT	**CHEMICAL EQUILIBRIUM**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Children understand the concept and apply it in examples.
CORE CONCEPTS /MAJOR AREA	Factors effecting chemical equilibrium
CRITERIA/ TYPE OF QUESTION	**ASSERTION & REASONING**

QUESTION 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

ASSERTION: In the reaction of preparation of ammonia,as the temperature increases rate of forward reaction increases.

REASON : As the temperature increases rate of endothermic reactions increases.

Answer: d (A is false but R is true)

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Children appreciate use of catalyst in a reaction

CORE CONCEPTS /MAJOR AREA	Effect of catalyst on chemical equilibrium.
CRITERIA/ TYPE OF QUESTION	**ASSERTION & REASONING**

QUESTION 2:

ASSERTION: A catalyst increases the rate of the chemical reaction.
REASON :A Catalyst provide a new low energy pathway for the conversation of reactants to products.

Answer: a (Both A and R are true and R is the correct explanation of A)

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	Classify the substances into acids & bases on the the basis of Bronsted-Lowry. Concept.
CORE CONCEPTS /MAJOR AREA	Bronsted-Lowry. Concept
CRITERIA/ TYPE OF QUESTION	**ASSERTION & REASONING**

QUESTION 3:

ASSERTION: According to Bronsted- Lowry concept NH_3 is a base
REASON :NH_3 is a proton acceptor.

Answer: a (Both A and R are true and R is the correct explanation of A)

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Children classify the acids and bases as strong and weak on basis of ionisation & learn the concept of conjugate base & conjugate acid
CORE CONCEPTS /MAJOR AREA	Conjugate base & conjugate acid
CRITERIA/ TYPE OF QUESTION	**ASSERTION & REASONING**

QUESTION 4:

ASSERTION: HNO_3 gives a conjugate base NO_3^- which is weaker base than H_2O
REASON :HNO_3 is a weak acid .

Answer: c (A is true but R is false.)

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	Children understand the concept and apply it in examples.
CORE CONCEPTS /MAJOR AREA	Chemical equilibrium

CRITERIA/ TYPE OF QUESTION	**ASSERTION & REASONING**

QUESTION 5:

ASSERTION: NaCl is soluble in water
REASON: The process of solvation is exothermic in nature.

Answer: b (Both A and R are true but R is not the correct explanation of A.)

PREPARED BY: UJITHRA SREEKANTH (BVBVM KODUNGALLUR)

TOPIC /UNIT	**REDOX REACTION**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Students will be able to apply the concept of finding the oxidation number to identify the correct order of oxidation states in chlorine-containing compounds.
CORE CONCEPTS /MAJOR AREA	Oxidation Number
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:
Which is the correct increasing order of the oxidation number of chlorine in the following compounds :
(a) $HClO4 < NaClO_3 < Cl_2O < NaCl$ (b) $NaCl < Cl_2O < NaClO_3 < HClO_4$
(c) $Cl_2O < HClO_4 < NaCl < NaClO_3$ (d) $NaClO_3 < NaCl < HClO_4 < Cl_2O$
ANS: Option (b)

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Students will be able to determine the oxidation states, and the identification of specific compounds where carbon exhibits tetra covalency and an oxidation state of +2.
CORE CONCEPTS /MAJOR AREA	Covalency and an oxidation state
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:
In which of the following compounds , carbonexhibits tetra covalency and oxidation state of +2 ?
(a) CHI_3 (b) CCl_4 (c) CH_2Br_2 (d) C_2H_6

ANS: Option (a)

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	Students will be able to apply redox principles, such as changes in oxidation states, in identifying species

	(species in the intermediate oxidation state) that can undergo disproportionation reactions.
CORE CONCEPTS /MAJOR AREA	oxidation state and disproportionation reactions.
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

Which of the following species can act as both an oxidant and a reductant ?

(a) BrO_4^- (b) MnO_4^- (c) NO_3^- (d) IO^-

ANS : Option (d)

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Students will understand that oxidation numbers are typically whole numbers (in molecule or simple ion) that can be expressed in simple terms. They will consider the structure of KI_3 to find the oxidation state.
CORE CONCEPTS /MAJOR AREA	Oxidation numbers
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

ASSERSION : Oxidation number of iodine in KI_3 is -1/3 .

REASON : A coordinate bond is formed between I_2 molecule and I^- ion .

ANS: Assertion is incorrect and reason is correct .

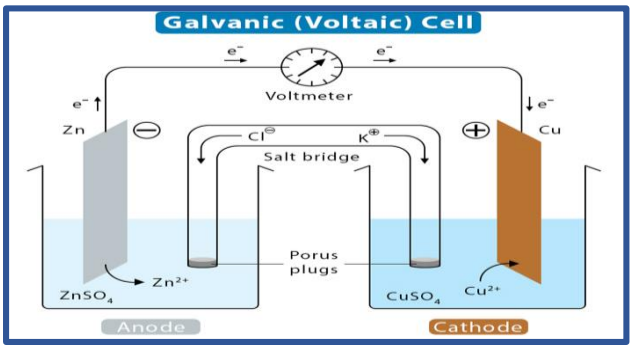
QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	Students will be able to apply the concept of redox reactions to calculate the standard electrode potential (E°), to understand the purpose and role of the salt bridge in maintaining electrical neutrality and to represent a galvanic cell, specifically the Daniel cell, in the form of an electrode notation.
CORE CONCEPTS /MAJOR AREA	The standard electrode potential
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Redox reactions are important class of reactions which are taking place in our daily life. Metals are good reducing agents because they can lose electrons easily whereas non-metals are good oxidising agents which can gain electrons easily.

In electrolytic cells ,a direct redox reaction occurs, the transference of electrons is limited to very small distances and therefore, no useful electrical work could be obtained In these reactions, chemical energy appears as heat . However, if the transference of electrons occurs through some metallic wires, useful electrical work could be performed. Such redox reactions are called indirect redox reactions and electrical energy is produced during such spontaneous reactions instead of heat

energy. The arrangement for carrying out indirect redox reactions is called Galvanic cell e.g. Daniel cell .



It generally consists of two half cells and a salt bridge. Each half-cell further consists of a metallic electrode dipped into an electrolyte. These two half-cells are connected to a voltmeter and a switch externally with the help of metallic wires.

Answer the following questions:

(a) Calculate the $E^{o}_{Ni^{2+}/Ni}$ when the cell potential of the cell
$Ni_{(s)}\,|\,Ni^{2+}(1M)\,||Cu^{2+}(1M)\,|\,Cu_{(s)}$ is 0.597 V ($E^{o}_{Cu^{2+}/Cu}$ = 0.34 V) .

ANS: $E^{o}_{cell}=E^{o}_{red}-E^{o}_{oxid}$

$0.597 = 0.34 - E^{o}_{oxid}$

$0.597-0.34 = - E^{o}_{oxid}$

$E^{o}_{oxid} = -0.257$

(b) Write two functions of the salt bridge .

ANS: (i) A Salt bridge is used to maintain electrical neutrality inside the circuit of a galvanic cell.
(ii) A Salt bridge acts as an electrical connection between two half cells.
(iii) A Salt bridge prevents the diffusion of solution from one cell to the other.
(any two)

(c) Give the cell representation of the Daniel cell .

ANS: $Zn_{(s)}\,|\,Zn^{2+}_{(aq)}(1M)\,||\,Cu^{2+}_{(aq)}\,(1M)\,|\,Cu_{(s)}$

PREPARED BY: KULVINDER KAUR

TOPIC /UNIT	**SOME BASIC PRINCIPLES AND TECHNIQUES**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Students will be able to •understand that electromeric effect is a temporary effect. •know that organic compounds having a multiple bond (a double or triple bond) show this effect in the presence of an attacking reagent only
CORE CONCEPTS /MAJOR AREA	Electromeric effect
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question
QUESTION 1: The temporary effect in which there is complete transfer of a shared pair of pi-electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent ia called	

(a) inductive effect
(b) hyperconjugation effect
(c) positive resonance effect
(d) electromeric effect

Ans: d

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Students will be able to •acquire the knowledge that the technique is applied to separate substances which are steam volatile and are immiscible with water.
CORE CONCEPTS /MAJOR AREA	separate substances
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:
Which of the following technique is used to separate a mixture of o – nitrophenol and p – nitrophenol?
(a) Sublimation
(b) Steam distillation
(c) Fractional distillation
(d) Simple distillation

Ans: b

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	Students will be able to •apply their knowledge that a mixture of benzene and thiophene with sulphuric acid causes sulphonation of the thiophene but leaves the benzene untouched. •understand that thiophenesulphonic acid dissolves in the sulphuric acid layer, which can be separated easily
CORE CONCEPTS /MAJOR AREA	
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:
Choose the correct answer out of the following choices.
(a) Both assertion and reason are true and the reason is the correct explanation of assertion.
(b) Both assertion and reason are true but the reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

Assertion : Commercial benzene containing thiophene is purified by shaking with conc. Sulphuric acid.

Reason: The boiling point of benzene is 353 K while that of thiophene is 357 K**.**
Ans: b

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Students will be able to •get the knowledge that Kjeldahl's method is not applicable for compounds containing nitrogen as nitro and azo groups and for compounds having nitrogen directly attached to the ring (e.g. pyridine) because the nitrogen of these compounds does not change to ammonium sulphate
CORE CONCEPTS /MAJOR AREA	
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:
Assertion : Nitrogen present in m - dinitrobenzene can be estimated by Kjeldahl's method.
Reason: During digestion, nitrogen of m - dinitrobenzene is not completely converted into (NH4)2SO4.
Ans: d

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	Students will be able to understand and write the chemical reactions involved in the qualitative analysis of organic compounds.
CORE CONCEPTS /MAJOR AREA	qualitative analysis of organic compounds.
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:
The elements present in organic compounds are carbon and hydrogen. In addition to these, they may also contain oxygen, nitrogen, sulphur, halogens and phosphorus. During the detection of elements by Lassaigne's test, the covalent compounds are converted into ionic compounds by fusion with metallic sodium. The nitrogen, sulphur and halogens present in the organic compound are converted into cyanides, sulphides and halides respectively which are then detected by their usual tests.
(a) An organic compound containing N. S and O as extra elements is fused with sodium metal and then extracted with water. Name the compound formed when sodium fuses with nitrogen and carbon and write its formula.
Ans. Sodium Cyanide , NaCN

(b) The sodium fusion extract is acidified with acetic acid and lead acetate is added to it. Write the reaction involved during the process and which colour precipitates formed?
Ans. A black precipitate of lead sulphide indicates the presence of sulphur.
$S^{2-} + Pb^{2+} \longrightarrow PbS$ (Black)

OR

(b) Name the compound which will give blood red colour while doing Lassaigne's

test for nitrogen and the reactions. (

Ans. Sodium thiocyanate is formed. It gives blood red colour and no Prussian blue since there are no free cyanide ions.

$Na + C + N + S \longrightarrow NaSCN$

$Fe^{3+} + SCN^- \longrightarrow [Fe(SCN)]^{2+}$ Blood red

PREPARED BY: Nidhi Agnihotri

TOPIC /UNIT	**GENERAL PRINCIPLES OF ORGANIC CHEMISTRY**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Students will be able to understand the concept and apply it in examples
CORE CONCEPTS /MAJOR AREA	Metamers
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

Metamers are structural isomers in which the number of carbon atoms differ around the functional group.

- Which among the following pairs are metamers?

a) Propanol and propan-2-ol
b) Propanal and Propanone
c) N-Ethylethanamine and N-Methylpropanamine
d) Ethenol and Ethanal

Answer: c)

Explanation: N-Ethylethanamine and N-Methylpropanamine have same functional group but size of alkyl group around it is different.

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Students will be able to analyze the difference in the reactivity of reaction intermediates like carbocations, cabanions etc.
CORE CONCEPTS /MAJOR AREA	Reaction intermediates
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

Which of the following is the most reaction carbocation?

a) Tert-Butyl carbocation
b) n-Butyl cabocation
c) Iso-propyl carbocation
d) Iso-butyl carbocation

Answer: a)

Explanation: tertiary carbocations are the most stable due to more number of alkyl groups.

QUESTION NUMBER	**3**

EXPECTED LEARNING OUTCOMES	Students will be able evaluate the facts about inductive effect.
CORE CONCEPTS /MAJOR AREA	Inductive effect.
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

Halogens show negative inductive effect (-I effect or electron withdrawing effect) when attached to carbon chain.

- **Assertion : 2-Chloroethanoic acid has more acidic strength than ethanoic acid.**
- **Reason : Choro group is electron donating group.**

Answer: c) A is correct, but R is wrong

Explanation: Halogens are electron withdrawing group and show -I effect

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Students will be able to able to understand the rules of IUPAC nomenclature.
CORE CONCEPTS /MAJOR AREA	IUPAC nomenclature
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion : 4-methylpentane doesn't exist.

Reason : As per lowest locant rule, the number of carbon atom should be done in such a manner so that. substituent gets the lowest number possible.

Answer: d)

Explanation: Correct name of compound is 2-Methylpentane

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	Students will be able to recall the methods of quantitative and qualitative analysis of organic compounds for various elements.
CORE CONCEPTS /MAJOR AREA	Quantitative and qualitative analysis
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Read the given passage and answer the following questions:

Quantitative analysis is an analysis method used to determine the number of elements or molecules produced during a chemical reaction. Organic compounds comprise carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur and halogens. The various methods used for the measurement of the percentage composition of elements in an organic compound include various techniques. Qualitative analysis is the analysis of the species present in a given compound. For example, if a compound is taken, the qualitative analysis would be more focused on finding the elements and the ions present in the compound rather than study as to how much they are present.

Q1 What is meant by qualitative analysis?
Q2 Which method is used to estimate carbon and hydrogen?
Q3 How is the estimation of halogens done in organic compound?
Q4 Nitrogen is difficult to be estimated. Which method is used for the estimation of nitrogen?

OR

What is the catalyst used in Kjeldahl's method for the estimation of nitrogen?

ANSWERS-

1. Qualitative analysis determines the percentage composition of elements present in a compound.
2. The Liebig's combustion method is used to estimate carbon and hydrogen. The hydrogen present is oxidised to water, and the carbon present is oxidised to carbon dioxide.
3. The Carius method is used for the estimation of halogens. They are treated with acidified silver nitrate.
4. The Dumas method is used for the estimation of nitrogen. Nitrogen gas is released in its free form, confirming the presence of nitrogen.

OR

$CuSO_4$ is used as a catalyst for the estimation of nitrogen in Kjeldahl's method.

PREPARED BY: Megha Mudgal Bhardwaj

TOPIC /UNIT	**HYDROCARBONS (AROMATIC)**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	Predict the expected product in different aromatic reactions
CORE CONCEPTS /MAJOR AREA	Aromatic reactions
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

The product obtained when two moles of ethyne and one mole of propyne is made to undergo cyclic polymerization by passing through red hot iron tube

a)Benzene
b)Toluene
c)m-xylene
d)Mesitylene

Answer: b

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	Apply his/her knowledge to write a chemical report
CORE CONCEPTS /MAJOR AREA	Friedel-Crafts reaction
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

The function of anhydrous $AlCl_3$ in the Friedel-Crafts reaction is

a. To absorb water
b. To absorb HCl
c. To produce an electrophile
d. To produce nucleophile

Answer: c

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	The students will be able to explain the various reactions of benzene.
CORE CONCEPTS /MAJOR AREA	reactions of benzene
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 3:

Ozonolysis of toluene gives :

a. two molecules of glyoxal
b. two molecules of glyoxal and one molecule of methyl glyoxal
c. three molecules of glyoxal
d. two molecules of methyl glyoxal and one molecule of glyoxal.

Answer: b

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	Analyze the reasons for the unique chemical properties in some aromatic compounds.
CORE CONCEPTS /MAJOR AREA	aromatic compounds
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion: The presence of nitro group makes the benzene ring less reactive.

Reason: The overall electron density on the benzene ring increases due to the nitro group.

Answer: c

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	Identify and predict the properties of aromatic compounds.
CORE CONCEPTS /MAJOR AREA	
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Read the given passage and answer the questions that follow:

Aromatic compounds, also known as "mono- and polycyclic aromatic hydrocarbons", are organic compounds containing one or more aromatic rings. The word "aromatic"

originates from the past grouping of molecules based on odor, before their general chemical properties were understood. The current definition of aromatic compounds does not have any relation with their odor. Aromatic compounds play key roles in the biochemistry of all living things. Key aromatic hydrocarbons of commercial interest are benzene, toluene, *ortho*-xylene and *para*-xylene. Benzene is the least complicated hydrocarbon. The nature of its bonding was first recognized by August Kekulé in the 19th century. Aromatic hydrocarbons display aromaticity. Their carbon hydrogen ratio is high and they undergo electrophilic substitution reactions and nucleophilic aromatic substitutions.

Which of the following statements is wrong?

a. Aromatic compounds are richer in carbon content.

b. Aromatic compounds burn with clear blue flame.

c. Aromatic compounds are stable.

d. Aromatic compounds show substitution reaction.

Answer :b

PREPARED BY: K R SINDHU

TOPIC /UNIT	**HYDROCARBONS (ALIPHATIC)**
QUESTION NUMBER	**1**
EXPECTED LEARNING OUTCOMES	The student will be able to distinguish addition reactions in the presence of peroxide and in the absence of peroxide.
CORE CONCEPTS /MAJOR AREA	Distinguishing Reactions
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 1:

When propene reacts with HBr in presence of peroxide it gives

a) Iso propyl bromide

b) Alkyl bromide

c) 1-Bromo propane

d) none of these.

Answer: option (c) 1-Bromo propane

QUESTION NUMBER	**2**
EXPECTED LEARNING OUTCOMES	The student will be able to analyse the ozonolysis and construct the compound
CORE CONCEPTS /MAJOR AREA	The ozonolysis
CRITERIA/ TYPE OF QUESTION	Multiple Choice Question

QUESTION 2:

Compound 'X' on reaction with O3 followed by Zn/H2O gives Formaldehyde and 2-methyl propanal as products. The compound 'X' is

a)3-Methylbut-1-ene
b) 2-Methylbut-1-ene
c) 2-Methylbut-2-ene
d) Pent-2-ene

Answer : option (a)3-Methylbut-1-ene

QUESTION NUMBER	**3**
EXPECTED LEARNING OUTCOMES	The Student will be able to acquire knowledge and apply it to the situation.
CORE CONCEPTS /MAJOR AREA	Acidic Character of Alkynes
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 3:

Assertion (A): Ethyne is more acidic than ethene.
Reason (R): Ethyne is 'sp' hybridised, which is more electronegative due to 50% s-character.
Answer : Both A and R are true and R is the correct explanation of A.

QUESTION NUMBER	**4**
EXPECTED LEARNING OUTCOMES	The student will be able to demonstrate conformations
CORE CONCEPTS /MAJOR AREA	Conformations
CRITERIA/ TYPE OF QUESTION	ASSERTION & REASONING

QUESTION 4:

Assertion (A): There are infinite number of conformations of ethane possible.
Reason (R): Eclipsed conformation is least stable due to maximum repulsion and torsional strain.
Answer: Both A and R are true and R is not the correct explanation of A.

QUESTION NUMBER	**5**
EXPECTED LEARNING OUTCOMES	The student will be able to identify the compound which can show geometrical isomerism
CORE CONCEPTS /MAJOR AREA	geometrical isomerism
CRITERIA/ TYPE OF QUESTION	**CASE STUDY**

QUESTION 5:

Read the given passage and answer the questions that follow:
Hydrocarbons are compounds of carbon and hydrogen only, obtained from coal and petroleum mainly which are major sources of energy. Hydrocarbons are classified as open chain, saturated (alkanes), unsaturated (alkenes and alkynes), cyclic (alicyclic) and aromatic based on structure.Alkanes show conformational isomerism due to free rotation along C-C bond leading to staggered and eclipsed conformations of ethane.

Staggered conformation is more stable, Alkenes show geometrical (Cis-trans) isomerism due to restricted rotation around carbon-carbon double bond.

1- Out of 1-butene and 2-butene which will show geometrical isomerism.?
2- Why is cis-2-butene has a higher boiling point than trans-2-butene?
3- What effect does branching of an alkane chain on its boiling point?

Answer : (a) But-2-ene will show geometrical isomerism.
(b) It is because cis-2-butene is more polar, has more van der Waals forces of attraction than trans-form.
c)The greater the branching, the lower will be boiling point because surface area will decrease hence, boiling point decreases

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