



KS3.M-N13 Standard Form

AQA KS3.M-N13 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Write each number in standard form (scientific notation).

(a) Write 4300000 in standard form. (1)

(b) Write 0.00072 in standard form. (1)

(c) Write 12500 in standard form. (1)

(d) Write 0.03 in standard form. (1)

2 Write these standard form numbers as ordinary numbers.

(a) Write 6.5×10^3 as an ordinary number. (1)

(b) Write 9.1×10^{-5} as an ordinary number. (1)

3 Order these numbers from smallest to largest. Express each comparison using their standard form where helpful: 3.2×10^{-3} , 0.00045, 1.1×10^{-2} .

(3)

4 Multiply and give your answer in standard form.

(a) Work out $(3 \times 10^4) \times (2 \times 10^3)$. (2)

(b) Work out $(4.5 \times 10^{-2}) \times (2 \times 10^3)$. (2)

5 Divide and give your answer in standard form.

(a) Work out $(6 \times 10^5) / (2 \times 10^2)$. (2)

(b) Work out $(8.4 \times 10^{-1}) / (2 \times 10^2)$. (1)

6 A star is 4.2×10^{16} metres from Earth. A light wave from the star travels at 3×10^8 m/s. Estimate how many seconds the light takes to reach Earth. Give your answer in standard form, to 2 significant figures.

(2)

7 Express each of these in standard form, using integers for powers of ten and one decimal place for the coefficient if needed.

(a) 0.0009 (1)

(b) 2500000 (1)

- 8** Calculate and give your answer in standard form, simplifying coefficients to be between 1 and 10 if needed: $(7 \times 10^4) \times (5 \times 10^{-7}) + (3 \times 10^{-2})$.

(3)

- 9** The mass of a bacterium is about 2.5×10^{-12} kg. Write the mass of 1 million such bacteria in standard form.

(2)

- 10** A chemical container holds $4.8 \times 10^2 \text{ cm}^3$ of liquid. Another holds $1.2 \times 10^{-1} \text{ cm}^3$. What is the total volume in standard form?

(3)

- 11** Convert 0.0064 to standard form and give the coefficient to 2 significant figures.

(2)

- 12** A physics exam question: The charge on an electron is about 1.6×10^{-19} coulombs. How many electrons are needed to make a charge of $3.2 \times 10^{-16} \text{ C}$? Give your answer in standard form, to 2 significant figures.

(3)

13 State whether each of these numbers is greater than, equal to, or less than 1 in standard form. Give an explanation for each.

(a) 5.0×10^{-1} (1)

(b) 9.1×10^0 (1)

14 A comet travels 2.5×10^9 metres in 5.0×10^4 seconds. Find its average speed in metres per second in standard form.

(3)

15 Show your working: Simplify $(1.2 \times 10^6) + (3.8 \times 10^5)$ and give the answer in standard form.

(4)

16 A radio signal has wavelength 0.0025 metres. Express this wavelength in standard form and then calculate how many wavelengths fit into 1 kilometre. Give the final answer in standard form to 2 significant figures.

(3)

- 17** Explain why a number written as 10.2×10^3 is not in standard form and rewrite it correctly.

(2)

-
- 18** Stretch question: The brightness of a distant star is 2.4×10^{-8} units. After a change it is measured as 6.0×10^{-9} units. By what factor did the brightness change? Give your answer in standard form and explain whether it increased or decreased.

(3)

Mark scheme · KS3.M-N13 Standard Form

Question 1

- (a) **B1** 4.3×10^6 cao
- (a) Answer: **4.3×10^6**
- (b) **B1** 7.2×10^{-4} cao
- (b) Answer: **7.2×10^{-4}**
- (c) **B1** 1.25×10^4 cao
- (c) Answer: **1.25×10^4**
- (d) **B1** 3×10^{-2} cao
- (d) Answer: **3×10^{-2}**

Question 2

- (a) **B1** 6500 cao
- (a) Answer: **6500**
- (b) **B1** 0.000091 cao
- (b) Answer: **0.000091**

Question 3

- **M1** convert to same form or decimals, e.g. $3.2 \times 10^{-3} = 0.0032$, $1.1 \times 10^{-2} = 0.011$
- **A1** correct order: 0.00045, 3.2×10^{-3} , 1.1×10^{-2} cao
- **B1** one correct comparison shown (allow follow through if order given correctly)
- Answer: **0.00045, 3.2×10^{-3} , 1.1×10^{-2}**

Question 4

- (a) **M1** multiply coefficients and add powers: $3 \times 2 = 6$ and $10^4 \times 10^3 = 10^7$
- (a) **A1** 6×10^7 cao
- (a) Answer: **6×10^7**
- (b) **M1** multiply coefficients and add powers: $4.5 \times 2 = 9.0$ and $10^{-2} \times 10^3 = 10^1$
- (b) **A1** 9×10^1 cao
- (b) Answer: **9×10^1**

Question 5

- (a) **M1** divide coefficients and subtract powers: $6/2 = 3$ and $10^{5-2} = 10^3$
- (a) **A1** 3×10^3 cao
- (a) Answer: **3×10^3**
- (b) **B1** 4.2×10^{-3} cao
- (b) Answer: **4.2×10^{-3}**

Question 6

- **M1** distance divided by speed: $4.2 \times 10^{16} / 3 \times 10^8$ or equivalent method
- **A1** 1.4×10^8 s cao to 2 significant figures
- Answer: **1.4×10^8 s**

Question 7

- (a) **B1** 9.0×10^{-4} cao
- (a) Answer: **9.0×10^{-4}**
- (b) **B1** 2.5×10^6 cao
- (b) Answer: **2.5×10^6**

Question 8

- **M1** multiply first two terms: $7 \times 5 = 35$ and $10^{4-7} = 10^{-3}$ giving 35×10^{-3}
- **M1** convert 35×10^{-3} to 3.5×10^{-2} and add 3×10^{-2} to get 6.5×10^{-2}
- **A1** 6.5×10^{-2} cao
- **Answer: 6.5×10^{-2}**

Question 9

- **M1** 1 million = 10^6 so multiply coefficients: $2.5 \times 10^{-12} \times 10^6$
- **A1** 2.5×10^{-6} kg cao
- **Answer: 2.5×10^{-6} kg**

Question 10

- **M1** convert to same power or adjust: $4.8 \times 10^2 = 480$, $1.2 \times 10^{-1} = 0.12$ then add to get 480.12
- **M1** express 480.12 in standard form: 4.8012×10^2 or round if required
- **A1** 4.8012×10^2 cao
- **Answer: 4.8012×10^2 cm³**

Question 11

- **M1** write 0.0064 as 6.4×10^{-3} then round coefficient to 2 s.f
- **A1** 6.4×10^{-3} cao
- **Answer: 6.4×10^{-3}**

Question 12

- **M1** divide total charge by charge per electron: $3.2 \times 10^{-16} / 1.6 \times 10^{-19}$
- **M1** compute $3.2/1.6 = 2$ and subtract powers: $10^{-16} - (-19) = 10^3$ giving 2×10^3
- **A1** 2.0×10^3 cao to 2 s.f
- **Answer: 2.0×10^3**

Question 13

- (a) **B1** less than 1 with reason: coefficient $5.0 \times 10^{-1} = 0.5 < 1$
- (a) **Answer: Less than 1 because $5.0 \times 10^{-1} = 0.5$**
- (b) **B1** greater than 1 with reason: $9.1 \times 10^0 = 9.1 > 1$
- (b) **Answer: Greater than 1 because $9.1 \times 10^0 = 9.1$**

Question 14

- **M1** divide coefficients and subtract powers: $2.5/5.0 = 0.5$ and $10^{9-4} = 10^5$ giving 0.5×10^5
- **M1** adjust to standard form 5.0×10^4
- **A1** 5.0×10^4 m/s cao
- **Answer: 5.0×10^4 m/s**

Question 15

- **M1** write 3.8×10^5 as 0.38×10^6 or convert 1.2×10^6 to same power and add coefficients
- **M1** add coefficients: $1.2 + 0.38 = 1.58$
- **M1** express as standard form 1.58×10^6
- **A1** 1.58×10^6 cao
- **Answer: 1.58×10^6**

Question 16

- **M1** convert 0.0025 to 2.5×10^{-3} and $1 \text{ km} = 1000 \text{ m} = 1.0 \times 10^3 \text{ m}$
- **M1** divide: $(1.0 \times 10^3) / (2.5 \times 10^{-3}) = 0.4 \times 10^6$ or equivalent
- **A1** 4.0×10^5 cao to 2 s.f
- **Answer: 4.0×10^5**

Question 17

- **M1** explain that coefficient must be between 1 and 10, and 10.2 is ≥ 10 so not standard form
- **A1** correct rewrite 1.02×10^4 cao
- Answer: **1.02×10^4**

Question 18

- **M1** find ratio $6.0 \times 10^{-9} / 2.4 \times 10^{-8}$ or $2.4 \times 10^{-8} / 6.0 \times 10^{-9}$ depending on wording
- **M1** compute ratio = $0.25 = 2.5 \times 10^{-1}$ or inverse 4.0×10^0 ; identify decrease
- **A1** brightness decreased by a factor of 2.5×10^{-1} (ie it is 0.25 of original) cao
- Answer: **2.5×10^{-1} (decreased)**