

Standard form

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class

Teacher

Time allowed: 90 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 10): you must not use a calculator.
- **Section B** (questions 11 to 25): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 79.

Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

For teacher's use

Q	Mark	Q	Mark
1		14	
2		15	
3		16	
4		17	
5		18	
6		19	
7		20	
8		21	
9		22	
10		23	
11		24	
12		25	
13			
TOTAL			

Section A**You must not use a calculator**Do not
write
outside
the box

- 1** (a) Write 6.2×10^4 as an ordinary number.

Answer _____

[1 mark]

- (b) Write 0.00059 in standard form.

Answer _____

[1 mark]

- 2** (a) Circle the number that is written in standard form.

 23×10^5 2.3×10^5 0.23×10^6 2.3^5 **[1 mark]**

- (b) Write 47×10^3 in standard form.

Answer _____

[1 mark]

3

The table shows the approximate mass of one seed of each of four plants.

Plant	Mass of one seed (grams)
Sunflower	5×10^{-2}
Mustard	0.0021
Poppy	5×10^{-4}
Orchid	1×10^{-6}

- (a) Write the plants in order of the mass of one seed.
Start with the lightest.

Answer _____

[1 mark]

- (b) How many times heavier is a sunflower seed than a poppy seed?

Answer _____

[2 marks]

4

Work out $(3 \times 10^5) \times (4 \times 10^{-2})$
Give your answer in standard form.

Answer _____

[2 marks]

- 5** Work out $3.6 \times 10^4 + 5.2 \times 10^3$
Give your answer in standard form.

Answer _____

[2 marks]

- 6** Ava works out $(2.4 \times 10^8) \div (6 \times 10^3)$
Here is her working.

$$2.4 \div 6 = 0.4$$

$$10^8 \div 10^3 = 10^5$$

$$0.4 \times 10^5 = 4 \times 10^6$$

- (a)** Explain the mistake Ava has made.

[1 mark]

- (b)** Write down the correct answer in standard form.

Answer _____

[1 mark]

- 7** A 3D printer builds a model one layer at a time.
Each layer is 2×10^{-4} metres thick.
How many layers does the printer use to build a model 6 cm tall?

Answer _____

[3 marks]

- 8 A computer can do 4×10^9 calculations each second.

How many minutes does it take the computer to do 2.4×10^{12} calculations?

Answer _____ minutes

[3 marks]

- 9 (a) Work out $(2 \times 10^3)^3$
Give your answer in standard form.

Answer _____

[1 mark]

- (b) Work out $\sqrt{1.6 \times 10^9}$
Give your answer in standard form.

Answer _____

[2 marks]

10 $x = 2 \times 10^n$ where n is an integer.

- (a)** Write x^3 in standard form.
Give your answer in terms of n .

Answer _____

[1 mark]

- (b)** Write $\frac{1}{x}$ in standard form.
Give your answer in terms of n .

Answer _____

[2 marks]

Section B



You may use a calculator

Do not
write
outside
the box

11 Work out $\frac{4.7 \times 10^8 + 3.2 \times 10^7}{1.6 \times 10^{-4}}$

Give your answer in standard form to 3 significant figures.

Answer _____

[2 marks]

12 The table gives information about two cities.

	Population	Area (km ²)
City A	8.9×10^6	1.57×10^3
City B	2.4×10^6	4.1×10^2

Which city has more people per km²?

You must show your working.

Answer _____

[3 marks]

- 13** A company copies all of its computer files to a backup drive.
The files are 7.2×10^{13} bytes of data.
The data is copied at 2.4×10^9 bytes per second.

How many hours does the copying take?
Give your answer to 1 decimal place.

Answer _____ hours

[3 marks]

- 14** A sheet of paper is 9.7×10^{-5} metres thick.
A ream is a pack of 500 sheets of paper.
Reams are stacked on top of each other in a gap 32 cm high.

Work out the greatest number of reams that fit in the gap.

Answer _____

[3 marks]

- 15** A strand of hair grows 4.6×10^{-9} metres every second.
Work out how many centimetres the strand of hair grows in a year of 365 days.
Give your answer to 1 decimal place.

Answer _____ cm

[3 marks]

16

The mass of one grain of sand is 6.7×10^{-4} grams.

A bag of play sand has a mass of 25 kg

- (a) Work out an estimate of the number of grains of sand in the bag.
Give your answer in standard form to 2 significant figures.

Answer _____

[3 marks]

- (b) Leah says,
“That is about 4 million grains of sand.”
Is Leah correct? Give a reason for your answer.

[1 mark]

- 17** In 2024 about 1.74×10^6 people in the UK were aged 85 or over.
The population of the UK was about 6.84×10^7

(a) What percentage of the population was aged 85 or over?
Give your answer to 1 decimal place.

Answer _____ %

[2 marks]

(b) The number of people aged 85 or over in 2024 was 14% more than in 2014
Work out the number aged 85 or over in 2014
Give your answer in standard form to 3 significant figures.

Answer _____

[2 marks]

- 18** The mass of the Earth is 5.97×10^{24} kg
The mass of the Moon is 1.23% of the mass of the Earth.
The mass of Mars is 6.42×10^{23} kg

How many times heavier is Mars than the Moon?
Give your answer to 1 decimal place.

Answer _____

[3 marks]

19 6.02×10^{23} molecules of water have a total mass of 18 grams.

- (a)** Work out the mass, in grams, of one molecule of water.
Give your answer in standard form to 3 significant figures.

Answer _____ g
[2 marks]

- (b)** A raindrop contains 1.7×10^{21} molecules of water.
Work out the mass of the raindrop in milligrams.
Give your answer to 2 significant figures.

Answer _____ mg
[2 marks]

- 20** The energy, E joules, held in a mass of m kg is given by

$$E = mc^2$$

where $c = 2.998 \times 10^8$

- (a) Work out the value of E when $m = 4.7 \times 10^{-6}$
Give your answer in standard form to 3 significant figures.

$E =$ _____

[2 marks]

- (b) A large city uses 3.6×10^{14} joules of energy in one day.
Work out the mass that holds this much energy.
Give your answer in grams to 2 significant figures.

Answer _____ g

[3 marks]

- 21** A grain of pollen is a sphere with diameter 3.3×10^{-5} m
A virus is a sphere with diameter 1.4×10^{-7} m

How many times greater is the volume of the grain of pollen than the volume of the virus?
Give your answer in standard form to 2 significant figures.

Answer _____

[3 marks]

- 22** A soap bubble is a sphere with radius 4.5 cm
The soap film that makes the bubble is 7.5×10^{-7} m thick.

$$\text{Surface area of a sphere} = 4\pi r^2$$

Work out an estimate of the volume of soap film in the bubble, in cm^3
Give your answer in standard form to 2 significant figures.

Answer _____ cm^3
[4 marks]

- 23** In an old story, 1 grain of rice is put on the first square of a chessboard, 2 grains on the second square, 4 on the third, and so on, doubling each time.
The total number of grains on all 64 squares is $2^{64} - 1$
One grain of rice has a mass of 2.5×10^{-5} kg
The world grows about 5.2×10^8 tonnes of rice each year.
1 tonne = 1000 kg

How many years would it take the world to grow all the rice on the chessboard?
Give your answer to the nearest 10 years.

Answer _____ years
[4 marks]

- 24** Gold can be beaten into very thin sheets called gold leaf.
1 gram of gold is beaten into a square sheet 1.2×10^{-7} m thick.
The density of gold is 1.93×10^4 kg/m³

Work out the length of a side of the square sheet.
Give your answer to the nearest centimetre.

Answer _____ cm

[4 marks]

- 25** The Sun is a sphere with a surface area of 6.09×10^{12} km²
The Earth is a sphere with a radius of 6.37×10^3 km

$$\text{Surface area of a sphere} = 4\pi r^2 \quad \text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

How many times greater is the volume of the Sun than the volume of the Earth?
Give your answer in standard form to 2 significant figures.

Answer _____

[5 marks]

END OF QUESTIONS