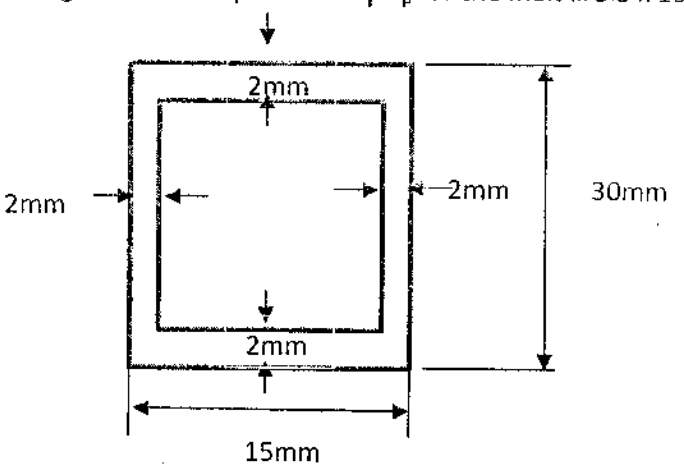
FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF POLYMER AND TEXTILE ENGINEERING
2014/2015 HARMATTAN SEMESTER EXAMINATION
PTE 401: POLYMER PROCESSING ENGINEERING TECHNOLOGY II
TIME: 2½ HRS DATE: APRIL 24, 2015. INSTRUCTIONS: ANSWER FOUR QUESTIONS

1a.The exit region of a die used to extrude a plastic section is 10mm long and has the cross-sectional dimensions shown below. If the channel is being extruded at the rate of 3m/min, calculate the power absorbed in the die exit and the melt temperature rise in the die given that the product of ρC_p for the melt is 3.5×10^6 and the shear stress is 2.5×10^3 N/m^2.



b. (i) Describe with chemical equations the first and second stages of chemical reactions involved in the production of polyurethane foam.

(ii). Outline the general foam-forming requirement (iii) What is 'cream time'as used in foam production

2a. An acrylic material at a temperature of 230°C passes through a cylindrical die of diameter 3.5mm and length 27mm. if the maximum strain rate is 100s^{-1} and pressure drop in the die is given as 10^5 N/m^2. Calculate:

(i) The viscosity of the molten material (ii)The dwell time of the material in the die (iii)The maximum shear stress

b.(i) Define the following: Paints and Coating

(ii) Mention four materials that serve as webs in coating (iii) What is the difference between varnishes and lacquers?

3a. For a particular polymer melt, the power law constants are 35KNS^n/m^2 and n = 0.25. If the polymer flows through an injection nozzle of diameter 4mm and length 30mm at a rate of 4.5×10^{-5} m^3/s. Estimate the pressure drop in the nozzle.

b.(i) Write short note on plastic machining

(ii) Enumerate the contributions of plastic machining in the development of plastic industries.

4.A polymer solution can be represented by the equation relating shear stress (τ) to shear rate (γ) as follows:

$$\tau = 2.70 \times \frac{10^3 dyne}{cm^2}(sec^{0.635})(\gamma^{0.635})$$

(i) What is the viscosity in centipoise at a shear stress of 10,000dynes/cm^2
(ii) Is the solution dilatant, pseudoplastic or rheopectic? Give reasons for your answer.

5a. Given the velocity profile of a power law fluid as $V = V_o\left[1 - \left(\frac{r}{R}\right)^{\frac{n+1}{n}}\right]$

Derive an expression for the discharge (Q) in the relevant terms.

b(i) State the difference between adhesive bonding and mechanical fastening.

(iii) Explain the two methods of plastic decoration