Test answers - Indices and standard form

Year: Year 10 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $(4x^3)^2 = 16x^6$ (1), times $3x$ is $48x^7$ (1) Square both the 4 and the power: $4^2 = 16$ and $x^{3\times2} = x^6$. Then multiply by $3x$, adding the indices. The answer is $48x^7$.

b. $\left(\frac{5}{2}\right)^2 = \frac{25}{4}$ (1) and $9^{\frac{1}{2}} =$ **3** (1) A negative index means the reciprocal, so turn the fraction upside down and square it. A power of $\frac{1}{2}$ is a square root, so $9^{\frac{1}{2}} = 3$.

Answer to Question 2 (4 marks)

a. 8.6×10^{-5} (1) The decimal point moves 5 places to the right to give 8.6, so the power is -5.

b. $3 \times 4 = 12$ and $10^{5-2} = 10^3$ (1), so $12 \times 10^3 = 1.2 \times 10^4$ (1) 12 is not between 1 and 10, so we write $12 = 1.2 \times 10^1$. The answer is 1.2×10^4.

c. $7.2 \div 9 = 0.8$ and 10^4, so 8×10^3 (1) 0.8 is not between 1 and 10, so $0.8 \times 10^4 = 8 \times 10^3$.

Check (c) by reversing the division: $8000 \times 900 = 7\,200\,000$, which is 7.2×10^6 as given.

Answer to Question 3 (4 marks)

a. $\frac{3 \times 10^8}{3.4 \times 10^2} = 8.82 \times 10^5$ (1 for division, 1 for the answer) Divide the speed of light by the speed of sound. Light is about 8.82×10^5 times faster than sound.

b. $\frac{5.1 \times 10^3}{3.4 \times 10^2} =$ **15 seconds** (1 for the method, 1 for the answer) The light arrives almost at once, so the delay is the time the sound takes: time = distance ÷ speed. The thunder is heard 15 seconds after the flash.

Answer to Question 4 (4 marks)

a. $\frac{60 \times 0.4}{0.2} =$ **120** (1 for rounding to 1 s.f., 1 for the answer) Round 58.7 to 60, 0.41 to 0.4 and 0.19 to 0.2. The estimate is 120.

b. Accurate value $= \frac{58.7 \times 0.41}{0.19} = 126.7$ (1), so the estimate is **smaller**: 0.41 and

58.7 were rounded down (0.4) or only slightly up while the denominator 0.19 was rounded up to 0.2 (1).

In detail: 58.7 rises by about 2%, 0.41 falls by about 2% and 0.19 rises by about 5%, so the fraction becomes smaller overall.

Answer to Question 5 (4 marks)

a. $64^{\frac{1}{3}} = 4$, then $4^{-2} = \dfrac{1}{16}$ (1 for each stage) The denominator 3 means a cube root and the minus sign means the reciprocal. So $64^{-\frac{2}{3}} = \frac{1}{16}$.

b. $\dfrac{1}{16} = 2^{-4}$ (1), so $x + 3 = -4$ and $x = \mathbf{-7}$ (1) Write $\frac{1}{16}$ as a power of 2, then set the indices equal. Check: $2^{-7+3} = 2^{-4} = \frac{1}{16}$. So $x = -7$.

In (a), working the other way round, $64^2 = 4096$ and $\sqrt[3]{4096} = 16$, gives the same result but is harder without a calculator. A common error is to give -16 or $-\frac{128}{3}$.