1. How would you characterize the flow of toothpaste at room temperature?

a) Newtonian flow
b) Non-Newtonian, viscoplastic
c) Non-Newtonian, shear-thickening.

Hint: ESDU 97034 gives guidance on this and other Newtonian and non-Newtonian flows

The correct answer is B). An initial shear stress (tube squeeze!) is required to initiate flow, and the more you squeeze, the faster it comes as the substance thins.

2. A liquid flows in a pipe with a mass flow rate of 1 kg/s. A second fluid flows in an identical pipe (same length, diameter, inner wall roughness) at the same temperature and mass flow rate, but this fluid is a bubbly, two-phase mixture of liquid and gas. How do the pressure drops in the pipes compare?

a) They are the same
b) The liquid only flow has a higher pressure drop
c) The bubbly gas-liquid flow has a higher pressure drop.

The correct answer is C). Guidance on pressure drops in single and two-phase flows in straight pipes is given in a range of ESDU Data Items.

3. A shock was travels across a lake and meets the entrance to a 2km long water filled pipe draining from the lake. The first 1km of the pipe (the lake end) is steel and the remainder is plastic. Which of the following is correct?

a) The wave speed of water in the lake is higher than the speed of sound.
b) A shock is reflected from the pipe entrance and travels back across the lake.
c) The shock wave increases its speed as it passes along the steel pipe.
d) The shock wave slows down as it passes along the steel pipe.
e) The shock wave increased speed again as it passes along the plastic pipe.
f) The shock wave slows down again as it passes along the plastic pipe.
g) The wave speed does not change in the pipe.
h) The correct answers are a, b, d and f

Hint: See ESDU 83046

The correct answers are A), B), D), F).The speed of propagation of pressure waves in contained and uncontained liquids and gases using ESDU 83046.

4. A pump is required to raise 0.07 m^3/s of water from a sump to an open reservoir. The total head rise ΔH is 66 meter. An engineer estimated that the pump would operate at constant speed 2900rev. /min pumping 0.07 m^3/s with total head rise equal to 72 meters. Following values have been obtained from a pump manufacturer for the actual operating point: ΔH equal to 68.5 meters, flow rate equal to 0.072 m^3/s. The pump runs at constant speed 2900rev. /min. What is an actual speed of the pump?

a) 2980 rev/min.
b) 2833 rev/min.
c) 2484 rev/min.

Hint: ESDU 80031 presents a method for estimating the size, efficiency and typical flange sizes of a pump suited to a given duty.

Correct Answer is b) ESDU 80031

5. The compresbile flow in a converging duct is said to be choked when:

a) The Mach number is equal to unitity across the duct at a minimum-area location or at the duct exit.
b) The mass flow rate is the maxium possible for given conditions.
c) The Mach number is equal to unitity across the duct at a maximum-area location or at the duct inlet.
d) a) and b) is correct

Hint: See ESDU 74028

The correct answer is c) ESDU 74028 gives curves and equations for use in the calculation of isentropic flow of a perfect gas; they are applicable to numerous practical situations.

6. Estimate an upstream separation of a flow in a sudden contraction with a sharp edge (D_1 =0.020m, D_2 = 0.015 m). The fluid is water, flowing at a rate of 0.3 kg/s, its density is 1000kg/m^3 and dynamic viscosity is 0.001 Pa.s.

a) L_{slx}= 0.014 m and L_{slr}= 0.04 m
b) There is no upstream separation
c) L_{slx}= 0.0042 m and L_{slr}= 0.0016 m

Hint: See ESDU 05024

The correct answer is c) ESDU 05024 provides information on pressure loss and flow characteristics in flow of Newtonian fluids through a sudden contraction of duct area.

7. Calculate a friction coefficient/factor of a circular pipe of 0.15 m diameter made of metal sheet for Reynolds number equal to $6x10^4$.

a) 0.054
b) 0.0054
c) 0.0108

Hint: See ESDU 66027

The correct answer is b) ESDU 66027 applies to frictional pressure losses for incompressible flow in pipes running full.

8. Determin impleller diametr for forward-curved centrifulat fan which supplies an air to a small ventilation system at the see level. Required flow rate is 7/m3/s and a gauge static pressure is 450 Pa. (Please note that the spacific speed of fan should be approximaterly 2.7)

   a) 0.8 m
   b) 0.3 m
   c) 0.4 m

   Hint: See ESDU 79037

The correct answer is a) ESDU 79037 gives information to assist the specialist and non-specialist in fan selection and tender appraisal.

9. What is a typical accuracy of a liquid column manometer:
   a) 0.2-1%
   b) 1-2%
   c) 0.02- 0.2%

   Hint: See ESDU 12003

   Correct answer is c)

Or

10. Which of the following instruments can't be use to messure pressure:
    a) Venturi tube
    b) Bourdon gauge
    c) U-tube

    Hint: See ESDU 12003

Correct answer is a) ESDU 12003 provides an overview of the techniques for measuring fluid pressure and flow rate, and of the range of instruments that can be selected for specific internal flow applications.

11. Determine the thrust on the back face of a centrifugal compressor impeller if the pressure at the exducer tip is 2.5 bars. The impeller spins at 100 000rpm and has a diameter of 0.16m (b=0.08m) .The shaft diameter is 0.02 (a=0.01). The density can be taken as ρ= 3 kg/m^3 and a swirl ratio for the cavity is β=0.4.

    a) 7033N
    b) 3307N
    c) 3703N

    Hint: See ESDU 07004

The correct answer is b) ESDU 07004 introduces the subject of flow in applications where rotating machinery components induce flow rotation.