# 2015-XE-40-52

EE24BTECH11035 - KOTHAPALLI AKHIL

1) The velocity profile in turbulent flow through a pipe is approximated as

$$\frac{u}{u_{max}} = \left(\frac{y}{R}\right)^{1/7}$$

where u_{max} is the maximum velocity, R is the radius, and y is the distance measured normal to the pipe wall towards the centerline. If u_{av} denotes the average velocity, the ratio $\frac{u_{av}}{u_{max}}$ is

a) $\frac{2}{15}$

b) $\frac{1}{5}$

c) $\frac{1}{3}$

d) $\frac{49}{60}$

2) A steel sphere (density $\rho_s = 7900\,\text{kg/m}^3$) of diameter 0.1 m is dropped from rest in water (density $\rho_w = 1000\,\text{kg/m}^3$). The gravitational acceleration is $9.81\,\text{m/s}^2$. Assuming that the drag coefficient is constant and equal to 1.33, the terminal velocity attained by the sphere in m/s is _____

3) An inclined venturimeter connected to an inverted manometer is shown in the figure. The cross-sectional areas at the inlet and the throat are $2 \times 10^{-3}\,\text{m}^2$ and $2 \times 10^{-4}\,\text{m}^2$, respectively. The densities of water and oil are $1000\,\text{kg/m}^3$ and $800\,\text{kg/m}^3$, respectively. The gravitational acceleration is $9.81\,\text{m/s}^2$. If the discharge of water through the venturimeter is $5 \times 10^{-4}\,\text{m}^3/\text{s}$, neglecting viscous effects and assuming uniform velocities across the inlet and the throat, the manometer reading h, in meters, will be _____
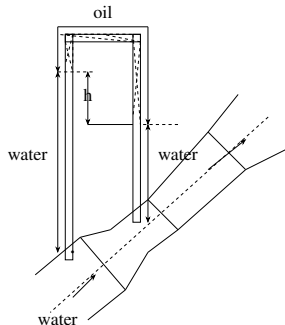
4) A plane jet of water with volumetric flow rate $0.012\,\text{m}^3/\text{s}$ and cross-sectional area $6 \times 10^{-4}\,\text{m}^2$ strikes a stationary plate inclined at angle θ and leaves as two streams, as shown in the figure. The ratio of the discharge through section 2 to that through section 3 is 3 : 1. The velocities may be considered uniform across the cross-sections, and the effects of friction may be neglected. The density of water is $1000\,\text{kg/m}^3$. Ignoring the effects of gravity, the magnitude of the normal force exerted on the plate, in N, is
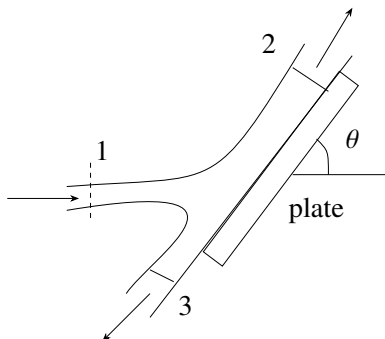
5) Arrange the following elements in order of increasing melting point:
   (P) Gallium
   (Q) Tungsten
   (R) Aluminium
   (S) Gold

   a) (A) $P < R < Q < S$
   b) (B) $S < P < R < Q$
   c) (C) $P < R < S < Q$
   d) (D) $R < S < Q < P$

6) When the atoms in a solid are separated by their equilibrium distance,

   a) (A) the potential energy of the solid is lowest
   b) (B) the force of attraction between the atoms is maximum
   c) (C) the force of repulsion between the atoms is zero
   d) (D) the potential energy of the solid is zero

7) To which of the following categories of materials does Teflon (PTFE) belong?

   a) (A) Thermosets
   b) (B) Thermoplastics
   c) (C) Elastomers
   d) (D) Block copolymers

8) Which of the following statements is **TRUE** about the glass transition temperature (T_g)?

   a) T_g appears below the melting temperature in a perfectly crystalline material
   b) Upon heating through T_g, heat capacity remains constant but the thermal expansion coefficient changes

c) Upon heating through T_g, heat capacity changes but the thermal expansion coefficient remains the same

d) Upon heating through T_g, both the heat capacity and thermal expansion coefficient change

9) The slope of a graph of $\log_e$(conductivity) versus $1/T$ (where T is the temperature) for an intrinsic semiconductor with energy gap E_g is:

a) $E_g/2k$
b) $-E_g/2k$
c) E_g/k
d) $-E_g/k$

10) Which is **NOT** a ceramic forming process?

a) extrusion
b) slip casting
c) forging
d) tape casting

11) Which of the following is **NOT** a soft magnetic material?

a) Iron-silicon steel
b) Nickel zinc ferrite
c) Nickel iron alloy
d) Alnico

12) The eutectic reaction is
   [Note: S = solid; L = liquid]

a) $L \rightleftharpoons S_1 + S_2 + S_3$
b) $L \rightleftharpoons S_1 + S_2$
c) $L_1 + S_1 \rightleftharpoons L_2 + S_2$
d) $L_1 + S_1 \rightleftharpoons S_2 + S_3$

13) Vacancies play an important role in:

a) deformation twinning
b) self diffusion
c) strain hardening
d) cross-slip