Edexcel GCSE

Mathematics

Higher Tier

Number: Standard form

Information for students

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 2 questions in this selection.

Advice for students

Show all stages in any calculations.
Work steadily through the paper. Do not spend too long on one question.
If you cannot answer a question, leave it and attempt the next one.
Return at the end to those you have left out.

Information for teachers

The questions in this document are taken from the 2009 GCSE Exam Wizard and include questions from examinations set between January 2003 and June 2009 from specifications 1387, 1388, 2540, 2544, 1380 and 2381.

Questions are those tagged as assessing “Standard form” though they might assess other areas of the specification as well. Questions are those tagged as “Higher” so could have (though not necessarily) appeared on either an Intermediate or Higher tier paper.

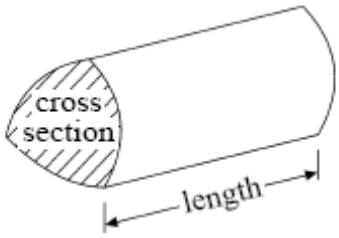
GCSE Mathematics

Formulae: Higher Tier

You must not write on this formulae page.

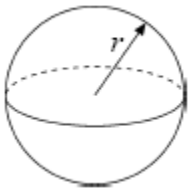
Anything you write on this formulae page will gain NO credit.

Volume of prism = area of cross section × length



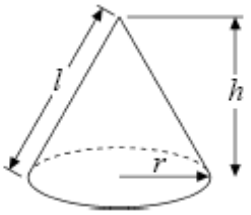
Volume of sphere $\frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$

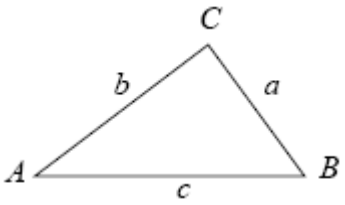


Volume of cone $\frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi rl$



In any triangle ABC



Sine Rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

1. Find the value of $\dfrac{5^5 \times 5^7}{5^{10}}$

……..

(Total 2 marks)

2. A spaceship travelled for 6×10^2 hours at a speed of 8×10^4 km/h.

(a) Calculate the distance travelled by the spaceship.
Give your answer in standard form.

..... km

(3)

One month an aircraft travelled 2×10^5 km.
The next month the aircraft travelled 3×10^4 km.

(b) Calculate the total distance travelled by the aircraft in the two months.
Give your answer as an ordinary number.

..... km

(2)

(Total 5 marks)

3. $$y^2 = \frac{ab}{a+b}$$

$a = 3 \times 10^8$
$b = 2 \times 10^7$

Find y.
Give your answer in standard form correct to 2 significant figures.

$y =$ .....

(Total 3 marks)

4. A floppy disk can store 1 440 000 bytes of data.

(a) Write the number 1 440 000 in standard form.

……

(1)

A hard disk can store 2.4×10^9 bytes of data.

(b) Calculate the number of floppy disks needed to store the 2.4×10^9 bytes of data.

……

(3)
(Total 4 marks)

5. A nanosecond is 0.000 000 001 second.

(a) Write the number 0.000 000 001 in standard form.

.....

(1)

A computer does a calculation in 5 nanoseconds.

(b) How many of these calculations can the computer do in 1 second?
Give your answer in standard form.

.....

(2)
(Total 3 marks)

6. (a) (i) Write 40 000 000 in standard form.

.....

(ii) Write 3×10^{-5} as an ordinary number.

.....

(2)

(b) Work out the value of

$$3 \times 10^{-5} \times 40\,000\,000$$

Give your answer in standard form.

.....

(2)
(Total 4 marks)

7. Work out $(3.2 \times 10^5) \times (4.5 \times 10^4)$

Give your answer in standard form correct to 2 significant figures.

……..

(Total 2 marks)

8. (a) Write the number 40 000 000 in standard form.

.....

(1)

(b) Write 1.4×10^{-5} as an ordinary number.

.....

(1)

(c) Work out

$$(5 \times 10^4) \times (6 \times 10^9)$$

Give your answer in standard form.

.....

(2)
(Total 4 marks)

9. Write in standard form

(a) 456 000

……

(1)

(b) 0.00034

……

(1)

(c) 16×10^7

……

(1)
(Total 3 marks)

10. The mass of 6.02×10^{23} atoms of carbon is 12 grams.

(a) Calculate the mass of 1 atom of carbon.
Give your answer in standard form correct to 3 significant figures.

..... g

(2)

(b) Calculate the number of atoms in 100 grams of carbon.
Give your answer in standard form correct to 3 significant figures.

.....

(2)
(Total 4 marks)

11. (a) Write 5.7×10^{-4} as an ordinary number.

.....

(1)

(b) Work out the value of $(7 \times 10^4) \times (3 \times 10^5)$

Give your answer in standard form.

.....

(2)
(Total 3 marks)

12. When you are h feet above sea level, you can see d miles to the horizon, where

$$d = \sqrt{\frac{3h}{2}}$$

(a) Calculate the value of d when $h = 8.4 \times 10^3$
Give your answer in standard form correct to 3 significant figures.

d = ...

(2)

(b) Make h the subject of the formula $d = \sqrt{\frac{3h}{2}}$

$h =$.....

(2)
(Total 4 marks)

13. (a) Write 30 000 000 in standard form.

.....

(1)

(b) Write 2×10^{-3} as an ordinary number.

.....

(1)
(Total 2 marks)

14. In 2003 the population of Great Britain was 6.0×10^7
In 2003 the population of India was 9.9×10^8

(a) Work out the difference between the population of India and the population of Great Britain in 2003.
Give your answer in standard form.

.....

(2)

In 1933 the population of Great Britain was 4.5×10^7

(b) Calculate the percentage increase in the population of Great Britain from 1933 to 2003.
Give your answer correct to one decimal place.

..... %

(3)
(Total 5 marks)

15. (a) (i) Write 7900 in standard form.

.....

(ii) Write 0. 00035 in standard form.

.....

(2)

(b) Work out $\frac{4\times10^{3}}{8\times10^{-5}}$

Give your answer in standard form.

.....

(2)
(Total 4 marks)

16. Work out

$$\frac{2\times2.2\times10^{12}\times1.5\times10^{12}}{2.2\times10^{12}-1.5\times10^{12}}$$

Give your answer in standard form correct to 3 significant figures.

.....

(Total 3 marks)

17. (a) Write 6.4×10^4 as an ordinary number.

.....

(1)

(b) Write 0.0039 in standard form.

.....

(1)

(c) Write 0.25×10^7 in standard form.

.....

(1)
(Total 3 marks)

18. The number of atoms in one kilogram of helium is 1.51×10^{26}

Calculate the number of atoms in 20 kilograms of helium.
Give your answer in standard form.

.....

(Total 2 marks)

19. (a) Write the number 39 000 in standard form.

.....

(1)

(b) Write 7.21×10^{-3} as an ordinary number.

.....

(1)
(Total 2 marks)

20. (a) Write 64 000 in standard form.

.....

(1)

(b) Write 156×10^{-7} in standard form.

.....

(1)
(Total 2 marks)

21. (a) Write 47 500 000 in standard form.

……

(1)

(b) Write 0.00006 in standard form.

……

(1)
(Total 2 marks)

22. Work out $(4 \times 10^3) \div (8 \times 10^5)$

Give your answer in standard form.

……

(Total 2 marks)

23. Work out $(3.4 \times 10^{12}) \div (1.2 \times 10^{-3})$
Give your answer in standard form, correct to 3 significant figures.

……..

(Total 2 marks)

24. (a) Write the number 50 000 000 in standard form.

…….

(1)

(b) Write the number 0.000 082 in standard form.

……

(1)
(Total 2 marks)

25. Write the number 620 000 000 in standard form.

……

(Total 1 mark)

26. (a) Write 3.8×10^3 as an ordinary number.

…….....……..

(1)

(b) Write the number 0.00045 in standard form.

…….....……..

(1)
(Total 2 marks)

27. (a) Write 5 720 000 in standard form.

.....

(1)

$p = 5\ 720\ 000$
$q = 4.5 \times 10^5$

(b) Find the value of $\dfrac{p-q}{(p+q)^2}$

Give your answer in standard form, correct to 2 significant figures.

.....

(2)
(Total 3 marks)

28. (a) Write 65 200 in standard form.

.....

(1)

(b) Write 8.36×10^{-2} as an ordinary number.

.....

(1)
(Total 2 marks)

29. (a) Write 0.000 000 000 054 in standard form.

.....

(1)

$$S = 12.6\ R^2$$

$R = 0.000\ 000\ 000\ 054$

(b) Use the formula to calculate the value of S.
Give your answer in standard form, correct to 3 significant figures.

$S =$ .....

(2)
(Total 3 marks)

30. (i) Write 638 000 in standard form.

.....

(ii) Write 5.03×10^{-2} as an ordinary number.

.....

(Total 2 marks)

31.

$$x = \sqrt{\frac{p+q}{pq}}$$

$p = 4 \times 10^8$
$q = 3 \times 10^6$

Find the value of x.
Give your answer in standard form correct to 2 significant figures.

$x =$ .....

(Total 3 marks)

32. Write 58 000 in standard form

.....

(Total 1 mark)

33. (a) Write 0.032 in standard form.

.....

(1)

(b) Write 1.58×10^4 as an ordinary number.

.....

(1)

(Total 2 marks)

34. Work out $(3 \times 10^{8}) \times (8 \times 10^{-2})$

Give your answer in standard form.

.....

.....

.....

.....

.....

(Total 2 marks)

35. (a) Write 76 800 000 in standard form.

.....

(1)

(b) Write 0.000 35 in standard form.

.....

(1)

(Total 2 marks)

36. (a) Write 4600 in standard form.

.....

(1)

(b) Write 2.9×10^{-4} as an ordinary number.

.....

(1)
(Total 2 marks)

37. Work out the value of $(2 \times 10^4) + (7 \times 10^3)$

Give your answer in standard form.

.....

(Total 2 marks)

38. (a) Write 431 000 in standard form.

.....

(1)

(b) Write 6.2×10^{-3} as an ordinary number.

.....

(1)
(Total 2 marks)

39. Write 450 000 in standard form.

.....

(Total 1 mark)

40. Work out $(9 \times 10^7) \div (3 \times 10^2)$

Give your answer in standard form.

.....

(Total 2 marks)

41. Write the number 0.00342 in standard form notation.

342×10^3	3.4×10^{-3}	342×10^{-3}	3.42×10^{-3}	3.42×10^{-2}
☐	☐	☐	☐	☐
A	**B**	**C**	**D**	**E**

(Total 1 mark)

42. What is the number 23 500 in standard form?

2.35×10^2	2.3×10^4	2.35×10^4	2.35×10^{-4}	235×10^4
A	**B**	**C**	**D**	**E**

(Total 1 mark)

43. Work out the value of $(6 \times 10^4) \times (4 \times 10^3)$
Give your answer in standard form.

.....

(Total 2 marks)

44. What is 0.00457 in standard form?

457×10^3	4.57×10^3	457×10^{-3}	4.57×10^{-3}	4.57×10^{-2}
A	**B**	**C**	**D**	**E**

(Total 1 mark)

45. Work out the value of $(3 \times 10^9) \div (6 \times 10^{11})$
Give your answer in standard form.

.....

(Total 2 marks)

46. (a) Write the number 14 000 000 in standard form.

.....

(1)

(b) Write 7×10^{-4} as an ordinary number.

.....

(1)
(Total 2 marks)

47. (a) Write the number 45 000 in standard form.

.....

(1)

(b) Write 6×10^{-2} as an ordinary number.

.....

(1)

(Total 2 marks)

48. What is 2.31×10^4 as an ordinary number?

2.310000	2 310 000	2310	23 100	0.000231
A	**B**	**C**	**D**	**E**

(Total 1 mark)

49. What is 0.00362 in standard form?

3.62	3.62×10^{-2}	3.62×10^{-4}	3.62×10^{3}	3.62×10^{-3}
A	**B**	**C**	**D**	**E**

(Total 1 mark)

50. Work out $(8 \times 10^6) \div (2 \times 10^{18})$
Give your answer in standard form.

.....

(Total 2 marks)

51. What is 0.0007 when written in standard form?

0.7×10^3	0.7×10^{-3}	7×10^{-3}	7×10^4	7×10^{-4}
A	**B**	**C**	**D**	**E**

(Total 1 mark)

52. Work out $(6.4 \times 10^5) \times (5 \times 10^4)$

Give your answer in standard form.

.....

(Total 2 marks)

53. What is 0.00643 in standard form?

6.43×10^{-1}	0.643×10^{-2}	6.4×10^{-3}	643×10^{-5}	6.43×10^{-3}
A	**B**	**C**	**D**	**E**

(Total 1 mark)

54. Work out $(3 \times 10^6) \times (5 \times 10^{-4})$

Give your answer in standard form.

.....

(Total 2 marks)

01. 25 2

5^{5+7-10}

M1 for 5^{5+7-10}
A1 cao

[2]

02. (a) 4.8×10^7 3

$6 \times 10^2 \times 8 \times 10^4$
$48 \times 10^6 = 4.8 \times 10^7$

M1 for $6 \times 10^a \times 8 \times 10^b$ *oe, a and b integers including 0*
A1 for 48×10^6 *oe*
A1 cao

(b) 230000 2

200 000 + 30 000 = 230000

B2 cao

(B1 for sight of 200 000 or 30 000 or 2.3×10^5 or 23×10^4)

[5]

03. 4.3×10^3 3

$$\frac{6 \times 10^{15}}{3.2 \times 10^8}$$

1.875×10^7

B3 for 4.3×10^3 to 4.34×10^3

(B2 for 1.875×10^7 oe or 4300 to 4340 or final answer of 1.9×10^7)

(B1 for sight of 6×10^{15} oe or 3.2×10^8 oe)

[3]

04. (a) 1.44×10^6 1

B1 cao

(b) 1667 3

$(2.4 \times 10^9) \div (1.44 \times 10^6)$

M1 for $2.4 \times 10^9 \div$ "1.44×10^6" oe

A1 for 1666 or 1666.6… or 1666.7

A1 (dep) for 1667 cao

[4]

05. (a) 1.0×10^{-9} 1

B1 accept 1×10^{-9} or just 10^{-9}

(b) 2×10^8 2

$1 \div (5 \times 10^{-9})$

M1 for $1 \div$ ("5×10^{-9}") or digit 2 with zeros only seen

Condone omission of bracket for M1.

A1 cao

[3]

06. (a) 4×10^7
0.000 03 2

B1 cao
B1 cao

(b) 1.2×10^3 2

12×10^2
1.2×10^3

M1 for 12×10^2 or 1200 ft from "(a)"
A1 for 1.2×10^3 ft

[4]

07. 1.4×10^{10} 2

B2 for 1.4×10^{10} or 1.44×10^{10}
(B1 for 14.4×10^9 or 14400, 000, 000 or 14000, 000, 000 or 14×10^9)

[2]

08. (a) 4.0×10^7 1

B1 cao

(b) 0.000014 1

B1 cao

(c) 3.0×10^{14} 2

B2 cao accept 3×10^{14}
(B1 for 30×10^{13} or $5 \times 6 \times 10^{4+9}$)
SC: B1 for correct answer as an ordinary number

[4]

09. (a) 4.56×10^5 1

B1 cao

(b) 3.4×10^{-4} 1

B1 cao

(c) 1.6×10^8 1

B1 cao

[3]

10. (a) $\frac{12}{6.02 \times 10^{23}}$ 2

$= 1.99 \times 10^{-23}$

M1 for $\frac{12}{6.02 \times 10^{23}}$

A1 for 1.99×10^{-23} *or better (1.99335...)*

(b) $\frac{100}{12} \times 6.02 \times 10^{23} = 5.02 \times 10^{24}$ 2

M1 for $\frac{100}{12} \times 6.02 \times 10^{23}$

or 100 ÷ (a)

A1 for 5.02×10^{24} *or* 5.03×10^{24} *or better (5.0166...)*

ft from (a)

[4]

11. (a) 0.00057 1

B1 cao

(b) 2.1×10^{10} 2

M1 for $(7 \times 3) \times 10^{4+5}$ *or better, eg* 21×10^9*,*

21 000 000 000

A1 cao

[3]

12. (a) 12 600 or 1.26×10^4 2

1.12×10^2

M1 for 12 600 or 1.26×10^4

A1 for 1.12×10^2 – 1.123×10^2 *oe*

(b) $d^2 = \frac{3h}{2}$ 2

$= \frac{2d^2}{3}$

M1 for squaring each side

A1 for $\frac{2d^2}{3}$ *oe*

[4]

13. (a) 3×10^7 1

B1 cao

(b) 0.002 1

B1 cao

[2]

14. (a) $9.9 \times 10^8 - 6.0 \times 10^7$

$\pm 9.3 \times 10^8$ 2

M1 for $99 \times 10^7 - 6 \times 10^7$ *or* $9.9 \times 10^8 - 0.6 \times 10^8$ *or conversion of either to an ordinary number, or 930000000 or* 93×10^7 *or* 9.3×10^n *where n is any positive integer*

A1 cao

(b) $\frac{6.0 - 4.5}{4.5} \times 100 = \frac{1.5}{4.5} \times 100 =$

or $\frac{6.0 \times 10^7 - 4.5 \times 10^7}{4.5 \times 10^7} \times 100$

33.3% 3

M2 $\frac{6.0 \times 10^7 - 4.5 \times 10^7}{4.5 \times 10^7} \times 100$ *oe*

(M1 for $\frac{6.0 \times 10^7 - 4.5 \times 10^7}{4.5 \times 10^7}$ *or* $\frac{6.0 \times 10^7 - 4.5 \times 10^7}{6.0 \times 10^7} \times 100$

oe A1 33.3 – 33.4

or

M2 $\frac{6.0\times10^7}{4.5\times10^7}$ *× 100 – 100 or 33.3%*

(M1 $\frac{6.0\times10^7}{4.5\times10^7}$ *× 100 or 133.33(%))*

A1 33.3 – 33.4

NB Accept any of the above expressions without any reference to 10^7.

[5]

15. (a) (i) 7.9×10^3 1

B1 cao

(ii) 3.5×10^{-4} 1

B1 cao

(b) $4 \div 8 = 0.5$

$10^3 \div 10^{-5} = 10^8$

$= 5 \times 10^7$ 2

M1 for (4 ÷ 8 =) 0.5 or ($10^3 \div 10^{-5}$ *=)* 10^8 *or 4000/0.00008 or 5 ×* 10^x

where $x \neq 7$

A1 for 5 × 10^7 *cao*

[4]

16. $\frac{2\times2.2\times10^{12}\times1.5\times10^{12}}{2.2\times10^2-1.5\times10^2} = 9.43 \times 10^{12}$ 3

M1 6.6×10^{24} *or* 7×10^{11} *or* 0.7×10^{12}

or as ordinary numbers or calculator notation

M1 $\frac{6.6\times10^{24}}{7\times10^{11}}$ *or as ordinary number or calc notation*

A1 9.42×10^{12} *to* 9.43×10^{12}

SC B1 for 9.4… × 10^n *where* $n \neq 12$ *and an integer*

[3]

17. (a) 64000 1

B1 for 64000

(b) 3.9×10^{-3} 1

B1 for 3.9×10^{-3}

(c) 2.5×10^{6} 1

B1 for 2.5×10^{6}

[3]

18. $20 \times 1.51 \times 10^{26}$
3.02×10^{27} 2

M1 $20 \times 1.51 \times 10^{26}$ or 3.02×10^{n} or 30.2×10^{26} where n is a positive integer
A1 cao

[2]

19. (a) 3.9×10^{4} 1

B1 cao

(b) 0.00721 1

B1 cao

[2]

20. (a) 6.4×10^{4} 1

B1 cao

(b) 1.56×10^{-5} 1

B1 cao

[2]

21. (a) 4.75×10^7 1

B1 cao

(b) 6×10^{-5} 1

B1 cao

[2]

22. 5×10^{-3} 2

M1 for 5×10^n (integer n) ***OR*** *0.5×10^{-2}*
OR *$\frac{1}{2} \times 10^{-2}$ seen*
A1 cao

[2]

23. 2.83×10^{15} 2

B2 for 2.83×10^{15} or better
(B1 for 2.83×10^n where n is an integer or $A \times 10^{15}$ where $1 \leq A < 10$)

[2]

24. (a) 5×10^7 1

B1 cao

(b) 8.2×10^{-5} 1

B1 cao

[2]

25. 6.2×10^8 1

B1 cao

[1]

26. (a) 3800 1

B1 cao

(b) 4.5×10^{-4} 1

B1 cao

[2]

27. (a) 5.72×10^6 1

B1 cao

(b) 1.4×10^{-7} 2

B2 for 1.4×10^{-7} or $1.38\ (433\ldots) \times 10^{-7}$
(B1 for digits 527 or 617 or 380(689) or 138(433) or 14)

[3]

28. (a) 6.52×10^4 1

B1 cao

(b) 0.0836 1

B1 cao

[2]

29. (a) 5.4×10^{-11} 1

$12.6 \times (5.4 \times 10^{-11})^2$

(b) 3.67×10^{-20} 2

B1 cao
M1 for digits 2916 or 367(416)
A1 for $3.67(416) \times 10^{-20}$

[3]

30. (i) 6.38×10^5 2

B1

(ii) 0.0503

B1

[2]

31. 5.8×10^{-4} 3

B3 for 5.8×10^{-4} or $5.79(511\ldots) \times 10^{-4}$
(B2 for digits 335 (8333) or 336 or 579 (5112) or 58)
(B1 for digits 403 or 12)

[3]

32. 5.8×10^4 1

B1 cao

[1]

33. (a) 3.2×10^{-2} 1

B1

(b) 15800 1

B1

[2]

34. 24×10^6
2.4×10^7 2

B2
(B1 for 24×10^6 oe)

[2]

35. (a) 7.68×10^7 1

B1 cao

(b) 3.5×10^{-4} 1

B1 cao

[2]

36. (a) 4.6×10^3 1

B1 cao

(b) 0.00029 1

B1 cao

[2]

37. 20000 + 7000
= 27000
2.7×10^4 2

M1 for 20000 or 7000 seen oe
A1 cao

[2]

38. (a) 4.31×10^5 1

B1 cao

(b) 0.0062 1

B1 cao

[2]

39. 4.5×10^5 1

B1 cao

[1]

40. 3×10^5 2

M1 for sight of 90 000 000 ***and*** *300 or 300 000 or* $3 \times 10^7 \div 10^2$
A1 cao

Answer of $3^{10\text{^}5}$ *gets M1A0, but* $3^{\times 10\text{^}5}$ *gets full marks M1A1 since it could just be the way the candidate has written their correct answer.*

[2]

41. D

[1]

42. C

[1]

43. $6 \times 10^4 \times 4 \times 10^3$
$= 24 \times 10^7$

Alternative:
60 000 × 4000
= 240 000 000

2.4×10^8 2

M1 for $6 \times 4 \times 10^{4+3}$ *or better*
A1 cao
[SC: B1 for 2.4×10^n *where* $n \neq 8$ *if M0 scored]*
Alternative:
B1 for 60 000 and 4000 seen or 240 000 000 seen
B1 cao

[2]

44. D

[1]

45. $(3 \times 10^9) \div (6 \times 10^{11})$
$= 0.5 \times 10^{-2}$
5×10^{-3} 2

B2 for 5×10^{-3}
(B1 for 0.5×10^{-2} *or* $\frac{1}{2} \times 10^{-2}$
or 0.005 or $\frac{1}{200}$
or 5×10^x *provided x is an integer)*

[2]

46. (a) 1.4×10^7 1

B1 cao

(b) 0.0007 1

B1 cao

[2]

47. (a) 4.5×10^4 1

B1 for 4.5×10^4 *cao*

(b) 0.06 1

B1 for 0.06 cao

[2]

48. D

[1]

49. E

[1]

50. $8 \div 2 = 4$
$10^6 \div 10^{18} = 10^{-12}$
4×10^{-12} 2

B2 for 4×10^{-12}
(B1 for sight of 4×10^n *or* $n \times 10^{-12}$*)*

[2]

51. E

[1]

52. 3.2×10^{10} 2

B2 cao
(B1 3.2×10^n*, n an integer* $\neq 10$*, or* 32×10^9 *or*
32 000 000 000 or 3.2 exp10 or $3.2^{\times 10^{10}}$ *seen)*

[2]

53. E

[1]

54. 1.5×10^3 2

B2 for 1.5×10^3 cao

(B1 for $a \times 10^3$, $a \neq 1.5$ or 1.5×10^b, $b \neq 3$ or 15×10^2 or 1500)

[2]

01. A common error was to equate the numerator to 25^{12} rather than 5^{12} and then cancel by 5 to reach the correct answer. Candidates who used this incorrect method to obtain the correct answer scored no marks. More able candidates were able to use the correct method but then frequently left the answer as 5^2 instead of the required 25. There were signs of some poor arithmetic in answers to this question with 5 + 7 sometimes evaluated as 11 or 13.

02. **Paper 3**

Many misconceptions were demonstrated in this question. Firstly there was considerable misunderstanding about what operation was required, with many candidates incorrectly choosing to use division in part (a), or multiplication in part (b). Extra zeros were common, and a significant number of able candidates left their final answer to part (a) as 48×10^6. It was disappointing to see so many candidates who were unable to perform the calculation 6×8 correctly.

Paper 5

In part (a) the vast majority of candidates realised that they had to calculate $6 \times 10^2 \times 8 \times 10^4$ but a significant minority could then not evaluate this correctly. Some candidates who had correctly evaluated the product left their final answer in non-standard form as 48×10^6. In part (b) credit was awarded for writing either of the given numbers as an ordinary number but subsequent wrong calculations or wrong operations gained no further credit. Those who had a basic understanding of standard form notation and who showed working in part (b) normally gained at least the first mark.

03. Mathematics A

Paper 4

Full marks were rarely awarded in this question as candidates either failed to write the answer in standard form or gave the value of y^2. Many did gain two marks and some weaker candidates gained one mark for evaluating the numerator or denominator correctly, most commonly the numerator. An inability to use a scientific calculator efficiently was evident in the manner many candidates attempted the question. Some candidates wrote 6^{15} instead of 6×10^{15} and a significant minority replaced $\frac{10^{15}}{10^8}$ with 10^{23}.

Paper 6

Most candidates managed to gain one mark. Many gained two by leaving the answer as 1.875×10^7, overlooking the need to take a square root.

Mathematics B

Paper 17

Standard form questions continue to be poorly done by Intermediate level candidates. Quite often candidates were unable to write a number, written in standard form, as a normal number, extra 0's usually being the error. Many candidates failed to pick up marks by writing numbers in the form 6^{15} or 32^7 direct from their calculators. A significant number of candidates having found 1.875×10^7, or equivalent, went on to double or halve their answers showing a lack in understanding of square root.

Paper 19

A number of candidates failed to appreciate that they had calculated the value of y^2 rather than y once the substitution and evaluation had taken place. Careful reading of the question could have avoided this. It was clear that some candidates were unable to use their calculator to perform calculations when numbers were in standard form. A number of candidates failed to give their final answer in standard form as required.

04. Paper 3

Many candidates attempted to express the number in standard form. Common incorrect answers include 144×10^4 and 1.4×10^6 (ie unnecessary rounding). Most candidates knew that a division was required. For those who knew how to do this on their calculator this was then an easy question. However, many candidates tried to convert their amounts into ordinary numbers and this frequently led to errors. The context of the question was important, and most candidates who were able to do the calculation gave an answer which included a fraction of a floppy disc, rather than rounding their answer up to a whole number of discs.

Paper 6

Part (a) was well done with only a few writing 144×10^4, or 1.4×10^6
Part (b) was generally done by division of the numbers in standard form. One mark was allocated for rounding up the answer to the division calculation.

05. Mathematics A

Paper 4

The majority of candidates had at best only a partial understanding of standard form. A worrying trend is for candidates to write their answers directly from the calculator display, which in most cases will not earn them the mark since it is not written in correct standard form notation. In part (b) many candidates attempted the calculation in full, but frequently miscounted the number of zeros.

Paper 6

Part (a) was done successfully with only a few starting their answer with 0.1. Part (b) proved to be more of a challenge, because many candidates thought that they had to multiply rather than divide. A surprising number of candidates gave the number of operations that could be performed in 1 minute.

Mathematics B

Paper 17

Many candidates were able to write a nanosecond in standard form although just as many gave a positive index. A few 1^{-9} but this calculator notation is slowly disappearing. In part (b) candidates chose to multiply 1 by 5 or divide 1 by 5 in equal numbers often with inaccurate powers of 10.

Paper 19

A number of candidates failed to cope with the standard form notation. Common errors seen were 0.1×10^{-8}, 1×10^{9} and 1^{-9}. Part (b) was poorly attempted; the majority of candidates seemed unable to tackle the question at all.

06. Paper 3

Many candidates showed little understanding of standard form. In part (a), answers such as 40 million and 4^{7} were very common in (i). Candidates answered (ii) less well. Common mistakes were to omit the decimal point and write 000003 or to put it next to the three, e.g. 00000.3. Full marks were rarely achieved in part (b). Many of those who carried out the multiplication correctly gave the answer as 12×10^{2} or 1200. Other incorrect responses included 12×10^{-12} and 12×10^{35} and 7 (from 3×4) was often seen as the first part of an answer.

Paper 5

Part (a) of this standard form question was well answered with 72% of candidates obtaining both marks and a further 18% obtaining one mark for writing one of the numbers correctly in standard form. In part (b) only 40% of candidates were able to correctly work out the product of the two numbers.

07. Specification A

Higher Tier

A straightforward standard form. Marks were mainly lost through not changing from calculator form when writing the answer. Many candidates rounded from 1.44×10^{10} to 1.4×10^{11}

Intermediate Tier

This straightforward standard form question was answered correctly by about a quarter of candidates. It was clear that many candidates did not know how to use their calculator properly for standard form. It was common for candidates to write both 3.2×10^5 and 4.5×10^4 as ordinary numbers before attempting to multiply. Most were able to get to 1.4 or 1.44 but were unable to deal with the zeros. 10^{12} was quite common – possibly the result of using the wrong sequence on a calculator. Many of those who did enter the calculation correctly could not then write their answer in standard form and 1.4^{10} and 1.44^{10} were seen too often. Attempts at rounding the answer to 2 significant figures often resulted in the power of 10 being altered.

Specification B

Higher Tier

This question was answered correctly by about three quarters of candidates. A small number of candidates are still unable to interpret their calculator display correctly; an answer of 1.4^{11} was often seen

Intermediate Tier

Many candidates chose to convert the given numbers to 'ordinary' form, do the calculation and then convert their answers back into standard form; often with great success, although answers of 14.4×10^9, 1.4^{10}, 1.44^{10} and 1.44×10 were common. Many candidates also evaluated 14.4^9 and 1.44^{10} as powers of 14.4 and 1.44 respectively and then rounded their answers.

08. Intermediate Tier

In part (a) there were many candidates who did not understand standard form notation. Greater success was achieved in part (b), though there were some misplaced decimal points.

Higher Tier

This was a straightforward question on standard form. Parts (a) and (b) were very well answered. There were many good answers to part (c) attempting the addition of powers of 10 and then adding an additional power from the 30. There were some candidates who left the answer as 30×10^{13} and some candidates who wrote both the standard form numbers as ordinary numbers then carried out the multiplication in full. Often, they miscounted the number of zeroes and gained no marks.

09. Intermediate Tier

Standard form remains a topic which is usually badly answered, and this year was no exception. Few candidates demonstrated any understanding as to the nature of numbers written in standard form, with most merely restating the numbers with fewer, or more zeros attached.

Higher Tier

Generally this question was answered well. In part (a), the majority of the candidates were able to express the given number in standard form. The most common mistake was to give the answer as 4.5×10^5 In part (b), most candidates knew that they needed to include a negative sign with their power, but some moved the decimal point too far. Common errors here were 3.4×10^4 and 3.4×10^{-5} In part (c), a popular method was to expand the calculation as an ordinary number and then convert the answer to standard form. A common mistake was to give the final answer as an ordinary number.

10. This was poorly answered with the most common error in part (a) being the divisor not the dividend. A common misconception in part (b) was to multiply the answer to part (a) by 100 and not to divide 100 by the answer to part (a).

11. Paper 5523

Many candidates showed little understanding of standard form. About 20% of candidates could write 5.7×10^{-4} as an ordinary number in part (a). In part (b), about a quarter of candidates got as far as 21 000 000 000 or 21×10^9 but many could not write the final answer correctly in standard form. Those multiplying the numbers in non-standard form often made mistakes with the number of zeros, either when converting or when multiplying.

Paper 5525

Part (a) was done well by many candidates- more than three-quarters gaining full marks. The most common incorrect answers were 0.0057 and 0.000057. In part (b), a popular method was to first convert the numbers into ordinary numbers before multiplication, but this led frequently to an answer with a wrong number of zeros. Candidates adding indices were a little more successful, but final answers were often left as 21×10^9.

12. Paper 5524

Many made an attempt at this question. In part (a) it was common to see correct substitution into the formula, but even with calculators candidates were unable to process the calculation and then find the square root, the most common error being $\sqrt{3} \times 50 \div 2 = 43.3$. Part (b) was only for the better candidates, as most fell at the first hurdle and failed to square both sides; subsequent attempts at rearranging algebra were usually incorrect.

Paper 5526

Most candidates substituted in the correct values for part (a), but a minority omitted the leading number of 3. Correct substitution usually produced the correct value of 112, although there was a common error to take the square root of 3h, omitting the 2 in the denominator.

Part (b) proved more challenging, with many candidates adopting bizarre processes to deal with the square root sign. A small minority who started correctly by squaring both sides were unable to handle the 3 and 2 in the expression correctly.

13. Only the better candidates showed some understanding of standard form. Not surprisingly, more were able to write 30 000 000 in standard form than were able to write 2×10^{-3} as an ordinary number.

14. **Higher Tier**

There were a surprising number of errors in both parts of the question. For part (a), successful candidates simply used their calculator accurately. Many candidates felt the need to change the populations into ordinary numbers, performing the subtraction and then converting back into standard form. Some candidates displayed a lack of understanding of standard form by writing $9.9 \times 10^8 - 6.0 \times 10^7 = 3.9 \times 10^1$.

Part (b) proved to be more challenging. Successful responses to the question consisted of the approaches $\frac{\text{New} - \text{Old}}{\text{Old}} \times 100$ and $\frac{\text{New}}{\text{Old}} \times 100 - 100$. However, there was a lot of confusion with $\frac{\text{New} - \text{Old}}{\text{New}} \times 100$ and $\frac{\text{New}}{\text{Old}} \times 100$ being frequently seen. It could be that the use of standard form meant that answers were less meaningful to candidates, so that responses of 1.33 were written down without any reflection.

Some candidates lost a mark because they gave no heed to the instruction to write down the percentage correct to 1 decimal part.

Intermediate Tier

Working with numbers in standard form remains a challenge for most candidates, even when they have their calculators with them. Many prefer to work with ordinary numbers, and some credit was available for those who converted the numbers correctly into ordinary numbers; for most this was the only mark they earned in this question. Those who did convert into ordinary numbers were rarely able to convert their answer back into standard form. In part (b) very few students knew what to do. Most tried again to convert to ordinary numbers, but were then confused about how to work out percentage change. Division was more often by 60 than 45, some having $45 \div 60 = 75\%$.

15. Higher Tier

Part (a) was done well by most candidates, (i) more successfully than (ii). Common errors showed a confusion in either the requirements of standard form, e.g., or in the meaning of positive and negative exponents, e.g. 79×10^2, or in the meaning of positive and negative exponents, e.g. 3.5×10^4.

In part (b), many candidates converted both numerator and denominator to an ordinary number before dividing. Generally this method proved to be less successful than dividing each part separately to get and then converting to standard form. Common errors indicated confusion between the role of numerator and denominator in the fraction, e.g. 0.5×10^{-8}, 2×10^8, $0.5 \times 10^{?}$ and $\frac{4000}{0.00008} = 3.2 \times 10^9$

Intermediate Tier

Only the better candidates tend to show some understanding of standard form. Nevertheless, in part (a) more than 20% of candidates were able to write 7900 in standard form. Slightly fewer wrote 0.00035 in standard form. Correct answers in part (b) were very rare. Some candidates gained a mark for writing 4000/0.00008 but then could not proceed correctly. Many divided 8 by 4 instead of dividing 4 by 8.

16. Higher Tier

Candidates with some calculator skills were able to get. Many went on to get $\frac{6.6 \times 10^{24}}{7 \times 10^{11}}$ the wrong answer 9.43×10^{34} from incorrect use of the. Those candidates who had been coached to use the exp key or to use brackets for the numerator and denominator were generally successful in gaining all the marks. Those candidates who converted everything into ordinary numbers generally were not.

Intermediate Tier

Few candidates gained any marks in this question. It was clear that very few candidates knew how to use their calculator to process standard form calculations. It was common to see numbers written with the index against the number, omitting the × 10.

17. In part (a), many candidates were able to write the number in standard form as 64 000. Common incorrect answers here were 640 000 (mostly) and 6400. In part (b), many candidates were able to write the number in standard as 3.9×10^{-3}. Common incorrect answers here were 3.9×10^{-4} (mostly) and 3.9×10^3. Candidates were less successful in part (c) where the most popular incorrect answer was 2.5×10^8.

18. Candidates who understand standard form were successful as the task was straightforward. A number of candidates changed the number of atoms to an ordinary number and then multiplied by 20, but generally miscounted the number of zeros either when converting or in their answer. An answer of 1.51×10^{520}, or 3.02×10^{520} coming from 26×10 was often seen.

19. Many candidates clearly had no understanding of standard form and were unable to answer this question. Of those candidates who did, 39×10^3 and 0.000721 were the most common incorrect answers seen in part (a) and part (b) respectively.

20. In part (a) almost 70% of the candidates were able to write 64 000 in standard form. The success rate in part (b) was much lower with just over 30% able to write 156×10^{-7} in standard form. Here, 1.56×10^{-9} was a common incorrect answer. Many candidates, though, wrote the answer as an ordinary number.

21. In common with the linear scheme, candidates understanding of standard form is poor. Many candidates stripped off the zeros alone giving answers as 475×10^5 and 6 (or 0.6) $\times 10^4$, however some had the basic idea but failed to write answers in the correct form, giving instead answers as 4×10^7, 4.75^7 or 475×10^5 and 0.6×10^{-4} or 6^{-5}.

22. The answers to this question were frequently disappointing. $\frac{4}{8}$ was often written as 2. Many solutions had a positive power of 10. A minority of candidates found the correct answer but did not give this in standard form as required.

23. 2.83^{15} was given as an incorrect answer by a number of candidates. The importance of correctly interpreting calculator notation should be stressed to candidates. Weaker candidates were unable to use their calculators to carry out a calculation in standard form.

24. A very poorly answered question with only the more able candidates scoring well. Writing numbers in standard form (and the reverse) is usually done well at this level; it may be that, not having to perform calculations in SF until stage 3, this topic has not been taught to any depth, thus affecting understanding. It was not uncommon to see answers of "50 million" given in part (a).

25. Many had an idea of the format required, but many incorrect answers were seen, including 6.2^8, 62^8, 6.2×10^{-8}, 0.62×10^9 and 62×10^7. There was evidence of poor counting as 6.2×10^7 and 6.2×10^9 were also often frequently seen.

26. Most candidates were familiar with the concept of standard form but only the more able gave correct answers, 3.8000 and 38000 being the usual errors in part (a) while 45×10^{-5}, 4.5×10^4, 4.5×10^{-5} and 0.45 were mistakes often seen in part (b). Part (a) with a 44% success and part (b) with a 26% success rate indicates improvement in the understanding of standard form at this level.

27. Less than two thirds of candidates were able to write the given number correctly in standard form. Fewer still were able to go on and find the value of the given expression. Many candidates were able to gain some credit in part (b) for showing their working which showed a knowledge of the order in which the calculations should be carried out.

28. Popular alternatives to the correct answers were 6.5×10^4, 652×10^2, 65.2×10^2 and 6.52×10^3 in part (a) while 00836, without any decimal point and 0.00836 were the most common errors made in part (b).

29. Only just over half of the candidates were able to write the given number correctly in standard form. In part (b) many candidates were unable to successfully calculate the value of S. A common error being to multiply R by 12.6 and then square.

30. Approximately two thirds of candidates were able to work with numbers in standard form. A common error in part (a) was to give the answer as 638×10^3. In part (b) 0.503 and 50300 were common wrong answers.

31. This was a fairly routine question testing use of standard form on calculators. The majority of candidates were able to score some marks on this question but only 14% of candidates were able to score full marks. Some candidates clearly had no idea how to enter numbers in standard form into their calculators. A common error was to see candidates adding 4×10^8 and 3×10^6 to obtain an answer of 7×10^n.

32. Only about two thirds of candidates were able to answer this straightforward question correctly. A common error was to give an answer of 58×10^3.

33. Expressing a number in standard form was poor in part (a). Candidates fared better in part (b) although 1580000 was often seen.

34. The majority of candidates who answered this question correctly did so by working with the numbers in standard form. Some errors were made in attempting to write the initial answer of 24×10^6 in standard form. 2.4×10^5 was a common incorrect answer.

35. Approximately 70% of candidates answered part (a) correctly but only about 60% of candidates were successful in part (b). A common error was to give the wrong power of ten.

36. A third of candidates successfully converted 4600 into standard form and 2.9×10^{-4} into and ordinary number 46×10^2 was not uncommon and 29000 was often seen in part (b)

37. This question was answered very poorly. The most successful candidates were those who wrote the given numbers as ordinary numbers, carried out the calculation and then converted their answer to standard form. Candidates were tried to work in standard form generally gave the answer incorrectly as 9×10^7 or 14×10^7. Some errors in the conversion from standard form were seen with 2×10^4 written as 200000 and 7×10^3 written as 70000.

38. This very straightforward question was only answered correctly by about 50% of the candidates.

39. Candidates struggled to write 450 000 in standard form. Many did not realise that the decimal point needed to be between the 4 and the 5, preferring to write 45×10^4 or 450×10^3. The mean mark for this 2 mark question was only 0.5.

40. Many candidates showed a lack of understanding of the concept of standard form. Attempts to convert the given numbers into ordinary numbers was poor, quite often the decimal point remaining in the number, for example 9.0000000 When the conversions were successful, answers were often left as 300000

A major problem is ignorance of the facility of a standard form button (exp on most calculators) leading to all the unnecessary conversions of the initial 2 numbers.

41. No Report available for this question.

42. No Report available for this question.

43. Although the correct answer was seen many times, answers of 24×10^7, 240 000 000 and 2.4^8 were not uncommon; all receiving just one mark. Many candidates gained one mark for correctly converting 6×10^4 and 4×10^3 to ordinary numbers, however 600000 and 40000 were common mistakes.

Powers were often carelessly written; many time 10^8 appeared as 108 and so lost the mark. Weaker candidates usually failed to score any marks at all here.

44. No Report available for this question.

45. Standard form questions have always been somewhat challenging but this one appeared to be well within the capability of the student, particularly as they could use a calculator if they wished. Around 42% got this fully correct with a further 16% scoring 1 mark for either 0.05 or 0.5×10^{-2} or 5×10^{n}. Dealing with $3 \div 6$ and $10^{9} \div 10^{11}$ as a first step was often seen. Knowing how to deal with the resulting 0.5×10^{-2}, which scored the method mark, to produce a result in standard form was also generally well handled by those who were familiar with the idea of standard form.

Other methods prevailed with $3000000000 \div 600000000000$ sometimes being seen in the working but not always leading to the correct final result. Many others wrote 5^{-03} or 5 –03 clearly not knowing how to interpret their calculator display. There does still seem to be some reluctance to deal with the processing in a standard form way and further practice may be needed as part of the preparation for answering this type of question.

46. 14×10^{6} and 14^{6} were the most common errors made in part (a). In part (b), it was not uncommon to see answers of 0.007, 0.70000, 70000 and 70^{-4} instead of 0.0007

47. Again a question where candidates knew what they had to do but unfortunately many candidates could not cope with the negative index in part (b) though part (a) was mostly correct.

48. No Report available for this question.

49. No Report available for this question.

50. In this question both marks were scored by just over half of candidates. Seemingly, few candidates were able to use their calculator efficiently. Working seen indicated that many candidates had converted the calculation to one involving ordinary numbers before working out their answer. Common incorrect answers which scored one mark included 4×10^{12} and 4×10^{24}. Unfortunately it was not uncommon to see answers expressed as powers of 4 or 40. 4^{-12} was often seen.

51. No Report available for this question.

52. Standard form is almost always tested on this paper and it was well understood with 55% of candidates obtaining both marks for a correct answer. A further 15% gained one mark for an incomplete attempt to write the answer correctly with answers of 32×10^9 or 32 000 000 000.

A surprising 30% of candidates gained no marks.

53. No Report available for this question.

54. This question proved to be a good discriminator with each of the marks 2, 1 and 0 being awarded to about one third of the candidates.

Of the two thirds of candidates who could not be awarded full marks, about half were able to use their calculator correctly to evaluate the product (but were unable to give their answer in correct standard form) or give a partially correct answer in the form $1{\cdot}5 \times 10^n$ ($n \neq 3$).

The responses 1500, $1{\cdot}5 \times 10^{11}$ and $1{\cdot}5 \times 10^2$ were commonly seen.