

# HALF YEARLY EXAMINATION 2016

## CHEMISTRY

SET-2

S-3

ADARSH XIN 2  
Max. Marks: 70

Time: 3 hours

**General Instruction:**

- (i) All question are compulsory.
- (ii) Question no. 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Question no. 6 to 10 are short answer questions and carry 2 marks each.
- (iv) Question no. 11 to 22 are also short answer questions and carry 3 marks each.
- (v) Question no 23 is value based question and carry 4 marks.
- (vi) Question no. 24 to 26 are long answer questions and carry 5 marks each.
- (vii) Use log tables if necessary, use of calculators is not allowed.

Atomic masses:

[H = 1u, C = 12u, O = 16 u, N = 14 u, Mg = 24u, S = 32 u, Na = 23u, Cl = 35.5 u,

Fe = 56 u],  $h = 6.626 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$  or Js,  $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$ ,  $c = 3 \times 10^8 \text{ m/s}$ 

- What is the oxidation state of Cl in  $\text{ClO}_2^-$ ?
- Write down the general outer electronic configuration of 'd' block elements and also state one of their important property.
- What is the number of unpaired electrons in  $\text{Cr}^{3+}$  ( $Z = 24$ )?
- State the law of multiple proportions.
- Calculate the number of ' $\sigma$ ' & ' $\pi$ ' bonds present in the given molecule



- Which of the following elements will have the greatest difference between their first and second ionisation enthalpy?

Mg, Si, P, Na

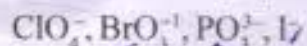
- Give the IUPAC name and identify the group of the periodic table to which the element with  $Z = 117$  belong.
- Identify the oxidizing and reducing agent in the reaction given below:
  - (a)  $4\text{Zn} + \text{NO}_3^- + 7\text{H}_2\text{O} \rightarrow 4\text{Zn}^{2+} + \text{NH}_4^+ + 10 \text{OH}^-$
  - (b)  $\text{Cr}_2\text{O}_7^{2-} + 3\text{H}_2\text{S} + 8\text{H}^+ \rightarrow 2\text{Cr}^{3+} + 3\text{S} + 7\text{H}_2\text{O}$
- How many electrons are present in 8 g of  $\text{SO}_2$ ?
- How many molecules of oxygen are present in a cylinder of capacity 5.6 L if the ratio of the gases oxygen and nitrogen present is 1 : 3 by volume?

9. Discuss the shapes of given molecules on the basis of VSEPR theory



10. (a) What are disproportionation reactions?

(b) Which of the following species does not show disproportionation reactions?



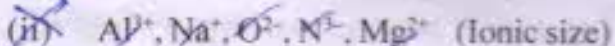
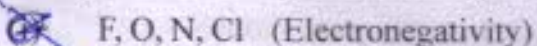
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(a) Justify that the reaction given below is a redox reaction



(b) Can  $\text{F}_2$  undergo disproportionation? Discuss.

11. (a) Arrange the following in increasing order of the property indicated



(b) An atom contains six electrons in 3d subshell. What will be its position in the periodic table (group and period number)?

12. A photon of wavelength 4000 Å strikes a metal surface whose work function is 2.31 eV. Calculate

(a) Energy of the incident photon

(b) KE of electron emitted

13. A given solution of sulphuric acid is 80% by mass and has a density of 1.8 g/cc calculate

(a) molality

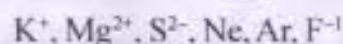
(b) molarity

14. (a) Differentiate between a 'σ' and 'π' bond.

(b) Give reason why  $\text{CO}_2$  molecule is linear but  $\text{SO}_2$  is bent on the basis of dipole moment.

(c) Draw all the possible resonance structures for nitrate ion ( $\text{NO}_3^-$ ) showing all the electrons.

15. (a) Which of the following species are isoelectronic?



(b) What is the number of electrons which has  $(n + l)$  value equal to '4'?

(c) Draw the boundary surface diagram of the following orbitals.



16. Rajat was given the following data of few elements

Element	$\Delta_f H_1$	$\Delta_f H_2$	$\Delta_{\text{vap}} H$
A	520	4300	-60
B	419	3051	-44
C	1681	3374	-348
D	1008	1846	-295
E	2372	5251	+48

What must be the answers given by Rajat to the following questions:

- (a) Most reactive metal
- (b) Most reactive nonmetal
- (c) Metal that can form stable covalent halides MX where X is a halogen
- (d) Least reactive non-metal
- (e) Element forming the most basic oxide
- (f) A noble gas

17. (a) What is the frequency and wavelength of a photon emitted during transition from  $n = 5$  to  $n = 2$  state in a H atom?

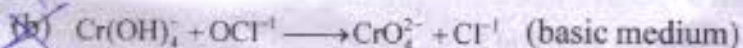
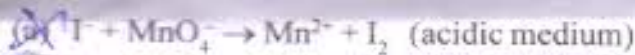
(b) Differentiate between  $\psi$  and  $\psi^2$

OR

(a) Calculate the wave number for the longest wavelength transition in Balmer series for H-atom.

(b) Differentiate between absorption and emission spectrum.

18. Balance the following ionic equation



19. (a) 100 mL solution of NaOH containing 5g of it is mixed with 200 mL of M/5 NaOH solution. What is the resultant Molarity?

(b) An organometallic compound contains C = 64.4%, H = 5.5 % and the rest of it is Iron by mass. Determine the empirical formula of the compound.

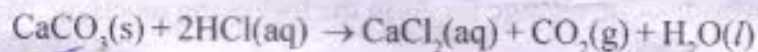
20. Account for the following:

(a) Second electron gain enthalpy for sulphur is less positive than that of oxygen.

(b) Oxygen form  $\text{O}^-$  more easily than Nitrogen

(c) Ionization energy and electron gain enthalpy are both positive for an inert gas.

21. Calcium carbonate reacts with HCl according to the following reaction:



(a) What mass of  $\text{CaCl}_2$  is formed if 250 mL of 0.50 M HCl reacts with 1000 g of calcium carbonate?

(b) Identify the limiting reagent

(c) What is the volume of  $\text{CO}_2$  released at STP?

22. (a) Calculate the formal charge on all the atom in  $\text{O}_3$ .

(b) LiF is insoluble in water despite being ionic but LiI readily dissolves in organic solvent. Explain.

23. A teacher asked the students to predict the geometry of  $\text{NH}_4^+$  molecule based on their knowledge of hybridisation. Kusum predicted the shape to be square planer while Kiran predicted it to be tetrahedral.

- Who predicted the correct shape?
- Giving reason explain the shape on the basis of hybridisation.
- What human value did you learn?

24. (a) State Pauli's exclusion principle.

(b) Why is electronic energy negative?

(c) List two important drawbacks of Bohr's theory.

(d) Calculate the de Broglie wavelength for a coin weighing 1 g moving with a velocity of 80 m/s.

OR

(a) State Hund's rule of maximum multiplicity.

(b) Illustrate how copper has an exceptional configuration.

(c) List two important drawbacks of Rutherford's model.

(d) Calculate the uncertainty in the position of an electron whose momentum is determined with an accuracy of  $\pm 0.02\%$ .

25. Explain the following:

(a)  $\text{SF}_6$  violate octet rule

(b) Structure of  $\text{PCl}_5$  allows it to behave like a chlorinating agent.

(c)  $\text{MgO}$  has a higher lattice enthalpy than  $\text{CaO}$ .

(d)  $\text{H}_2\text{O}$  has a smaller bond angle than  $\text{NH}_3$ .

(e)  $\text{AlCl}_3$  is more covalent than  $\text{NaCl}$ .

OR

(a) All five P-Cl bonds in  $\text{PCl}_5$  not equal in length. Explain.

(b) Draw the Lewis dot structure of  $\text{NO}_2^-$ .

(c) Define dative bond

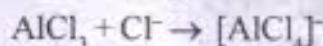
(d) NO violate Lewis octet rule. Explain

(e)  $\text{H}_2\text{O}$  and  $\text{H}_2\text{S}$  have different value of bond angle. Explain.

26. (a) Draw the shape of ethene ( $\text{C}_2\text{H}_4$ ) molecule and identify its state of hybridization.

(b) Calculate the number of bond pairs and lone pair of electrons in  $\text{CO}_2$ .

(c) Does the state of hybridisation change for Al in the following reaction? Mention



OR

(a) Draw the shape of ethyne ( $\text{C}_2\text{H}_2$ ) molecule and mention the total no of  $\sigma$  and  $\pi$  bonds in it.

(b)  $\text{NH}_3$  has a higher value of the dipole moment than  $\text{NF}_3$ . Explain.

(c) What is the nature of bond formed between  $\text{BF}_3$  and  $\text{NH}_3$ . Does the hybridization state change for Boron during the reaction.

