

SEM	SET	PAPER CODE	TITLE OF THE PAPER
IV	2013	12PCH4203A	APPLICATIONS OF THERMODYNAMICS AND ELECTROCHEMISTRY

SECTION – A

Answer all the questions:

20 x 1 = 20

Choose the correct answer:

1. The molar heat capacity at constant 'p' for a substance is

a) $\left(\frac{\partial E}{\partial T}\right)_v$

b) $\left(\frac{\partial H}{\partial T}\right)_v$

c) $\left(\frac{\partial E}{\partial T}\right)_p$

d) $\left(\frac{\partial H}{\partial T}\right)_p$

2. The difference of molar free energy in terms of fugacity, for an ideal gas is

a) $G_2 - G_1 = RT \ln \frac{P_2}{P_1}$

b) $F_2 - F_1 = RT \ln \frac{P_2}{P_1}$

c) $G_2 - G_1 = RT \ln \frac{V_2}{V_1}$

d) $F_2 - F_1 = RT \ln \frac{P_1}{P_2}$

3. The fugacity represents the actual behavior of

a) pressure

b) temperature

c) real gases

d) volume

4. For two moles of an ideal gas

a) $(C_p - C_v) = R$

b) $(C_p - C_v) = R/2$

c) $(C_v - C_p) = -2R$

d) $(C_p - C_v) = 0$

5. The EMF of the galvanic cell is
- | | |
|----------|----------|
| a) +1.1v | b) -1.1v |
| c) 1.2v | d) -1.2v |

Fill in the blanks:

6. The total energy of universe is _____.
7. The fugacity of a liquid is measured approximately by _____.
8. The ratio of the activity of any gas to its partial pressure becomes _____.
9. A reversible process involves _____ operations during the thermodynamics studies.
10. The standard hydrogen electrode is selected for coupling _____.

Answer in one or two sentences:

11. What is the chemical potential of a pure ideal gas?
12. Why is entropy of ice less than that of water?
13. What is “Lewis – Randall Rule”?
14. What is the condition of fugacity at low pressure?
15. Define the term “Standard state of activity”.
16. What is the reference state of activity?
17. What is the requirement for work done in isothermal reversible process?
18. What is the work done in adiabatic reversible process?
19. What is single electrode potential?
20. What is an electrochemical series?

SECTION – B

Answer all the questions:

5 x 6 = 30

21. a. Explain the Gibb's – Duhem equation.

OR

b. Explain the variation of chemical potential with temperature.

22. a. Explain the variation of fugacity with pressure.

OR

b. Discuss about the Duhem – Margules equation.

23. a. Explain Mean ionic activity.

OR

b. Write short notes on “activity co-efficient of electrolytes by freezing points”.

24. a. Show that the Joule – Thomson co-efficient for a real gas is not zero in the limit of zero.

OR

b. Show that for an ideal gas undergoing isothermal reversible expansion, (ie) $\Delta G = \Delta A$.

25. a. Derive Nernst equation for the potential of hydrogen electrode.

OR

b. Explain the concentration cells and its applications.

SECTION – C

Answer any FIVE questions:

5 x 10 = 50

26. Describe about the free energy of mixing.
27. Discuss briefly about the ‘Lewis – Randall Rule of Fugacity’.
28. Discuss about the activities and activity co-efficients in liquid solutions.
29. i. 10g of argon gas is compressed isothermally and reversibly at a temperature of 27°C from 10 litre to 5 litre. Calculate $q, w, \Delta E$ and ΔH . For this process $R = 20 \text{ CalK}^{-1}\text{mol}^{-1} \log 2 = 0.30$.
- ii. A system is provided 50J of heat and work done on the system is 10J. What is the change in internal energy? (6+4)
30. Describe the following terms
- (i) Storage cell (7)
- (ii) (ii) Fuel cell (3)
31. Illustrate about the following terms
- (i) Gibb’s – Helmholtz equation (7)
- (ii) Physical significance of free energy (3)
