

Measurements and Uncertainties [20 marks]

1. How many significant figures are there in the number 0.0450?

[1 mark]

- A. 2
- B. 3
- C. 4
- D. 5

Markscheme

B

2. An object is positioned in a gravitational field. The measurement of gravitational force acting on the object has an uncertainty of 3% and the uncertainty in the mass of the object is 9%. What is the uncertainty in the gravitational field strength of the field? [1 mark]

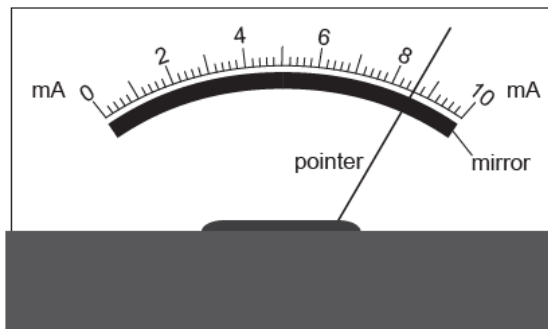
- A. 3%
- B. 6%
- C. 12%
- D. 27%

Markscheme

C

3. The diagram shows an analogue meter with a mirror behind the pointer.

[1 mark]



What is the main purpose of the mirror?

- A. To provide extra light when reading the scale
- B. To reduce the risk of parallax error when reading the scale
- C. To enable the pointer to be seen from different angles
- D. To magnify the image of the pointer

Markscheme

B

4. What is a correct value for the charge on an electron?

[1 mark]

- A. $1.60 \times 10^{-12} \mu\text{C}$
- B. $1.60 \times 10^{-15} \text{mC}$
- C. $1.60 \times 10^{-22} \text{kC}$
- D. $1.60 \times 10^{-24} \text{MC}$

Markscheme

C

5. A stone falls from rest to the bottom of a water well of depth d . The time t taken to fall is 2.0 ± 0.2 s. The depth of the well is calculated to be 20 m using $d = \frac{1}{2}at^2$. The uncertainty in a is negligible.

[1 mark]

What is the absolute uncertainty in d ?

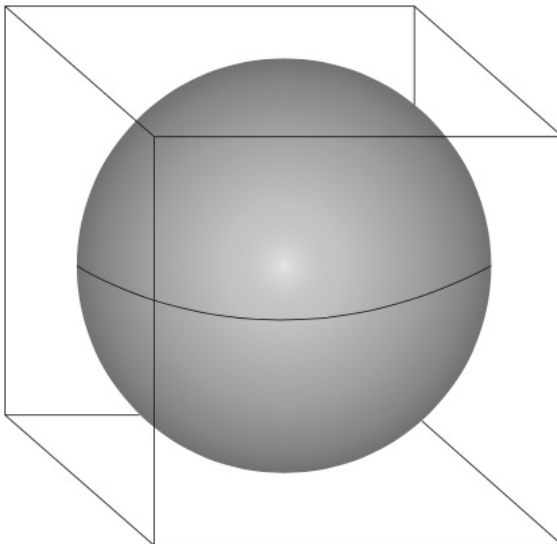
- A. ± 0.2 m
- B. ± 1 m
- C. ± 2 m
- D. ± 4 m

Markscheme

D

6. A sphere fits inside a cube.

[1 mark]



The length of the cube and the diameter of the sphere are $10.0 \pm 0.2 \text{cm}$.

What is the ratio $\frac{\text{percentage uncertainty of the volume of the sphere}}{\text{percentage uncertainty of the volume of the cube}}$?

- A. $\frac{3}{4\pi}$
- B. 1
- C. 2
- D. 8

Markscheme

B

7. A swimming pool contains 18×10^6 kg of pure water. The molar mass of water is 18 g mol^{-1} . What is the correct estimate of the number of water molecules in the swimming pool? [1 mark]
- A. 10^4
 - B. 10^{24}
 - C. 10^{25}
 - D. 10^{33}

Markscheme

D

8. Which of the following is a derived unit? [1 mark]
- A. Mole
 - B. Kelvin
 - C. Coulomb
 - D. Ampere

Markscheme

C

9. Which of the following is a fundamental unit? [1 mark]
- A. Ampere
 - B. Coulomb
 - C. Ohm
 - D. Volt

Markscheme

A

10. The radius of a sphere is measured with an uncertainty of 2%. What is the uncertainty in the volume of the sphere? [1 mark]
- A. 2%
 - B. 4%
 - C. 6%
 - D. 8%

Markscheme

C

11. The force of air resistance F that acts on a car moving at speed v is given by $F=kv^2$ where k is a constant. What is the unit of k ? [1 mark]
- A. kg m^{-1}
 - B. $\text{kg m}^{-2}\text{s}^2$
 - C. kg m^{-2}
 - D. $\text{kg m}^{-2}\text{s}^{-2}$

Markscheme

A

12. The volume V of a cylinder of radius R and height H is given by $V = \pi R^2 H$. The volume of the cylinder was measured with an uncertainty of 10% and the height was measured with an uncertainty of 6%. What is the uncertainty in the radius of the cylinder? [1 mark]
- A. 1%
 - B. 2%
 - C. 4%
 - D. 8%

Markscheme

D

13. The sides of a square are measured to be 5.0 ± 0.2 cm. Which of the following gives the area of the square and its uncertainty? [1 mark]
- A. 25.0 ± 0.2 cm^2
 - B. 25.0 ± 0.4 cm^2
 - C. 25 ± 2 cm^2
 - D. 25 ± 4 cm^2

Markscheme

C

14. The length of the side of a cube is 10.0 ± 0.3 cm. What is the uncertainty in the volume of the cube? [1 mark]
- A. ± 0.027 cm^3
 - B. ± 2.7 cm^3
 - C. ± 9.0 cm^3
 - D. ± 90 cm^3

Markscheme

D

15. The acceleration of free fall g is determined by the relationship $g = \frac{4\pi^2 l}{t^2}$. The uncertainty in the value of l is 2% and the uncertainty in the value of t is 5%. What is the uncertainty in g ? [1 mark]
- A. 3%
 - B. 7%
 - C. 8%
 - D. 12%

Markscheme

D

16. The current I through a resistor is measured with a digital ammeter to be 0.10 A. The uncertainty in the calculated value of P will be [1 mark]
- A. 1 %.
 - B. 2 %.
 - C. 5 %.
 - D. 20 %.

Markscheme

D

17. A body accelerates from rest with a uniform acceleration a for a time t . The uncertainty in a is 8% and the uncertainty in t is 4%. The uncertainty in the speed is [1 mark]
- 1. 32%.
 - 2. 12%.
 - 3. 8%.
 - 4. 2%.

Markscheme

B

18. Two lengths, a and b , are measured to be 51 ± 1 cm and 49 ± 1 cm respectively. In which of the following quantities is the percentage uncertainty the largest? [1 mark]
- A. $a + b$
 - B. $a - b$
 - C. $a \times b$
 - D. $\frac{a}{b}$

Markscheme

B

19. The length of each side of a sugar cube is measured as 10 mm with an uncertainty of ± 2 mm. Which of the following is the absolute uncertainty in the volume of the sugar cube? [1 mark]
- A. ± 6 mm³
 - B. ± 8 mm³
 - C. ± 400 mm³
 - D. ± 600 mm³

Markscheme

D

20. A volume is measured to be 52 mm^3 . This volume in m^3 is

[1 mark]

- A. $5.2 \times 10^3 \text{ m}^3$.
- B. $5.2 \times 10^1 \text{ m}^3$.
- C. $5.2 \times 10^{-1} \text{ m}^3$.
- D. $5.2 \times 10^{-8} \text{ m}^3$.

Markscheme

D