Physical Quantities and Units – 2023 June AS Physics 9702

1. June/2023/Paper_ 9702/11/No.1

   Which unit is **not** an SI base unit?

   A   A   **B**   kg   **C**   C   **D**   s

2. June/2023/Paper_ 9702/11/No.2

   What is the best estimate of the number of atoms in a piece of metal of volume $50\,\text{cm}^3$?

   A 5×10^{15} **B** 5×10^{25} **C** 5×10^{29} **D** 5×10^{31}

3. June/2023/Paper_ 9702/12/No.1

   A stone sinks in water.

   What is a possible value for the density of the stone?

   A $8 \times 10^2\,\text{kg}\,\text{m}^{-3}$

   B $2 \times 10^3\,\text{kg}\,\text{m}^{-3}$

   C $8 \times 10^3\,\text{N}\,\text{m}^{-3}$

   D $2 \times 10^4\,\text{N}\,\text{m}^{-3}$

4. June/2023/Paper_ 9702/12/No.2

   Gm, Tm, µm and pm are all units of length.

   Which unit is the largest and which unit is the smallest?

 | | largest unit | smallest unit |
   |---|---|---|
   | **A** | Gm | µm |
   | **B** | Gm | pm |
   | **C** | Tm | µm |
   | **D** | Tm | pm |

5. June/2023/Paper_ 9702/13/No.1

What **must** be included in a record of a physical quantity?

A   an integer value for the quantity

B   an SI unit

C   a numerical value for the quantity

D   a unit expressed in base units

6. June/2023/Paper_ 9702/13/No.2

What is the ohm expressed in SI base units?

A $kg\,m^2\,s^{-3}\,A^{-2}$ B $kg^{-1}\,m^{-2}\,s^3\,A^2$ C $J\,C^{-1}\,A^{-1}$ D $W\,A^{-2}$

7. June/2023/Paper_ 9702/21/No.1
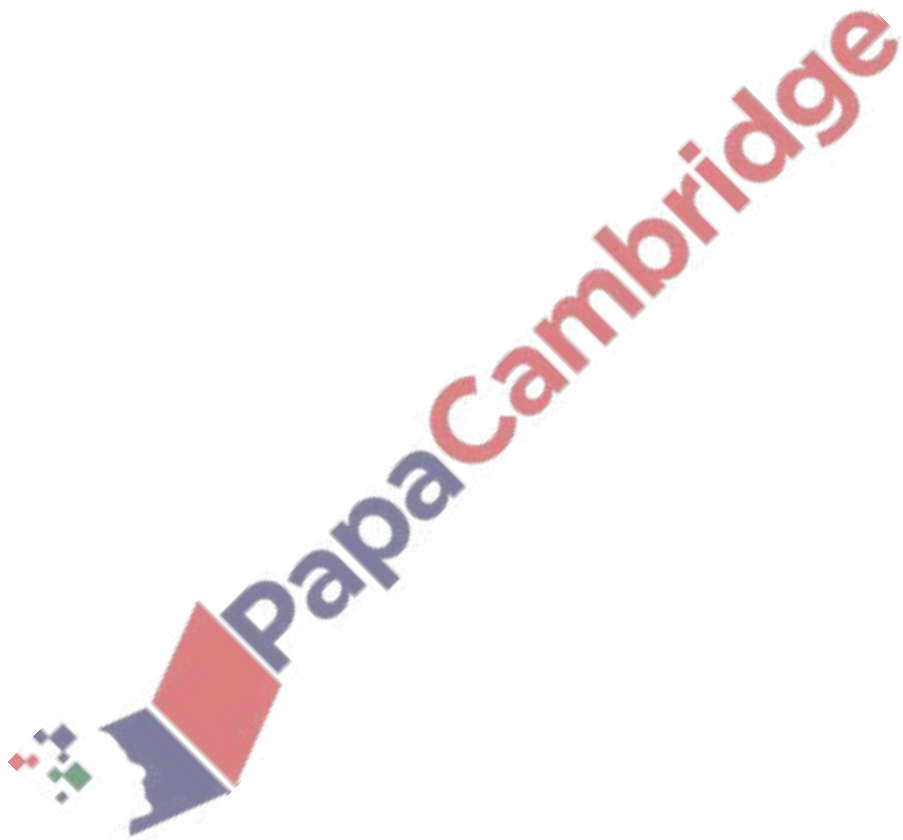
(a) (i) Define power.

....

.... [1]

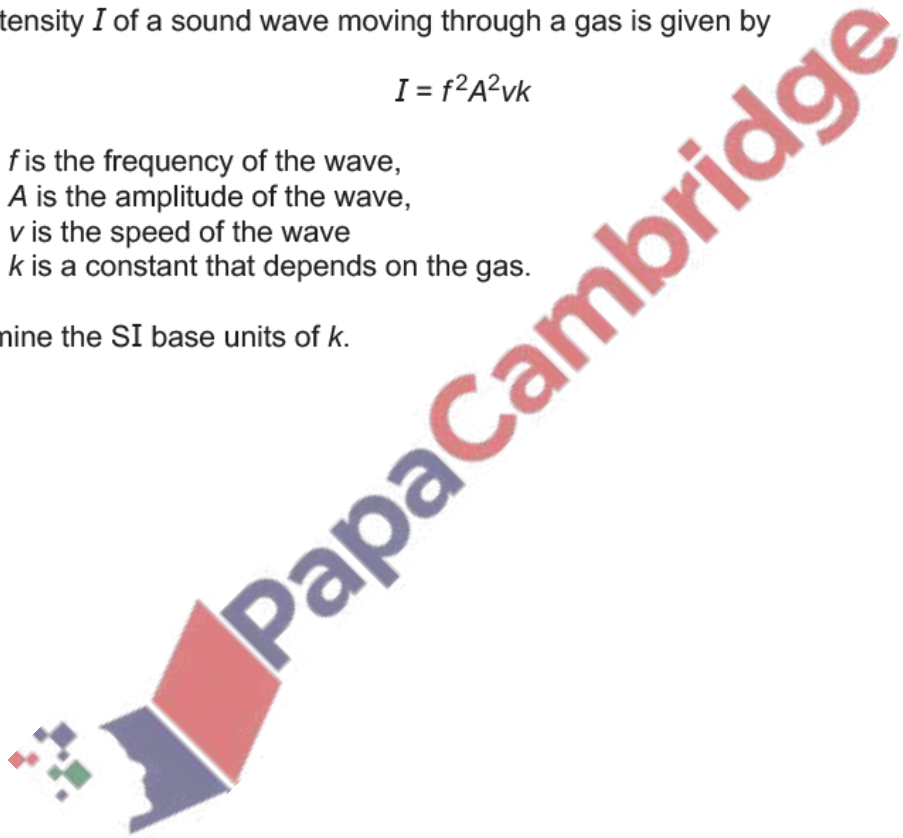**(ii)** Use the definition of power to show that the SI base units of power are $kg\,m^2\,s^{-3}$.

[1]

(b) The intensity I of a sound wave moving through a gas is given by

$$I = f^2 A^2 v k$$

where f is the frequency of the wave,
$\qquad$ A is the amplitude of the wave,
$\qquad$ v is the speed of the wave
and $\qquad$ k is a constant that depends on the gas.

Determine the SI base units of k.

SI base units .... [3]

[Total: 5]

(a) (i) Define pressure.

....

.... [1]

(ii) Use the answer to **(a)(i)** to show that the SI base units of pressure are $kg\,m^{-1}\,s^{-2}$.
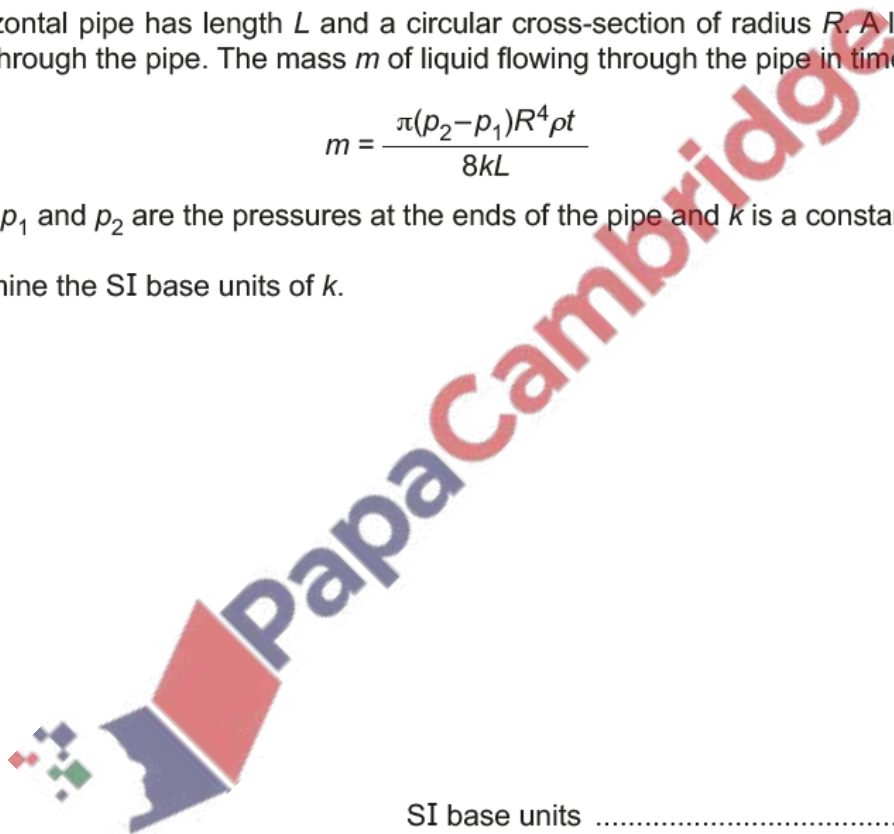
[1]

(b) A horizontal pipe has length L and a circular cross-section of radius R. A liquid of density ρ flows through the pipe. The mass m of liquid flowing through the pipe in time t is given by

$$m = \frac{\pi(p_2-p_1)R^4\rho t}{8kL}$$

where p_1 and p_2 are the pressures at the ends of the pipe and k is a constant.

Determine the SI base units of k.

SI base units .... [3]

A well has a depth of 36 m from ground level to the surface of the water in the well, as shown in Fig. 1.1.
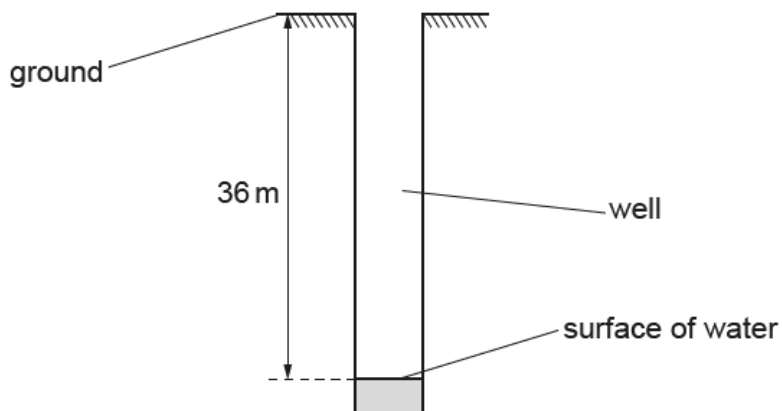
Fig. 1.1 (not to scale)

A student wishes to find the depth of the well. The student plans to drop a stone down the well and record the time taken from releasing the stone to hearing the splash made by the stone as it enters the water.

(a) Assume that air resistance is negligible and that the stone is released from rest.

Calculate the time taken for the stone to fall from ground level to the surface of the water.
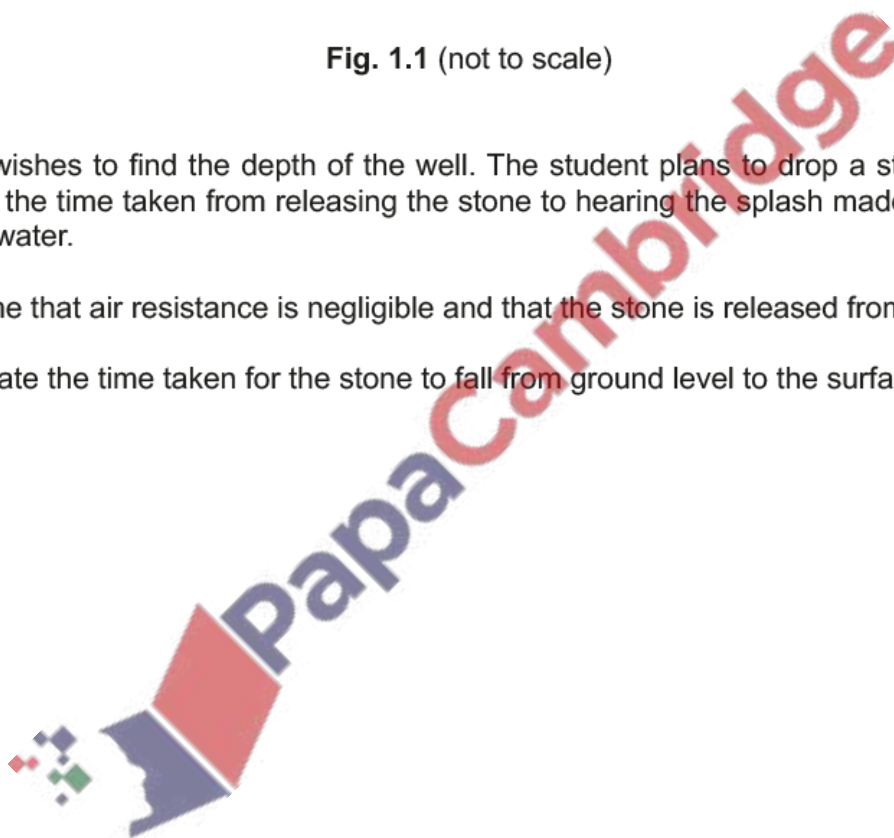
time = ... s [2]

(b) The time recorded by the student using a stop-watch is not equal to the time in **(a)**.

Suggest **three** possible reasons, other than the effect of air resistance, for this difference.

1 ....

....

2 ....

....

3 ....

....
[3]

(c) The student repeats the experiment three times and uses the results to calculate the depth of the well. The values are shown in Table 1.1.

Table 1.1

	1st experiment	2nd experiment	3rd experiment
depth/m	54.4	53.9	54.1

The true depth of the well is 36.0 m. Explain why these results may be described as precise but not accurate.
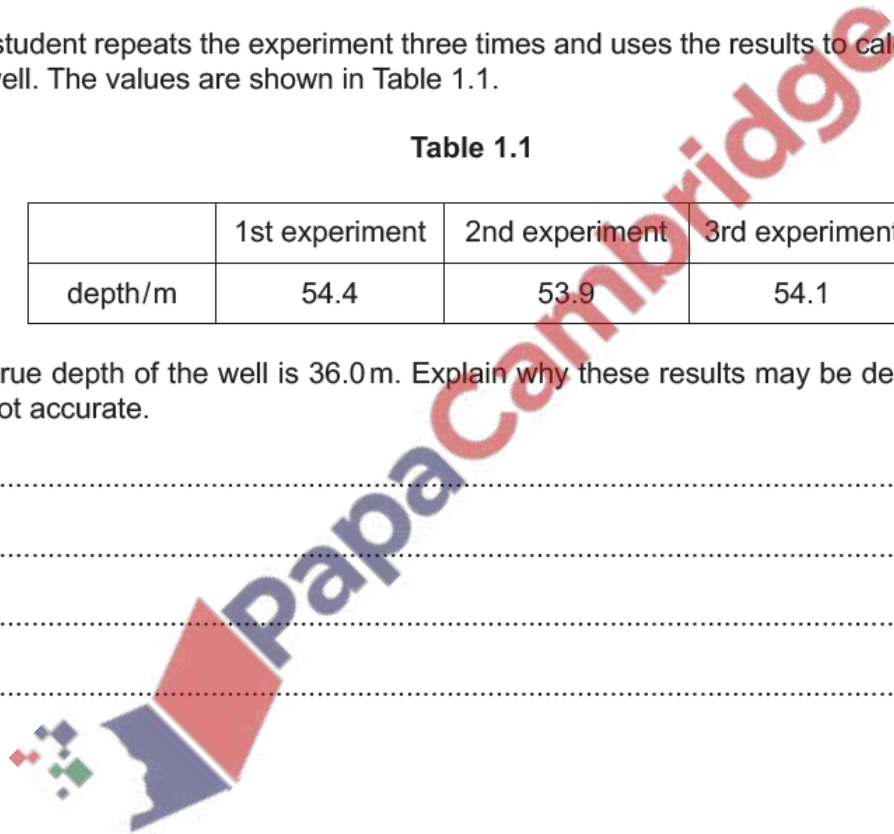
....

....

....

.... [2]

[Total: 7]

6

10. March/2023/Paper_ 9702/12/No.1

What represents a physical quantity?

A   3.0

B   kilogram

C   7.0 N

D   40%

11. March/2023/Paper_ 9702/12/No.2

The relationship between the variables D and T is given by the equation

$$\frac{1}{T} = \frac{b}{\sqrt{D}} + c$$

where b and c are constants.

The unit of D is m^2 and the unit of T is s.

What are the units of b and c?

	unit of b	unit of c
A	m s	s
B	m s^{-1}	s^{-1}
C	m^{-1} s	s
D	m^{-1} s^{-1}	s^{-1}

12. March/2023/Paper_ 9702/22/No.1(a)

(a) Underline **all** the SI base units in the following list.

ampere   coulomb   current   kelvin   newton   [1]