

Measurement Techniques – 2023 June AS Physics 9702

1. June/2023/Paper_9702/11/No.3

A copper pipe has a true diameter of 42.03 mm.

A builder measures the diameter of the pipe five times using digital calipers. The measurements are shown.

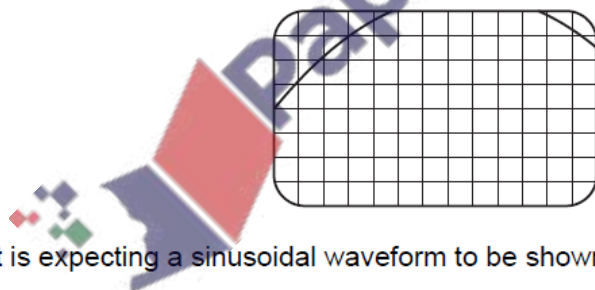
diameter / mm
48.01
47.99
48.01
48.00
47.99

What describes the builder's measurements?

- A accurate and precise
- B accurate but not precise
- C not precise and not accurate
- D precise but not accurate

2. June/2023/Paper_9702/11/No.20

In an experiment, a student uses a microphone and a cathode-ray oscilloscope (CRO) to analyse a sound wave. The diagram shows the trace on the screen of the CRO.



The student is expecting a sinusoidal waveform to be shown on the screen.

Which changes should the student make to the time-base and the y-gain of the CRO so that the screen shows a continuous trace for one complete cycle of the waveform?

	time-base	y-gain
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

3. June/2023/Paper_9702/12/No.3

Two measurements for a solid sphere are shown.

$$\text{mass} = (32.5 \pm 0.1)\text{g}$$

$$\text{diameter} = (1.87 \pm 0.04)\text{cm}$$

These values are used to determine the density of the sphere.

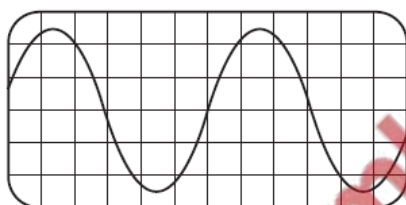
What is the percentage uncertainty in the density?

- A 2.4% B 4.6% C 6.1% D 6.7%

4. June/2023/Paper_9702/12/No.20

A microphone detects a sound wave. The microphone is connected to a cathode-ray oscilloscope (CRO).

The shape of the trace on the screen of the CRO is shown.



Which property of the sound wave can be determined by using only the measurement of a horizontal distance on the screen and the value of a control setting of the CRO?

- A amplitude
B frequency
C speed
D wavelength

5. June/2023/Paper_9702/13/No.3

What is the ohm expressed in SI base units?

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

6. June/2023/Paper_9702/22/No.1(c)

- (c) An experiment is performed to determine the value of k by measuring the values of the other quantities in the equation in (b).

The values of L and R each have a percentage uncertainty of 2%.

State and explain, quantitatively, which of these two quantities contributes more to the percentage uncertainty in the calculated value of k .

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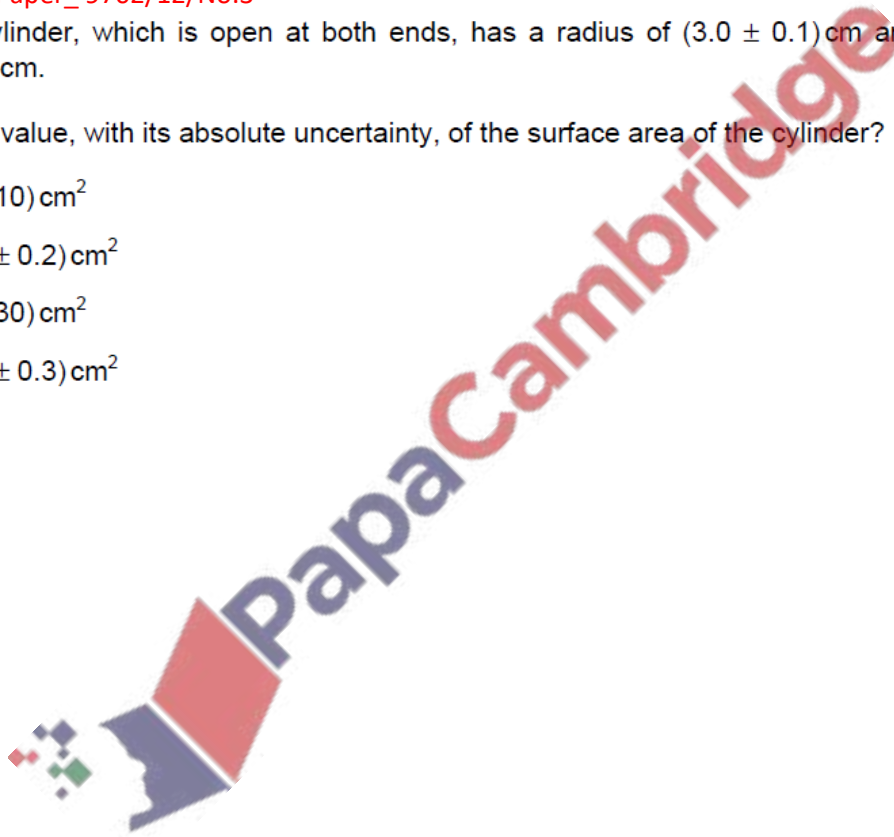
..... [1]

7. March/2023/Paper_9702/12/No.3

A hollow cylinder, which is open at both ends, has a radius of (3.0 ± 0.1) cm and a length of (15.0 ± 0.1) cm.

What is the value, with its absolute uncertainty, of the surface area of the cylinder?

- A (280 ± 10) cm²
- B (282.7 ± 0.2) cm²
- C (420 ± 30) cm²
- D (424.1 ± 0.3) cm²



(c) An experiment is performed to determine the acceleration of the car in (b). The following measurements are obtained:

$$s = 3.89\text{ m} \pm 0.5\%$$

$$v = 2.75\text{ ms}^{-1} \pm 0.8\%$$

(i) Calculate the acceleration a of the car.

$$a = \dots\dots\dots \text{ms}^{-2} \quad [1]$$

(ii) Determine the percentage uncertainty, to two significant figures, in a .

$$\text{percentage uncertainty} = \dots\dots\dots\% \quad [2]$$

(iii) Use your answers in (c)(i) and (c)(ii) to determine the absolute uncertainty in the calculated value of a .

$$\text{absolute uncertainty} = \dots\dots\dots \text{ms}^{-2} \quad [1]$$

