

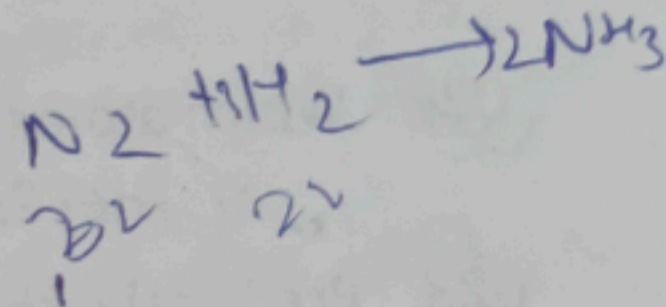
MM 70

General Instructions:

- a) There are 33 questions in this question paper with internal choice.
- b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- c) SECTION B consists of 5 very short answer questions carrying 2 marks each.
- d) SECTION C consists of 7 short answer questions carrying 3 marks each.
- e) SECTION D consists of 2 case-based questions carrying 4 marks each.
- f) SECTION E consists of 3 long answer questions carrying 5 marks each.
- g) All questions are compulsory.
- h) Use of log tables and calculators is not allowed

SECTION: A

- Q1 ✓ How many electrons in an atom can have the following quantum numbers? $n=4, m=-1/2$
a) 14 b) 15 c) 32 d) 16
- Q2 ✓ Commercially available HCl is 38 percent by mass. If its density is 1.2g/ml then its molarity is
a) 12.49M b) 11.75 M c) 11.80 M d) None of the above
- Q3 ✓ Out of Cl, N, and O, which one has positive electron gain enthalpy.
a) N b) Cl c) O d) None of the above
- Q4 ✓ The correct oxidation state of Cr in CrO_5 is:
a) +3 b) +2 c) +5 d) +6
- Q5 ✓ Which of the following are isoelectronic with Ar
a) Cl^- b) K^+ c) Ca^{2+} d) All of the above
- Q6 ✓ In the modern periodic table, the element with atomic number 119 is present in group
a) 9 b) 19 c) 1 d) 11
- Q7 ✓ The order of screening effect of electrons of s, p, d and f orbitals of given shell of an atom on its outer shell electrons is:
a) $p > d > s > f$ b) $f > d > p > s$ c) $s > p > d > f$ d) $f > p > s > d$
- Q8 ✓ Which group elements have the lowest ionisation enthalpy?
a) Group 2 b) Group 17 c) Group 18 d) Group 1
- Q9 ✓ 3L of N_2 react with 2 L of H_2 to form how many litres of NH_3 ?
a) 2 L b) 4L c) 4.05 L d) 1.33 L
- Q10 ✓ The shortest wavelength of hydrogen spectrum of Lyman series is
a) 1400 Å b) 911.7 Å c) 1100 Å d) 1200 Å
- Q11 ✓ Isostructural species are those which have the same shape and structure. Among the given species identify the isostructural pairs.
a) $[\text{NF}_3$ and $\text{BF}_3]$ b) $[\text{BF}_4^-$ and $\text{NH}_4^+]$ c) $[\text{BCl}_3$ and $\text{BrCl}_3]$ d) $[\text{NH}_3$ and $\text{NO}_3^-]$
- Q12 ✓ The oxidation state of Fe in Fe_3O_4 is
a) +2 b) +3 c) +8/3 d) +2, +3



03-10-2024

In the following questions, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions as given below:

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

Q13 **Assertion (A):** Molarity does have a unit and it is mol/litre.
Reason (R): Molarity does not change with temperature.

Q14 **Assertion (A):** The last electron in potassium enters into 4s orbital not 3d orbital.
Reason (R): (n+1) rule is used to determine the energy of a subshell.

Q15 **Assertion (A):** Lanthanum is the first member of Lanthanoid series.
Reason (R): Lanthanum does not have electrons in f orbital.

Q16 **Assertion (A):** Halogens show positive oxidation states in oxoacids
Reason (R): In HClO_4 , the oxidation state of Chlorine is +7

SECTION: B

Q17 Write down the main points of planck's quantum theory.

Q18 Write down the electronic configuration of the following elements
(Cr-24 and Cu-29)
a) Cr^{3+} b) Cu

Q19 Differentiate between electron gain enthalpy and electronegativity. (2 points)

Q20 Calculate the molality of a solution of sulphuric acid if its molarity is 1.35M. Given its density as 1.02g/cm^3 .

Q21 The reactant which is entirely consumed in reaction is known as limiting reagent. In the reaction $2\text{A} + 4\text{B} \rightarrow 3\text{C} + 4\text{D}$, when 5 moles of A react with 6 moles of B, then (i) Which is the limiting reagent? (ii) Calculate the amount of C formed?

OR

Calculate the number of moles of NaOH in 27 ml of 0.15M NaOH solution.

SECTION: C

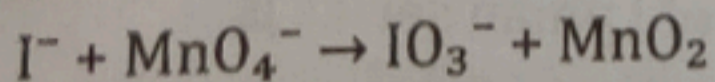
Q22 Which atoms are indicated by the following configurations?

a) $[\text{He}] 2s^1$ b) $[\text{Ne}] 3s^2 3p^3$ c) $[\text{Ar}] 4s^2 3d^3$

Q23 Predict the shapes of the following using VSEPR

IF_3 SF_4 XeO_3

Q24 a) Balance in Basic medium



b) Find oxidation no. of sulphur in H_2SO_5 .

Q25 Write down the general properties of s, p & d block elements.

Q26 Find the oxidation no. of the underlined element in the following:

Cr in $\text{Cr}_2\text{O}_7^{2-}$ N in NH_4^+ C in $\text{C}_2\text{O}_4^{2-}$

Q27 Write down three exceptions to the rule of octet.

- Q28 a) (i) Show that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.
(ii) Which physical quantity has the same unit as Planck's constant?

OR

- a) An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the atomic symbol.

SECTION: D

- Q29 Read the following passage and answer the questions that follow:

Oxidation number denotes the oxidation state of an element in a compound according to set of rules formulated on the basis of that electron pair in a covalent bond belongs entirely to more electronegative element. If two or more than two atoms are present in a molecule/ion as $S_2O_3^{2-}$, Cr_2O_3 , the oxidation number of atom will be average of the oxidation number of all atoms. All elements in uncombined state are assigned oxidation number zero. Hydrogen is assigned -1 with metals and +1 with non-metals. Chlorine, Bromine, Iodine when combined with oxygen, in oxoacids and oxo-anions have positive oxidation numbers. The algebraic sum of oxidation number of all elements and atoms in a compound is equal to zero and equal to charge in an ion. In Stock notation oxidation number is written in parenthesis in Roman numerals.

- a) What is oxidation number of Au in $HAuCl_4$?
b) What is oxidation number of Cl in $HClO_2$?
c) i. In Pb_3O_4 , what are oxidation states of Pb?
ii. In OF_2 , what is oxidation number of oxygen?

OR

- c) Write stock notation for i. SnO_2 ii. Fe_2O_3

- Q30 Read the passage given below and answer the following questions:

Heisenberg's uncertainty principle states it is impossible to determine simultaneously the exact position and momentum (or velocity) of an electron. It rules out existence of definite path of electron and other similar particles. Electron is a tiny particle. To see an electron we need highly energetic light. Highly energetic photons will strike with electrons and change its velocity so position will be more certain but velocity will be uncertain. If we use less energetic light, then velocity will be more certain but position of electron will be uncertain. If we use light of moderate energy, there will be some uncertainty in both position (Δx) and velocity (Δv).

- a) Why is it not possible to determine the exact position and velocity of a subatomic particle like electron?
b) An object has mass 10 kg, then what will be the value of $\Delta x \cdot \Delta v$?
c) The uncertainty in velocity of electron is 1% then what will be Δx , [velocity of electron = $3 \times 10^8 \text{ ms}^{-1}$, $m = 9.1 \times 10^{-31} \text{ kg}$]

OR

- c) If Δx in proton is 0.1 \AA , what will be value of Δv ? [$m_p = 1.67 \times 10^{-27} \text{ kg}$]

SECTION: E

- Q31 Two elements A and B have atomic number 16 and 19 respectively.

- a) Write the electronic configuration of the elements.
b) Which element belongs to s-block of periodic table?

- Which is a powerful oxidizing agent?
Write the formula of the compound formed between A and B.

OR

The first and the second ionization enthalpies (in kJ mol⁻¹) and the electron gain enthalpy (in kJ mol⁻¹) of a few elements are given below:

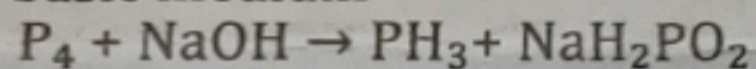
Elements	ΔH_1	ΔH_2	$\Delta_{eg} H$
I	520	7300	-60
II	419	3051	-48
III	1681	3374	-328
IV	1008	1846	-295
V	2372	5251	+48
VI	738	1451	-40

Which of the above elements is likely to be:

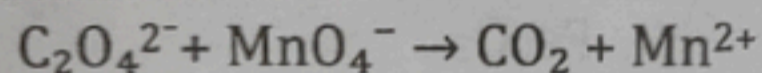
- the least reactive element.
- the most reactive metal.
- the most reactive non-metal.
- the least reactive non-metal.
- the metal which can form a stable binary halide of the formula MX₂ (X=halogen).
- the metal which can form a predominantly stable covalent halide of the formula MX (X=halogen)

Q32 a) Define oxidation number.

b) Balance in basic medium



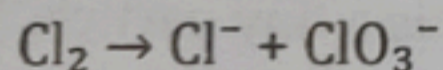
c) Balance in acidic medium



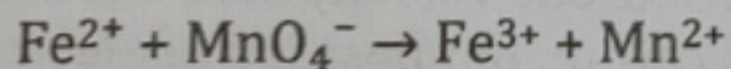
OR

a) Define disproportionation Rx

b) Balance in basic medium



c) Balance in acidic medium



Q33 a) Define law of constant proportion.

b) How many molecules of water of hydration are present in 630 mg of oxalic acid (H₂C₂O₄·2H₂O)?

c) Calculate the difference of number of atoms present in 1.0 g of C-14 isotope and 1.0 g of C-12 isotope of carbon.

OR

a) Define Gay lussac's law of combining volumes.

b) Calculate the number of molecules and atoms present in 5.60L of ozone (O₃) at STP.

c) Calculate the number of gold atoms in 300 mg of a gold ring of 20 carat gold (atomic number of Au=197). Pure gold is 24 carat.