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Name

Reg. No. . . . .

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(UG-CCSS)

Core Course—Chemistry

CH3 B05—PHYSICAL CHEMISTRY—I

Time : Three Hours

Maximum : 30 Weightage

I. Answer *all* the twelve questions. Each question carries a **weightage** $\frac{1}{4}$. This section contains multiple choice, fill in the blanks and one word answer questions :

1 The RMS velocity of SO_2, CH_4, O_2 and CO_2 at any temperature is in the order :

    (a) $SO_2 > CO_2 > O_2 > CH_4$.

    (b) $CH_4 = O_2 > CO_2 > SO_2$.

    (C) $CH_4 > O_2 > CO_2 > SO_2$.

    (d). $SO_2 > CO_2 > CH_4 = O_2$.

2 The vapour pressure of a liquid is influenced by :

    (a) Temperature.

    (b) Surface area.

    (c) Intermolecular force.

    (d) All these.

3 An extensive property among the following is :

    (a) Specific heat.

    (b) Surface tension.

    (c) Heat capacity.

    (d) Molality.

4 Which among the following equilibria is not affected by pressure ?

    (a) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$.

    (b) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$.

    (c) $N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$.

    (d) $2 SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$.

5 The value of equilibrium constant of a reaction is not affected by :

    (a) Temperature.

    (b) Initial amount of reactants.

    (c) Reacton stoichiometry.

    (d) Constancy of volume or pressure at which the value is measured.

6 The temperature at which a real gas obeys ideal behaviour over a wide range of pressure is called _____

Turn over

7 The work done by the system during free expansion is _____

8 For a spontaneous process at any temperature and pressure, the value of Gibb's free energy change is _____

9 Particles which obey Bose Einstein statistics are called _____

10 According to Le Chaterlier's principle endothermic reactions are favoured by _____

11 Name a substance, which possesses residual entropy.

12 Give one example of heterogeneous equilibria.

(**12 x $\frac{1}{4}$** = 3 weightage)

II. Answer *all* the *nine* questions. Each question carries a weightage 1 :

13 Write the van der Waals' equation for n moles of a gas and explain the terms.

14 What is compressibility factor of a gas ?

15 Mention any two factors that affect the surface tension of a liquid.

16 What is meant by optical exaltation ?

17 Define inversion temperature of a gas.

18 Calculate the difference between ΔH and ΔE for the reaction $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O(l)$ at 300 K.

19 State the third law of thermodynamics.

20 The activity of 2.5 moles of a gas changes from 0.05 to 0.35 at 300 K. Calculate the change in Gibb's free energy.

21 The value of K_c for the equilibrium $N_2O_{4(0}$ $2NO_{2(g)}$ is found to be 6.45 x 10^{-3} mol L^{-1} at 27° C. Calculate the value of K_p at the same temperature.

(9 x 1 = 9 weightage)

III. Answer any *five* questions. Each question carries a weightage 2 :

22 How will you derive an equation for most probable velocity of a gas from Maxwell-Boltzmann distribution law ?

23 What is parachor ? How is it used to elucidate molecular structure ?

24 Derive an equation for the work of isothermal reversible expansion of 'n' moles of an ideal gas from volume V_1 to V_2 at temperature TK.

25 Heat supplied to a carnot engine is 453.6 Kcal. How much useful work can be done by the engine which works between 0° C. and 100° C. ?

26 Explain Stirling's approximation.

27 Derive the relation between Partition function and Entropy.

28 State and explain Le-Chatelier's principle.

(5 x 2 = 10 weightage)

IV. Answer any *two* questions. Each question carries a weightage 4 :

29 What are critical constants ? How are they related to van der Waals' constant ? Write the Amagat's method of determining critical volume of a gas.

30 Derive the Clausius-Clapeyron equation for liquid-vapour equilibrium. Mention any two applications of the equation.

31 (a) Show that the entropy 'S' and probability 'W' are related as $S = K \ln W$.

(b) Starting from Van't Hoff reaction isotherm, derive the integrated form of Van't Hoff equation.

(2 x 4 = 8 weightage)