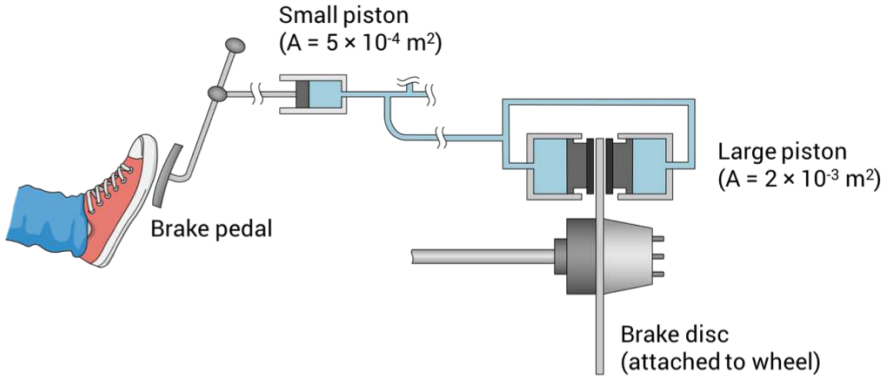
0 1

The braking systems of cars and many other vehicles rely on the fact that the pressure exerted by a force can be transmitted through a fluid. The below diagram shows a typical car braking system.



When the brake pedal is pushed, the pressure exerted on the small piston next to it (the *master cylinder*) is transferred to the large pistons at all four wheels. For clarity, just one of these four pistons is shown above. At each wheel, the action of the large piston causes the calipers (brake pads) to be pushed towards the brake disc. The friction between the calipers and brake disc is what causes the vehicle to slow down.

0 1 . 1

The driver in the above diagram applies a force of 20 N to the brake pedal. Calculate the pressure which this will exert on the fluid inside the small piston. Include an appropriate unit with your answer.

Pressure = _____ Unit _____

[4 marks]

0 1 . 2

Calculate the braking force which is produced at each wheel.

Force = _____ N

[4 marks]

0 2

A holidaymaker takes a scuba diving class. They are told that the pressure acting on them will double when they dive to a depth of 10 m.

0 2 . 1

If the (atmospheric) pressure at the surface is 100 kPa, estimate the density of the seawater in which they are diving. Take g = 9.8 N/kg.

Density = _____ kg/m^3

[3 marks]

0 2 . 2 The following day, they go skydiving from an altitude of 5 km. Before jumping out of the plane with their parachute, they glance at the barometer, and notice that the air pressure is 55 kPa. Explain why the air pressure at this altitude is lower than the pressure at the surface.

[3 marks]

0 3 As shown in **Figure 1** below, an ice cube is held beneath the surface of a beaker of water by applying a downwards force on it.

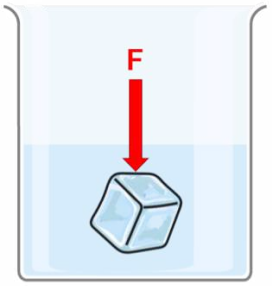


Figure 1: ice cube held beneath surface of water

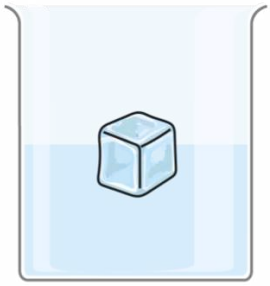


Figure 2: after ice cube is released

0 3 . 1 The ice cube weighs 0.23 N and the upthrust acting on it has a magnitude of 0.25 N. Determine the magnitude of force F.

F = _____ N

[2 marks]

0 3 . 2 Determine the volume of the ice cube. The density of water is 1 g/cm^3 and the value of g is 9.8 N/kg.

[4 marks]

0 3 . 3 When the force is removed, the ice cube floats to the surface and comes to rest as shown in Figure 2. Explain why this happens in terms of the forces involved.

[3 marks]