Rajiv Gandhi University of Knowledge Technologies

P1SEM1CHEMEST221112

CHEMISTRY

Date: 22.11.12 **Time: 3 hrs**
Max Marks: 60

Section – A

I. Answer any thirty (30) of the following questions selecting the most suitable alternative. **(1M × 30 = 30M)**

1. The ratio of the rate of diffusion of helium and methane gases under identical condition of pressure and temperature will be _____
   a. 4 : 1
   b. 2 : 1
   c. 1 : 1
   d. 0.5 : 1

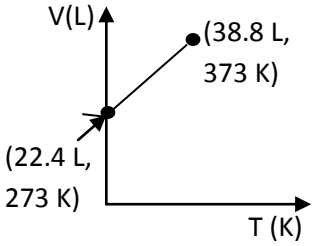
2. Arrange the halides of Lithium in the decreasing order of their lattice energy:
   a. Li–I > Li–Br > Li–Cl > Li–F
   b. Li–Br > Li–Cl > Li–F > Li–Cl
   c. Li–F > Li–Cl > Li–Br > Li–I
   d. Li–I > Li–F > Li–Br > Li–Cl

3. The element with electronic configuration $[Ne]3s^2 3p^2$ represents a
   a. metal
   b. non–metal
   c. metalloid
   d. transition element

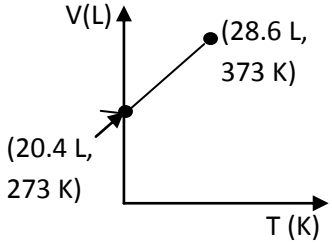
4. The oxidation state of Fe in $[Fe(H_2O)_5NO]^{2+}$ is _____
   a. + 1
   b. + 2
   c. + 3
   d. 0

5. Which one of the following volume (V) – temperature (T) plots represents the behavior of one mole of an ideal gas at the atmospheric pressure?

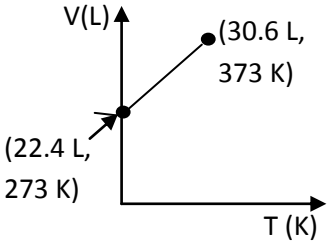
a.



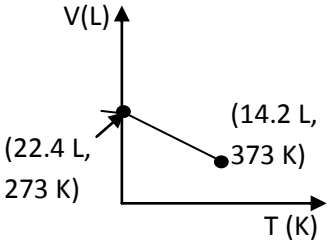
b.



c.



d.



6. The radii of the molecules A & B are 0.32 A^0, 1.92 A^0 respectively. The ratio of their lattice energies is _____

a. 3:5
b. 5:3
c. 4:1
d. 6:1

7. The first ionization enthalpy of Na, Mg, Al and Si follows the sequence given below:

a. Na < Mg > Al < Si
b. Na > Mg > Al > Si
c. Na < Mg < Al > Si
d. Na > Mg > Al < Si

8. A carbon compound contains 12.8% carbon, 2.1% hydrogen, 85.1% bromine. The molecular weight of the compound is 187.9. The molecular formula is _____ (Atomic masses: C = 12; H = 1.0; Br = 80)

a. CHBr
b. CH_2Br_2
c. $C_2H_3Br_2$
d. $C_2H_4Br_2$

9. The radius of the third orbit of Li^{2+} is _____

a. 0.47 A^0
b. 1.58 A^0
c. 2.13 A^0
d. 3.14 A^0

10. According to kinetic theory of gases, which one of the following statements is true for a diatomic molecule?

a. The pressure exerted by the gas is proportional to mean velocity of the molecule
b. The pressure exerted by the gas is proportional to root mean velocity of the molecule
c. The root mean velocity of the molecule is inversely proportional to the temperature
d. The mean translational kinetic energy of the molecule is proportional to the absolute temperature

11. In each of the following molecule/ions, identify the isostructural pairs.

a. I_3^+, ICl_2^-
b. ClO_3F, ClO_4^-
c. $SOCl_2$, NO_2Cl
d. SF_4, CF_4

12. Na^+ is smaller than sodium atom because ____

a. Nucleus in each case contains different nucleons
b. Sodium atom has an electron lesser than sodium ion
c. The force of attraction is less in Na^+ than in Na atom
d. Sodium atom has an electron greater than sodium ion

13. The percentage composition by mass of oxygen in sodium sulphate is _____

a. 16.32
b. 32.65
c. 48.97
d. 65.30

14. How many spectral lines are formed in Balmer series when an electrons jumps from 7^{th} energy level?

a. 21
b. 15
c. 10
d. 6

15. H_2 and He warms in Joule-Thomson experiment because:

a. They have high inversion temperatures

b. They have zero inversion temperatures

c. They have very low inversion temperatures

d. Their Joule-Thomson coefficient is zero

16. The maximum ionization enthalpy in a period is shown by _____

a. Alkali metals
b. Inert gases
c. Alkaline earth elements
d. Halogens

17. The correct order of atomic/ionic radii of the species given below is _____

a. Na < Be < B
b. $F^- < O^{2-} < N^{3-}$
c. Na < Li < K
d. $Fe^{3+} < Fe^{2+} < Fe^{4+}$

18. Balance the following equation:

$$N_2O_5 \rightarrow N_2O_4 + O_2$$

a. $2\ N_2O_5 \rightarrow N_2O_4 + 2\ O_2$

b. $3\ N_2O_5 \rightarrow N_2O_4 + 5\ O_2$

c. $N_2O_5 \rightarrow N_2O_4 + 4\ O_2$

d. $2\ N_2O_5 \rightarrow 2\ N_2O_4 + O_2$

19. The velocity of an electron in the second orbit of hydrogen atom is _____

a. 0.19×10^8 cm/s
b. 1.09×10^8 cm/s
c. 0.19×10^6 cm/s
d. 1.09×10^6 cm/s

20. Assertion (A) : The value of van der Waal`s constant 'a' is larger for ammonia than for nitrogen

Reason (R): Hydrogen bonding is present in ammonia

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

21. Which one of the following halides has different bond lengths?

a. BCl_3
b. CCl_4
c. $BeCl_4$
d. PCl_5

22. Which one of the following is an amphoteric oxide?

a. MgO
b. Al_2O_3
c. SiO_2
d. P_2O_5

23. The equivalent weight of H_3PO_2 is _____

a. 32.3
b. 40.5
c. 51.2
d. 65.0

24. The energy of a photon is 5×10^{-19} J. Its wavelength in A^0 units is _____

a. 3.975×10^{3}
b. 3.975×10^{-3}
c. 3.975×10^{-17}
d. 3.975×10^{17}

25. The density of a gaseous compound is 3.38 g/L at 40 ^{0}C and 1.97 atm. The gaseous compound is _____

a. Nitrogen
b. Oxygen
c. Carbon dioxide
d. Sulfur dioxide

26. The common features among the species CN^-, CO and NO^+ are ____

a. Isoelectronic and are weak field ligands
b. Bond order is equal to three and are Isoelectronic
c. Bond order is equal to two and are π–acceptors
d. Bond order is equal to three and are weak field ligands

27. Which one among the following series is obtained in both absorption and emission spectrums?

a. Lyman series
b. Balmer series
c. Paschen series
d. Brackett series

28. The volume of oxygen gas at 0 ^{0}C and 1 atm, needed to burn completely 1 L of propane gas (C_3H_8) under the same conditions is _____

a. 5 L
b. 10 L
c. 7 L
d. 6 L

29. Which one the following statement is incorrect?

a. The shape of atomic orbital depends on the azimuthal quantum number
b. The orientation of atomic orbital depends on the magnetic quantum number
c. The energy of an electron in an atomic orbital of multi-electron atom depends on the principle quantum number
d. The number of degenerate atomic orbitals of one type depends on the values of azimuthal quantum numbers

30. The chemical name of $Mg_3(PO_4)_2$ is _____

a. Magnesium phosphide
b. Magnesium phosphite
c. Magnesium phosphoxide
d. Magnesium phosphate

31. The molecule having zero dipole moment is _____

a. CH_2Cl_2
b. BF_3
c. NF_3
d. ClO_2

32. The correct sequence which shows decreasing order of the electro negativity of II^{nd} period elements is _____

a. Li > Be > B > C > N > O > F
b. Li > Be > B > N > C > O > F
c. F > O > N > C > B > Be > Li
d. F > O > C > N > B > Be > Li

33. If the mass of Earth is 6.0×10^{23} kg and the mass of a single bacterium is 10^{-3} g, how many bacteria would be needed to equal the mass of the earth?

a. 6×10^{26}
b. 6×10^{29}
c. 6×10^{20}
d. 6×10^{23}

34. The four quantum numbers of valence electron of an element, are n = 4, l = 0, m = 0, $s = -\frac{1}{2}$. The element is _____ and it is present in _____ group of the periodic table.

a. Ca; IIA
b. Ti; IVB
c. Sc; IIIB
d. K; IA

35. Which one of the following is a characteristic property of both mixtures and compounds?

a. Their properties are same as those of their components
b. Energy is released when they are formed
c. Their masses are equal to the sum of the masses of their components
d. They contain the components in fixed proportions

36. Element with atomic number 35 belong to _____

a. 3^{rd} period
b. 15^{th} group
c. 5^{th} period
d. 17^{th} group

Section – B

II. Answer any five of the following questions. **(3M × 5 = 15M)**

1.

a. The RMS velocity of a gas is 5×10^4 cm/s at 27 ^{0}C. Find its RMS velocity at 127 ^{0}C.

b. The kinetic energy of He gas is 800 cal at 27 ^{0}C. At what temperature the kinetic energy of the gas becomes 1200 cal.

2. An element with mass number 81 contains 31.7% more neutrons as compared to protons. Assign the symbol.

3. Write down any three favorable conditions for the cation formation?

4. **a.** The electron affinity of chlorine is 3.7 eV. How much energy in k cal is released when 2 g of chlorine is completely converted to Cl^- ion in gaseous state? (1 eV = 23.06 k cal mol^{-1})

b. Explain the effect of penetrating power on ionization potential.

5. Balance the following equation by the oxidation number method.

$H_2SO_4 + HI \rightarrow H_2S + I_2 + H_2O$

6. Using VSEPR model, predict the geometry of the following molecules and ions: (a) AsH_3 (b) OF_2 (c) $AlCl_4^-$

7. The kinetic energy of an electron is 3.0×10^{-25} J. Calculate its wavelength.

Section – C

III. Answer any three of the following questions. **(5M × 3 = 15M)**

1. **a.** Write the derivation of energy of hydrogen atom?

b. Calculate the wavelength (in nanometers) of a photon emitted by a hydrogen atom when its electron drops from the n = 5 level to the n = 3 level

2. a. The critical temperature and critical pressures of a gas are 300 K and 45 atm respectively. Calculate its excluded volume in lit mol^{-1}.

b. H_2 & O_2 gases are allowed to move from opposite ends of a tube of 100 meters. Find the distance at which the two gases meet each other from the side of H_2 gas.

3. Balance the following equation by ion electron method with required steps.

$$MnO_4^- + C_2O_4^{2-} \rightarrow Mn^{2+} + CO_2$$

4. **a.** What is valence bond theory? How does it differ from the Lewis concept of chemical bonding?

b. Draw the Molecular orbital energy level diagram of O_2 molecule.