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FIRST TERM EXAMINATION, 2015-16

Subject : Chemistry

Time : 3 Hrs.

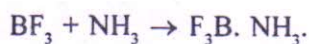
CLASS : XI

M.M. : 70

Instructions :

- (1) All questions are compulsory.
- (2) Q. Nos. 1 to 5 carry one mark each.
- (3) Q., Nos. 6 to 10 carry two marks each.
- (4) Q. Nos. 11 to 22 carry three marks each.
- (5) Q. Nos. 23 carry is 4 marks.
- (6) Q. Nos. 24 to 26 carry 5 marks each.
- (7) Use of log tables is allowed.

1. How are 0.50 mole Na_2CO_3 and 0.50 M Na_2CO_3 different ?
2. How do molarity and molality vary with the change in temperature ?
3. Arrange the following ions in order of decreasing ionic radii :
 Li^{2+} , He^+ , Be^{3+}
4. Out of σ and π bond, which one is stronger and why ?
5. Explain the physical significance of Vander Waal's parameter 'a'.
6. Critical temperature for CO_2 and CH_4 are 31.1°C and -81.9°C respectively. Which of these has stronger intermolecular forces and why ?
7. Is there any change in the hybridisation of B and N atoms as a result of the reaction ?
Explain.



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8. Arrange the following in decreasing order of their radii Cl, H, O, N. Justify.

9. In an atom, an electron is moving with a speed of 600 ms^{-1} with an accuracy of 0.005%. Find the certainty with which the position of the electron can be located. ($h = 6.6 \times 10^{-34} \text{ kg ms}^{-1}$, mass of electron, $m_e = 9.1 \times 10^{-31} \text{ kg}$)

10. Calcium carbonate reacts with aqueous HCl according to the reaction :



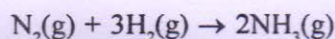
What mass of CaCO_3 is required to react completely with 25 ml of 0.75 M HCl? ($\text{MM}_{\text{CaCO}_3} = 100 \text{ g/mol}$).

OR

Chlorophyll the green colouring matter of plants contains 2.68% magnesium by weight. Calculate the number of magnesium atoms in 2.00 g chlorophyll. (At. mass of Mg = 24 amu)

11. If the density of methanol is 0.793 kg L^{-1} . What is its volume needed for making 2.5 L of its 0.025 M solution? ($\text{MM}_{\text{CH}_3\text{OH}} = 32 \text{ g/mol}$)

12. For the given reaction :



- (a) Calculate the mass of ammonia produced if $2.00 \times 10^3 \text{ g}$ dinitrogen reacts with $1.00 \times 10^3 \text{ g}$ of dihydrogen. ($\text{MM}_{\text{N}_2} = 28 \text{ g/mole}$ $\text{MM}_{\text{H}_2} = 2 \text{ g/mole}$)
- (b) Will any of the two reactants remain unreacted?
- (c) If yes, which one and what would be its mass?

13. A photon of wavelength $4 \times 10^{-7} \text{ m}$ strikes on metal surface, the work function on the metal being 2.13 eV. Calculate :

- (a) the energy of the photon (eV).
- (b) the kinetic energy of the emission
- (c) the velocity of the photoelectron.

(Given $1\text{eV} = 1.6 \times 10^{-19} \text{ J}$, $c = 3 \times 10^8 \text{ m/s}$)

(2)

14. (a) An atomic orbital has $n = 3$. What are the possible values of l and m ?
(b) List the quantum numbers (m and l) of electrons for 3d-orbital.
(c) Which of the following orbitals are possible :

1p, 2s, 2p, 3f

15. Calculate the wavelength for the emission transition if it starts from the orbit having radius 1.3225 nm and ends at 211.6 pm. Name the series to which this transition belongs and the region of the spectrum.

OR

An atom of an element contains 29 electrons and 35 neutrons. Deduce (i) the number of protons (ii) electronic configuration of the element (iii) Identify the element.

16. (a) Would you expect the second electron gain enthalpy of O as positive, more negative or less negative than first? Justify your answer.
(b) Explain why cations are smaller and anions are larger in radii than their parent atoms.

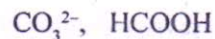
17. Among the second period elements the actual ionisation enthalpies are in the order :



Explain why :

- (a) Be has higher ionisation enthalpy than B ?
(b) N has higher ionisation enthalpy than O ?

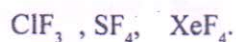
18. (a) Draw the Lewis structure for the following molecules and ions (along with formal charge) :



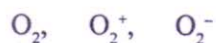
- (b) Which out of NH_3 and NF_3 has higher dipole moment and why ?

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19. Using VSEPR. (Valence Shell Electron Pair Repulsion) theory, predict the structure of the following compounds :



20. Using molecular orbital theory, write the electronic configuration of the following species



Compare the relative stability and indicate their magnetic properties.

21. A student forgot to add the reaction mixture to the round bottomed flask at 27°C but instead, he/she placed the flask on the flame. After a lapse of time, he realized his mistake and using a pyrometer, he found the temperature of the flask was 477°C . What fraction of air would have been expelled out ?

22. Pressure of 1 g of an ideal gas A at 27°C is found to be 2 bar. When 2 g of another ideal gas B is introduced in the same flask at same temperature, the pressure becomes 3 bar. Find the relationship between their molecular masses.

23. Reena loved to learn from experiment, when she read about the solubility of different compounds in water, she decided to prove it. She took some chemical compounds from her teacher in the laboratory and tried to dissolve them. These compounds were magnesium chloride, ethanol and ethyl amine. But she got confused because she found all of these are soluble in water. She discussed these results with her teacher who classified the reason for their observation.

- Why did Reena think that only certain compounds are soluble in water but others are not ?
- What explanation was given by the teacher ? Explain.
- What values are associated with Reena and her teacher ?

24. (a) Differentiate between an orbit and an orbital. (4 differences)
- (b) What is the lowest value of n that allows g orbital to exist?
- (c) What is the maximum number of emission lines obtained when the excited electron of a H atom in $n = 6$ drops to the ground state?

OR

- (a) What is the difference between a quantum and a photon?
- (b) Although Hydrogen has only one electron but many lines are seen in its spectrum, Why?
- (c) Which of the following are isoelectronic species : Na^+ , Mg^{2+} , Ar, Ca^{2+} , S^{2-} ?
25. (a) How many electrons in an atom have the following quantum numbers?
- (i) $n=4$ $m_s = \frac{-1}{2}$
- (ii) $n=3$ $l=0$
- (b) The bromine atom possesses 35 electrons. It contains 6 electrons in $2p$ orbitals, 6 electrons in $3p$ orbitals and 5 electrons in $4p$ orbitals. Which of these electrons experiences the lowest effective nuclear charge?
- (c) Using s , p , d , f notations, describe the orbital with the following quantum numbers:
- (i) $n=4$ and $l=2$
- (ii) $n=5$ and $l=3$

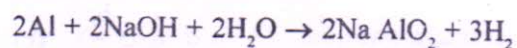
OR

- (a) Calculate the energy required for the process:



- (b) Show that the circumference of the Bohr orbit for hydrogen atom is an integral multiple of De-Broglie wavelength associated with the electron moving around the orbit.

26. (a) Why falling liquid drops are spherical ?
(b) Why at hills, use of pressure cooker is essential for cooking food ?
(c) The drain cleaner, Drainex contains small bits of aluminium which react with caustic soda to produce dihydrogen. What volume of dihydrogen at STP will be released when 0.54 g of Aluminium reacts ?



OR

- (a) For a gas 'A' $Z > 1$ for another gas 'C' $z = 1$ and for gas 'B' $z < 1$ under a given condition :
- Which one of the gases is more compressible ?
 - In which one of the gases the effect of 'a' outweighs the effect of 'b' ?
 - In which one of the gases effect of 'a' is balanced by effect of 'b' ?
- (b) A gas at $t^\circ\text{C}$, pressure P , density $d \text{ g cm}^{-3}$ has n moles enclosed in a room.
- If room is partitioned into 4 compartments what will be t , p , d and n in each compartment
 - What will be t , p , d and n if an equal volume of gas at pressure p , temp t is let inside.