明 新 科 技 大 學

九十六學年度研究所　☑碩　士　班　招生考試試題卷
　　　　　　　　　　　□碩士在職專班

系所名稱	科目	准考證號碼 (請考生填入)	考試日期	節次	第 1 頁/共 2 頁
化學工程研究所	輸送現象與單元操作		96年5月6日	第一節	

答案須寫在答案卷內，否則不予計分。

1. A steel pipe carrying steam has an outside diameter of 89 mm. It is lagged with 80 mm of insulation having an average k = 0.043 W/m-K. Two thermocouples, one located at the interface between the pipe wall and the insulation and the other at the outer surface of the insulation, give temperatures of 120 and 30　, respectively. Calculate the heat loss in W per m of pipe.　　　　　　　　　　　　　　　　　　　　　　(20%)

2. Explain the following terms.　　　(15%)
   (1) Newton's Law of Viscosity
   (2) Newtonian fluids
   (3) Incompressible fluids
   (4) Reynolds number
   (5) Laminar flow

3. Determine the average velocity v_{av} for turbulent flow in a circular tube with velocity profile expressed as　　　　　　　　　　　　　　　　　　　　　(20%)

$$v = v_{max}\left(1-\frac{r}{R}\right)^{\frac{1}{8}}$$

4. The density of a salt solution (containing 26.0wt% NaCl) is 1.175 g/cm^3, calculate
   (a) The mole percent of NaCl and water.
   (b) The concentration of NaCl with the unit of mol/L and kg/m^3.　　　(10%)

5. It is desired to produce 1000 kg/h $Na_3PO_4.12H_2O$ crystals from a feed solution containing 10.0 wt% Na_3PO_4 and traces of impurity. The original solution is first evaporated in an evaporator to a 33 wt% Na_3PO_4 solution and then cooled to 293 K in a crystallizer, where the hydrated crystals and a mother liquor solution are removed. One out of every 15 kg of mother liquor is discarded to waste to get rid of the impurities, and the remaining mother liquor is recycled to the evaporator. The solubility of Na_3PO_4 at 293 K is 9.91 wt%. Calculate the rates of feed solution and water evaporated in kg/h.
   　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(20%)

明 新 科 技 大 學

九十六學年度研究所 ☑ 碩 士 班 招生考試試題卷
　　　　　　　　　　□ 碩士在職專班

系所名稱	科目	准考證號碼 (請考生填入)	考試日期	節次	第 2 頁/共 2 頁
化學工程研究所	輸送現象與單元操作		96年5月6日	第一節	

答案須寫在答案卷內，否則不予計分。

6. Soybean oil with density 920 kg/m^3 is being pumped through a uniform-diameter pipe at a steady mass-flow rate. A pump supplies 250 J/kg mass of fluid flowing. The entrance abs pressure in the inlet pipe to the pump is 115.0 kN/m^2. The exit section of the pipe downstream from the pump is 3.50 m above the entrance and the exit pressure is 180.0 kN/m^2. Exit and entrance pipes are the same diameter. The fluid is in turbulent flow. Calculate the friction loss in the system. (15%)