1. Physical Quantities and Units

1.1 Physical quantities

Paper 1

Question Paper

1 What is a reasonable estimate of the momentum of a family car travelling at 25 kilometres per hour?

A $1 \times 10^4\,\text{kg m s}^{-1}$

B $1 \times 10^5\,\text{kg m s}^{-1}$

C $1 \times 10^6\,\text{kg m s}^{-1}$

D $1 \times 10^7\,\text{kg m s}^{-1}$

2 What is a reasonable estimate of the volume of one page from this examination paper?

A $60\,\text{mm}^3$ **B** $600\,\text{mm}^3$ **C** $6000\,\text{mm}^3$ **D** $60\,000\,\text{mm}^3$

3 A small car travels in a town.

What is a reasonable estimate of the kinetic energy of the car?

A $5 \times 10^4\,\text{J}$ **B** $5 \times 10^7\,\text{J}$ **C** $5 \times 10^{10}\,\text{J}$ **D** $5 \times 10^{13}\,\text{J}$

4 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}

5 What is a reasonable estimate of the cross-sectional area of the wire in a paper clip?

A $1 \times 10^{-3}\,\text{m}^2$ **B** $8 \times 10^{-5}\,\text{m}^2$ **C** $8 \times 10^{-7}\,\text{m}^2$ **D** $1 \times 10^{-9}\,\text{m}^2$

6 A student estimates the maximum speed of some different moving objects.

Which maximum speed is **not** a reasonable estimate?

A container ship: $10\,m\,s^{-1}$

B Olympic sprinter: $0.1\,km\,s^{-1}$

C racing car: $9000\,cm\,s^{-1}$

D snail: $0.01\,km\,h^{-1}$

7 Which term represents a physical quantity?

A metre

B percentage uncertainty

C quark flavour

D spring constant

8 Which estimate is reasonable?

A $1 \times 10^{-3}\,kg$ for the mass of a grain of sand

B $1 \times 10^{-2}\,m^3$ for the volume of a tennis ball

C $1 \times 10^{0}\,J$ for the work done lifting an apple from waist height to head height

D $1 \times 10^{4}\,W$ for the power of a light bulb in a house

9 What is needed to accurately represent all physical quantities?

A a base unit and a number

B a unit and a number expressed in standard form (scientific notation)

C a unit and a numerical magnitude

D an SI unit and a numerical magnitude

10 Which quantity is a physical quantity?

A flavour

B kelvin

C minute

D potential difference

11 What is a reasonable estimate of the volume of an adult person?

A $0.10\,m^3$ **B** $0.50\,m^3$ **C** $1.0\,m^3$ **D** $2.0\,m^3$

12 What is **not** a reasonable estimate of the physical property indicated?

A 2×10^3 W for the power dissipated by the heating element of an electric kettle

B $4 \times 10^2\,m^3$ for the volume of water in a swimming pool

C 5×10^5 N s for the momentum of a lorry moving along a road

D 6×10^2 N for the weight of a fully grown racehorse

13 What is essential when recording a measurement of a physical quantity?

A the measurement has an SI unit

B the measurement has a unit and a number

C the measurement has a unit given as a base unit

D the measurement is from an analogue scale

14 Which row shows what all physical quantities must have?

	magnitude	direction	unit
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✓

15 What is a reasonable estimate of the kinetic energy of a car travelling at a speed of $30\,m\,s^{-1}$?

A $10^2\,J$ **B** $10^4\,J$ **C** $10^6\,J$ **D** $10^8\,J$

16 What is a reasonable estimate of the mass of a raindrop?

A $10^1\,kg$ **B** $10^{-1}\,kg$ **C** $10^{-3}\,kg$ **D** $10^{-5}\,kg$

17 Which quantity is a physical quantity?

A atomic number

B efficiency

C number density of charge carriers

D strain

18 A student uses the volume of a metal coin in order to determine the density of the metal.

What is **not** needed in order to determine an estimate of the volume of the coin?

A estimate of the diameter

B estimate of the mass

C estimate of the thickness

D use of the formula for the volume of a cylinder

19 For which quantity is the magnitude a reasonable estimate?

A frequency of a radio wave 500 pHz

B mass of an atom 500 μg

C the Young modulus of a metal 500 kPa

D wavelength of green light 500 nm

20 A cyclist has a speed of $5\,m\,s^{-1}$ and a small car has a speed of $12\,m\,s^{-1}$.

Which statement does **not** give a reasonable estimate?

A The kinetic energy of the cyclist is 1×10^3 J.

B The kinetic energy of the car is 7×10^4 J.

C The momentum of the cyclist is $4 \times 10^2\,kg\,m\,s^{-1}$.

D The momentum of the car is $2 \times 10^5\,kg\,m\,s^{-1}$.

21 The radius of the Earth is approximately 6.4×10^6 m, and the radius of the Moon is approximately 1.7×10^6 m. A student wishes to build a scale model of the Solar System in the classroom, using a football of radius 0.12 m to represent the Earth.

Which object would best represent the Moon?

A basketball

B cherry

C golf ball

D tennis ball

22 A car is travelling at a speed of $20\,m\,s^{-1}$. The table contains values for the kinetic energy and the momentum of the car.

Which values are reasonable estimates?

	kinetic energy / J	momentum / $kg\,m\,s^{-1}$
A	3×10^5	3×10^4
B	3×10^5	5×10^6
C	2×10^7	3×10^4
D	2×10^7	5×10^6