NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
BACHELOR OF SCIENCE HONOURS DEGREE
SUPPLEMENTARY EXAMINATIONS – AUGUST 2010
TRANSPORT PHENOMENA – SCH 2108
TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

Answer **_ALL_** questions.

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1. (a) Define the following terms:

    (i)   Shear stress.
    (ii) Black body.
    (iii) Viscosity.   [6marks]

    (b) State the following:

    (i)   General rate of transport equation.
    (ii) Buckingham Pi theorem.
    (iii) Fourier equation.   [6 marks]

2. (a) Compare and contrast the following with the aid of diagrams:

    (i)   Laminar flow and turbulent flow.
    (ii) Absolute pressure and gauge pressure.   [8 marks]

    (b) With the aid of a shear stress-shear rate graph and relevant examples, explain the difference between:

    (i)   Dilatants and pseudoplastics.
    (ii) Bingham plastic and Newtonian fluid.   [10 marks]

    (c) State the continuity equation of an incompressible fluid.   [2 marks]

3. (a) Calculate the greatest pressure in a spherical tank, of 3.50m radius, filled with leenseed oil of specific gravity 0.87, if the pressure at the highest point is 160kPa. Density of water is 1 000kg/m^3.   [7 marks]

    (b) Water flows at the rate of 0.4m^3/min in a 7.5cm diameter pipe at a pressure of 70kPa. If the pipe reduces to 5cm diameter, calculate the new pressure.
                                                                 [8 marks]

(c)   The size of the pipe in 3(b) was changed and it was found that the new pressure in the pipe increased to 90kPa. Determine the percentage change in size of pipe from the original, 7.5cm diameter.   [5 marks]

4.   (a)   List five (5) instruments which are used to measure viscosity.   [5 marks]

       (b)   With the aid of a diagram, explain how one of the instruments you listed above operates.   [8 marks]

       (c)   With the aid of a diagram, describe and explain Reynolds' experiment.
                                                                          [7 marks]

5.   (a)   Discuss the mechanisms of heat transfer, giving examples where possible.
                                                                          [12 marks]

       (b)   State the following equations:

               (i)   Newton's law of cooling.
               (ii)   Fourier's equation.
               (iii)   Stefan-Boltzmann equation.   [6 marks]

       (c)   State Pascal's paradox.   [2 marks]

End of question Paper!!!