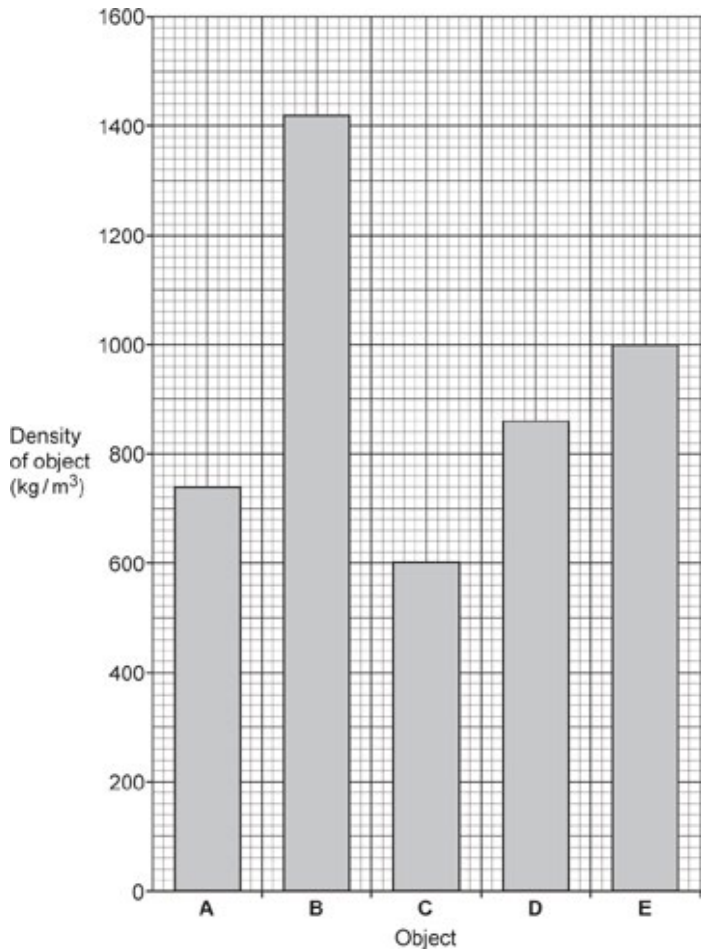**1(a).** A student investigates floating and sinking.

The student draws a bar chart to show the densities of five objects, **A**, **B**, **C**, **D** and **E**.



The student places the five objects into an unknown liquid and observes if each object floats or sinks.

- Objects **A** and **C** float.
- Objects **B**, **D** and **E** sink.

Use the bar chart to estimate the density of the liquid used.

Density = ............................................. kg / m³ **[1]**

**(b).** The student uses the internet to research the densities of five different liquids.

| Liquid | Density (kg / m³) |
|---|---|
| Alcohol | 800 |
| Diesel | 870 |
| Vegetable oil | 910 |
| Dishwashing soap | 1120 |
| Treacle | 1430 |

In which liquid would **all five** of the objects **A**, **B**, **C**, **D** and **E** float?

Liquid

_____**[1]**

**(c).** A swimmer in a pool dives from a depth of 0.5 m to a depth of 2.0 m.

Calculate the change in pressure the swimmer experiences.

Use the Equation Sheet.

Gravitational field strength = 10 N / kg

Density of water = 1000 kg / m$^3$

Change in pressure = .................................................... Pa **[2]**

**(d).** A student investigates floating and sinking.

Explain why some objects float and some objects sink in a liquid.

_____

_____

_____

_____**[2]**

**2(a).** A teacher connects a sealed syringe of gas with a moveable piston to a pressure gauge as shown in **Fig. 20.1**.
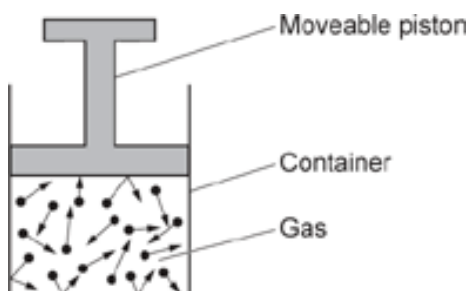


**Fig. 20.1**

State **one** way the teacher can increase the reading on the pressure gauge.

_____**[1]**

**(b).**

i.  A teacher has a gas enclosed in a container as shown in **Fig. 20.2**.



**Fig. 20.2**

The teacher slowly moves the piston outwards until the gas has twice its original volume. The temperature of the gas is kept constant.

Explain how and why the pressure in the container changes.

_____

_____

_____

_____

_____

**[3]**

ii.  When the volume of a gas is $2.4 \times 10^{-4}\,m^3$, the pressure is $2.5 \times 10^4\,Pa$.

Calculate the volume when the pressure is $1.5 \times 10^5\,Pa$.

Use the Equation Sheet.

Volume = .................................................. $m^3$ **[4]**

**(c).** Explain why a bicycle pump gets warmer when it is used to inflate a tyre.

_____

_____

_____

_____

**[3]**

**3.** Which statement describes a **simple** model of the Earth's atmosphere?

**A**    It covers the Earth to a height of about 700 km and is of uniform density.

**B**    It covers the Earth to a height of about 700 km and its density increases as the distance from the Earth increases.

**C**    It covers the Earth to a height of about 700 m and is of uniform density.

**D**    It covers the Earth to a height of about 700 m and its density increasesas the distance from the Earth increases.

Your answer   ☐                                                                                                              **[1]**

**4.** An object floating in water experiences an upwards force.

What causes this upwards force on the object?

**A**    Pressure at the top of the object is greater than at the bottom of the object.

**B**    Pressure at the top of the object is less than at the bottom of the object.

**C**    The density of the object is greater than the density of the water.

**D**    The weight of the water displaced is less than the weight of the object.

Your answer   ☐                                                                                                              **[1]**

**5.** A submarine travels to the bottom of an ocean. The ocean is 2.5 km deep and the density of the sea water is 1020 kg / m$^3$.

What is the water pressure on the submarine at the bottom of the ocean?

Use the Data sheet_J249 01/02/03/04, June 2022.
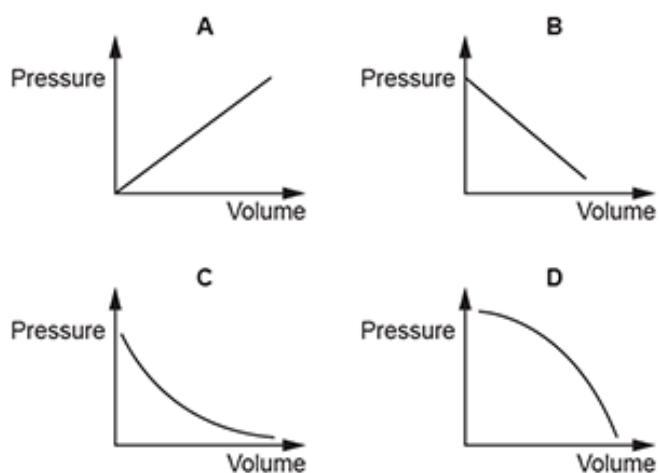
Gravitational field strength = 10 N / kg.

**A**    2.55 kPa

**B**    25.5 kPa

**C**    2.55 MPa

**D**    25.5 MPa

Your answer   ☐                                                                                                              **[1]**

**6.** A teacher measures the pressure and volume of a fixed gas at a constant temperature.



Which graph shows the correct relationship between pressure and volume for the gas?

Your answer ☐ **[1]**

**END OF QUESTION PAPER**