$a \times 10^{n}$

1. (a) Write 7.97×10^{-6} as an ordinary number.

7.97×10^{-6}

$0.000007 97$

0.00000797

(1)

0.00000797

(1)

(b) Work out the value of $(2.52 \times 10^{5}) \div (4 \times 10^{-3})$
Give your answer in standard form.

$a^{x} \div a^{y} = a^{x-y}$

$\frac{2.52}{4} = \frac{1.26}{2} = 0.63$ $\quad \frac{2.52}{4} = 0.63$

$10^{5} \div 10^{-3} = 10^{(5--3)} = 10^{8}$ (1)

0.63×10^{8}

6.3×10^{7}

(1)

6.3×10^{7}

(2)

(Total for Question is 3 marks)

2. The table shows some information about eight planets.

Planet	Distance from Earth (km)	Mass (kg)
Earth	0	5.97×10^{24}
Jupiter	6.29×10^{8}	1.898×10^{27}
Mars	7.83×10^{7}	6.42×10^{23}
Mercury	9.17×10^{7}	3.302×10^{23}
Neptune	4.35×10^{9}	1.024×10^{26}
Saturn	1.28×10^{9}	5.68×10^{26}
Uranus	2.72×10^{9}	8.683×10^{25}
Venus	4.14×10^{7}	4.869×10^{24}

(a) Write down the name of the planet with the greatest mass.

Jupiter

(1)

(b) Find the difference between the mass of Venus and the mass of Mercury.

$(4.869 \times 10^{24}) - (3.302 \times 10^{23})$

$= 4.5388 \times 10^{24}$ kg

(1)

Nishat says that Neptune is over a hundred times further away from Earth than Venus is.

(c) Is Nishat right?
You must show how you get your answer.

Planet	Distance from Earth (km)	Mass (kg)
Earth	0	5.97×10^{24}
Jupiter	6.29×10^{8}	1.898×10^{27}
Mars	7.83×10^{7}	6.42×10^{23}
Mercury	9.17×10^{7}	3.302×10^{23}
Neptune	4.35×10^{9}	1.024×10^{26}
Saturn	1.28×10^{9}	5.68×10^{26}
Uranus	2.72×10^{9}	8.683×10^{25}
Venus	4.14×10^{7}	4.869×10^{24}

$\frac{4.35 \times 10^{9}}{4.14 \times 10^{7}} = 105.07246...$ (1)

Yes, Nishat is correct because 105.07... > 100. (1)

(2)

(Total for Question is 4 marks)

3. Work out $(13.8 \times 10^{7}) \times (5.4 \times 10^{-12})$
Give your answer as an ordinary number.

$0.00074.52$

$(13.8 \times 10^{7}) \times (5.4 \times 10^{-12})$
$= 13.8 \times 5.4 \times 10^{7} \times 10^{-12}$
$= 74.52 \times 10^{-5}$
$= 0.0007452$

0.0007452

(Total for Question is 2 marks)

4. $T = \sqrt{\left(\frac{w}{d^3}\right)}$

$w = 5.6 \times 10^{-5}$
$d = 1.4 \times 10^{-4}$
} In standard form

(a) Work out the value of T.
Give your answer in standard form correct to 3 significant figures.

$a \times 10^b$ where $1 \leq a < 10$

$T = \sqrt{\frac{5.6 \times 10^{-5}}{(1.4 \times 10^{-4})^3}}$ = 4517.53... (1)

7 ≥ 5 so round the 1 up to 2

= 4520 to 3SF

$= 4.52 \times 10^3$

$1 \leq 4.52 < 10$

$T =$ 4.52×10^3 (1)

(2)

w is increased by 10% ← Scale factor of 1.1
d is increased by 5% ← Scale factor of 1.05

Lottie says,

"The value of T will increase because both w and d are increased."

(b) Lottie is wrong.
Explain why.

Calculating the scale factor by which T has been multiplied:

$= \sqrt{\frac{1.1}{1.05^3}} = 0.974\ldots$ (1)

0.97 > 1

The value of the scale factor by which T is multiplied (to calculate its new value) is less than 1, so there is a decrease in T (1)

(2)

(Total for Question is 4 marks)

5. (a) Work out an estimate for the value of $\sqrt{63.5 \times 101.7}$

$\approx \sqrt{64 \times 100}$ (1)

$\approx \sqrt{64} \times \sqrt{100}$

$\approx 8 \times 10$

≈ 80.

(1) 80

(2)

$(2.3)^6 = 148$ correct to 3 significant figures.

(b) Find the value of $(0.23)^6$ correct to 3 significant figures.

$0.23 = \frac{2.3}{10}$.

$\therefore (0.23)^6 = \left(\frac{2.3}{10}\right)^6 = \frac{(2.3)^6}{10^6} = \frac{148}{10^6}$

$= 0.000148$.

(1) 0.000148

(1)

(c) Find the value of 5^{-2}

$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$.

(1) $\frac{1}{25}$.

(1)

(Total for Question is 4 marks)

6. (a) Write 0.00562 in standard form.

(1) 5.62×10^{-3}

(1)

(b) Write 1.452×10^3 as an ordinary number.

(1) 1452.

(1)

(Total for Question is 2 marks)

	n = 1	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7
$2n^2 - 1$	1	7	17	31	49	71	97
$40 - n^2$	39	36	31	24	15	4	−9

③

clear that as these sequences continue they won't cross again

7. Work out $(3.42 \times 10^{-7}) \div (7.5 \times 10^{-6})$
Give your answer in standard form.

$\frac{a^x}{a^y} = a^{x-y}$

$$\frac{3.42 \times 10^{-7}}{7.5 \times 10^{-6}} = 0.456 \times \frac{10^{-7}}{10^{-6}} = 0.456 \times 10^{-7-(-6)} = 0.456 \times 10^{-7+6}$$

$$= 0.456 \times 10^{-1} = 4.56 \times 10^{-2}$$

① ①

4.56×10^{-2}

8. (a) Write 32 460 000 in standard form.

32 460 000.000
3.2460000000
3.246×10^7 (1)

3.246×10^7

(1)

(b) Write 4.96×10^{-3} as an ordinary number.

4.96×10^{-3}
0004.9600000
0.00496 (1)

0.00496

(1)

Asma was asked to compare the following two numbers.

$A = 6.212 \times 10^8$ and $B = 4.73 \times 10^9$

She says,

"6.212 is bigger than 4.73 so A is bigger than B."

(c) Is Asma correct?
You must give a reason for your answer.

She is incorrect because 10^8 is smaller than 10^9
(She did not take into account Standard form) (1)

(1)

9. Write these numbers in order of size. Start with the smallest number.

Standard form: $A \times 10^n$ $(1 \leq A < 10)$

6.72×10^5 (3)

67.2×10^{-4} → $6.72 \times 10 \times 10^{-4}$ → 6.72×10^{-3} (2)

672×10^4 → $6.72 \times 100 \times 10^4$ → 6.72×10^6 (4)

$0.000\,672$ → 6.72×10^{-4} (1)

0.000672 67.2×10^{-4} 6.72×10^5 672×10^4 ✓½

(Total for Question is 2 marks)

10. (a) Write 4.5×10^5 as an ordinary number.

$4.5 \times 100,000$

(1)

450 000

(1)

(b) Write 0.007 in standard form.

$7 \div 1000$ ÷1000 can be written as $\times 10^{-3}$.

(1)

7×10^{-3}

(1)

(c) Work out $4.2 \times 10^3 + 5.3 \times 10^2$
Give your answer in standard form.

$4.2 \times 10^3 + 5.3 \times 10^2$

$= 4.2 \times 10^3 + 0.53 \times 10^3$

(1)

$= 4.73 \times 10^3$

(1)

4.73×10^3

(2)

(Total for Question is 4 marks)