

# THAPAR UNIVERSITY

ARANYA 2009

"CHEM-IZZA"

FINAL ROUND



## INSTRUCTIONS:

Starting Time: 26<sup>th</sup> October 2009, 6PM

Ending Time: 28<sup>th</sup> October 2009, 6PM

Maximum Marks: 75

*For MCQ's*

Correct answer: 3 marks

Incorrect answer: -2 mark

*For subjective question's*

Correct answer: 5 marks

Incorrect answer: 0 marks

## PRIZES Worth: Rs. 5000/-

1. Individual Participation only.
2. The Quiz is open to school, college students and Professionals.
3. Only the ANSWERS to be mailed and not the complete solutions.
4. Contestants will have **48 hours** to send in their entries.
5. All entries must be sent to the email address "**onlinequiz09@gmail.com**", with the subject line 'FINAL ROUND ANSWERS', mentioning the **Name, Institute/Organization names, Contact number and Address.**
6. **Those who didn't qualify/participate in 1st round, can also take part in this round but 80% of their marks would be considered .**
7. **In case of a tie, the earlier submission wins!**
8. The decision of the Event Co-ordinators will be final.
9. The names of the winners will be announced on 29<sup>th</sup> October 11:59pm.
10. There may be more than one correct answer.

## SECTION 1: OBJECTIVE QUESTIONS

**Q1.** Which of the following fuels possesses the maximum calorific value?

- a. C=84%, H=6%, S=4%, O=6%
- b. C=84%, H=12%, S=1%, O=1%
- c. C=90%, H=5%, S=2%, O=3%
- d. C=95% ,H=2%, S=1%, O=2%

**Q2.** 0.5 grams of iron wire was dissolved in 75 ml of bench  $\text{H}_2\text{SO}_4$  and the volume was increased to 250 ml with water. 25 ml of this solution reduced 8.5ml of N/10  $\text{KMnO}_4$  solution. The amount of pure iron present was (atomic weight of Fe=56)

- a. 0.500 g
- b. 0.252 g
- c. 0.238 g
- d. 0.476 g.

**Q3.** Gibbs free energy of a reaction at  $27^\circ\text{C}$  and  $37^\circ\text{C}$  are -29.0 kcal and -30.0 kcal respectively. The enthalpy change in this temperature range is:

- a. 1.0 kcal
- b. 0.0 kcal
- c. -1.0 kcal
- d. -0.5 kcal.

**Q4.** The reaction  $\text{A (g)} + 2\text{B (g)} \rightarrow \text{C (g)} + \text{D (g)}$  is an elementary process. In an experiment involving this reaction, the initial partial pressure of A and B are  $p_A = 0.60$  atm and  $p_B = 0.80$  atm respectively. When  $p_C = 0.20$  atm , the rate of reaction relative to the initial rate is :

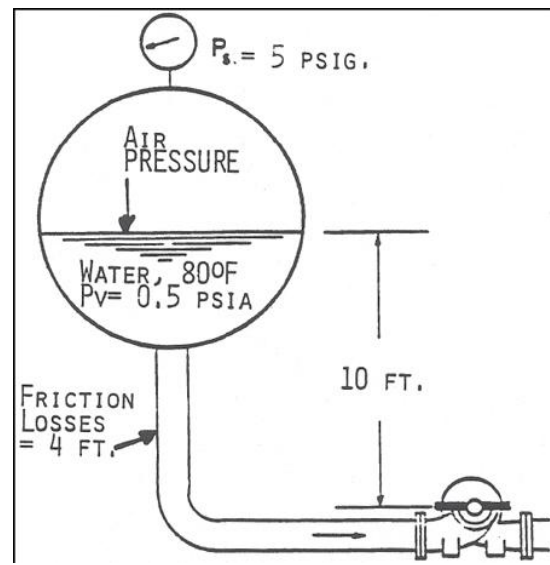
- a. 1/6
- b. 1/12
- c. 1/36
- d. 1/18.

**Q5. Statement:** In strongly acidic solutions aniline becomes more reactive towards electrophilic reagents.

**Reason:** The amino group being completely protonated in strongly acidic solution, the lone pair of electrons on the nitrogen is no longer available for resonance.

- Both statement and reason are correct and reason is the correct explanation of the statement.
- Both statement and reason are correct but reason is not the correct explanation of the statement.
- Statement is correct but reason is incorrect
- Statement is incorrect but reason is correct.

**Q6.** The NPSH available is:



- 12.548 meter
- 15.382 meter
- 17.768 meter
- none of these.

**Q7.** The solute C is being removed from its solution in A using a pure solvent B in a three stage cross current contactor. The feed rate is 30 kmol/h containing 10 mol% C. A total of 27 kmol/h of solvent B is used. The equilibrium reaction is linear. What will be the slope of the operating line for first stage if maximum amount of the solute C has to be recovered:

- a. 3.000
- b. -0.333
- c. -0.900
- d. -0.667.

**Q8.** Water at the rate of 68 kg/min is heated from 35-75°C by an oil having a specific heat of 1.9 kJ/kg-°C. The fluids are used in a counter flow double pipe heat exchanger and the oil enters the exchanger at 110°C and leaves at 75°C. The overall heat transfer coefficient is 320 W/m<sup>2</sup>-°C. The heat exchanger area is:

- a. 15.82m<sup>2</sup>
- b. 15.23 m<sup>2</sup>
- c. 14.68m<sup>2</sup>
- d. 14.53m<sup>2</sup>

**Q9.** 10 grams of glucose ( $\pi_1$ ), 10 grams of urea ( $\pi_2$ ), and 10 grams of sucrose ( $\pi_3$ ) are dissolved in 250 mL of water at 300 K ( $\pi$ =osmosis pressure of solution). The relationship between the osmosis pressures of the solutions is:

- a.  $\pi_1 > \pi_2 > \pi_3$
- b.  $\pi_3 > \pi_1 > \pi_2$
- c.  $\pi_2 > \pi_1 > \pi_3$
- d.  $\pi_2 > \pi_3 > \pi_1$ .

**Q10.** Which of the following represents Cauchy number:

- a.  $\rho V^2/EL$
- b.  $\rho l^2 V^2/EL^2$
- c.  $\rho V^2/K$
- d. None of these.

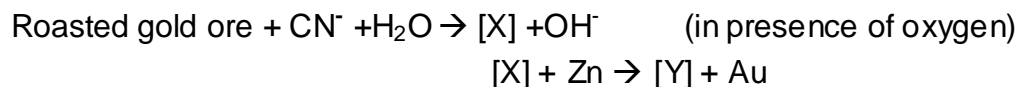
**Q11.** Phosphorus shows an oxidation number of +3 in:

- a. Orthophosphoric acid
- b. Orthophosphorous acid
- c. Metaphosphoric acid
- d. Pyrophosphoric acid.

**Q12.** Sphericity of pulverized coal is:

- a. 1
- b. <1
- c. >1
- d. ∞.

**Q13.** In the process of extraction of gold,



- a.  $\text{X} = [\text{Au}(\text{CN})_2]^-$ ,  $\text{Y} = [\text{Zn}(\text{CN})_4]^{2-}$
- b.  $\text{X} = [\text{Au}(\text{CN})_4]^{3-}$ ,  $\text{Y} = [\text{Zn}(\text{CN})_4]^{2-}$
- c.  $\text{X} = [\text{Au}(\text{CN})_2]^-$ ,  $\text{Y} = [\text{Zn}(\text{CN})_6]^{4-}$
- d.  $\text{X} = [\text{Au}(\text{CN})_4]^-$ ,  $\text{Y} = [\text{Zn}(\text{CN})_4]^{2-}$ .

**Q14.** The characteristic length of a particle increases from 1 mm to 1.11 mm when kept suspended in a solution of super saturation level  $s=1.05$  for 2 hours . If a particle of 0.8 mm size is allowed to grow in the same solution under similar conditions for 4 hours, the final size would be:

- a. 1.2 mm
- b. 0.9 mm
- c. 1.0 mm
- d. None of these.

**Q15.** A gaseous mixture of ethene and ethyne measuring 50 mL is mixed with 150 mL of  $\text{O}_2$  and burnt. After combustion and cooling, the volume of the mixture of gases is 112.5 mL. The percentage by volume of ethene in the mixture is:

- a. 75
- b. 60
- c. 50
- d. 80.

## SECTION 2: SUBJECTIVE QUESTIONS

**Q16.** By what percentage would the rate of absorption be increased or decreased by increasing the total pressure from 100 to 200 kN/m<sup>2</sup> in the following cases:

- a) The absorption of ammonia from a mixture of ammonia & air containing 10 % of ammonia by volume, using pure water as solvent. Assume that all the resistance to mass transfer lies within gas phase.
- b) The same conditions as (a), but the absorbing solution exerts a partial vapor pressure of ammonia of 5 kN/m<sup>2</sup>.

The diffusivity can be assumed to be inversely proportional to the absolute pressure.

**Q17.** A cooling coil, consisting of a single length of tubing through which water is circulated, is provided in a reaction vessel, the contents of which are kept uniformly at 360K by means of a stirrer. The inlet and outlet temperature of the cooling water are 280K and 320K respectively. What would be the outlet water temperature if the length of the cooling coil were increased by 5 times? (Assume overall heat transfer coefficient to be constant over the length of the tube and independent of the water temperature.)

**Q18.** The flow of a liquid in a 25 mm diameter pipe is measured with an orifice meter in which the orifice has a diameter of 19 mm. The aperture becomes partially blocked with dirt from the liquid. What fraction of the area can be blocked before the error in flow rate at a given pressure differential exceeds 15 %? Assume coefficient of discharge of orifice meter remains constant when calculated on the basis of the actual free area of orifice.

**Q19.** A gas of molecular mass 44 kg/kmol at temperature 373K and pressure 202.6 kN/m<sup>2</sup> is flowing in a duct. A pitot tube is located at the centre of the duct and is connected to a differential manometer containing water. If the differential reading is 38.1 mm water, what is the velocity at the centre of the duct? (The volume occupied by 1 kmol at 273K and 101.3 kN/m<sup>2</sup> is 22.4m<sup>3</sup>).

**Q20.** Material is fed to a dryer at the rate of 0.3 kg/sec and the moisture removed is 35% of the wet charge. The stock enters and leaves the dryer at 324K. The air temperature falls from 341K to 310K, its humidity rising from 0.01 to 0.02 kg/kg. Calculate the heat loss to the surroundings.

Latent heat of water at 324 K = 2430 kJ/kg.

Specific heat capacity of dry air = 0.99 kJ/kg-K.

Specific heat capacity of water vapor = 2.01 kJ/kg-K.

**Q21.** The pressure drop in a 10 m long Carbon Steel 0.00015m 2" 40 Schedule pipe (A fluid is flowing inside the pipe at rate of 15m<sup>3</sup>/hr, density is 900 kg/m<sup>3</sup> and viscosity equal to 0.7cP) is \_\_\_\_\_.