hemistry questions

**Paper details:**

Answer all questions please A(i) (3 marks) The pore size of membranes can be measured by using the decrease in vapour pressure of liquid nitrogen condensed in the pores (i.e. cavities) at low temperatures. Calculate the diameter of the pores in a membrane if at 80.0 K the pressure of N2 gas above the membrane is measured to be 1.310 bar. At 80.0 K liquid nitrogen has the following properties:  = 8.27 mN m-1 Vm = 3.528 x10-5 m3 mol-1 p\*vap = 1.369 bar (ii) (2 marks) Water droplets adhere weakly to lotus leaves and but strongly to rose petals, but in both cases the contact angle is ~150o.  Explain, with the aid of diagrams Bi) The partial pressure at 25 °C of the water vapour above a water-ethanol solution for which x(H2O) = 0.5 is 3.7 kPa. The total vapour pressure is 8.7 kPa. For pure water at 25°C, p\*(H2O) = 3.4 kPa; for pure ethanol p\*(ethanol) = 4.3 kPa. (i) (1 mark) Calculate the activity and activity coefficient of the water. (ii) (1 mark) Calculate the activity and activity coefficient of the ethanol. (iii) (2 marks) Calculate the molar excess Gibbs free energy when this water-ethanol mixture is made. (d) [4 marks] With the aid perhaps of a diagram, briefly describe osmosis and osmotic pressure. Briefly describe the role of osmosis in preservation of foods such as jams or salted meats. Describe the structure, specificity, reaction mechanism and regulation of one (1) only of the following: (i) A gastric enzyme that works well at pH 2-3. (ii) A gastric enzyme that works well at pH 7.6-8. (iii) A series of enzymes that result in blood clottin You are adding the non-ionic surfactant Triton X-100 (CMC = 0.25 mM) to an air-water interface and monitoring the surface tension as a function of surfactant concentration. Sketch a graph of surface tension vs surfactant concentration as Triton X-100 is added from 0 mM to 0.5 mM. (v) (3 marks) Your colleague is using a different Triton X surfactant to do the same experiment. Their surfactant has a longer aliphatic chain. Explain how you think this will affect micelle formation.  Imagine you are investigating the effect of salt on the interparticle forces in an emulsion. The emulsion is made of drops of sunflower oil in water and stabilised by sodium dodecyl sulfate. You observe that adding salt to the emulsion causes the average size of the drops to increase. Adding more salt causes the oil to form a separate layer above the water. Sketch graphs of the potential energy between pairs of oil drops in the emulsions under the conditions of: (i) no salt (ii) a low salt concentration and (iii) a high salt concentration.