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WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

OCR A Physics: SI units, prefixes and homogeneity

35-40 minutes independent practice + 15-20 minutes review | Total: 46 marks

Specification points covered

2.1.2(a) S.I. base quantities and units: mass (kg), length (m), time (s), current (A), temperature (K), amount of substance (mol).
2.1.2(b) Derived units of S.I. base units, including momentum (kg m s^{-1}) and density (kg m^{-3}).
2.1.2(c) Recognise and use units listed in this specification.
2.1.2(d) Check the homogeneity of physical equations using S.I. base units.
2.1.2(e) Use prefixes: pico, nano, micro, milli, centi, deci, kilo, mega, giga and tera.
2.1.2(f) Label graph axes and table columns using conventions such as speed / m s^{-1}.

A. Reading and recording measurements

1. A climate chamber logger records the current in a heater, the temperature in the chamber and the amount of gas released. Give the S.I. base-unit symbol for each quantity. [3 marks]

Recorded quantity	Reading	S.I. base-unit symbol
current in heater	0.80	
thermodynamic temperature	295	
amount of gas released	0.020	

2. A student writes these headings in a results spreadsheet: time (ms), potential difference - mV and current / microampere. Rewrite each using the OCR quantity / unit convention. [3 marks]

Student's heading	Correct heading
time (ms)	
potential difference - mV	
current / microampere	

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3. A cart travels 0.48 km in 2.4 ms while a sensor records a current of 0.35 mA. Convert all three readings to S.I. units before they are used in a calculation. [3 marks]

Recorded value	S.I. value
0.48 km	
2.4 ms	
0.35 mA	

B. Prefix choice in contexts

4. A timing system offers the prefixes p, n, μ, m, c, d, k, M, G and T. Write the symbols in increasing multiplier order. Then state the factor from centi to kilo and from giga to tera. [3 marks]

Increasing multiplier order	Factor c → k	Factor G → T

5. A laser laboratory compares three pulse durations: A = 650 ns, B = 0.80 μs and C = 0.0012 ms. Identify the longest pulse and calculate the difference between the longest and shortest pulses in ns. [3 marks]

6. Two protective coatings have thicknesses 7.5×10^{-9} m and 0.42 μm. Write both using suitable prefixes and state how many times thicker the larger coating is. [3 marks]

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7. A high-voltage supply operates at 2.5 kV and provides a current of 0.40 A. Use P = VI to calculate the power in watts and then with a suitable prefix. [3 marks]

8. A charge sensor operates at 3.0 mV and transfers 0.24 µC. Use W = VQ to calculate the energy transferred in joules and then with a suitable prefix. [3 marks]

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C. Derived units in measurements

9. A test rig presses a pad with a force of 18 N over an area of 3.0 cm^2. Use p = F / A to calculate the pressure in pascals. State the S.I. base units of pressure. [3 marks]

10. A 12.0 cm^3 polymer sample has a mass of 10.2 g. Calculate its density in kg m^{-3} and state the S.I. base units of density. [3 marks]

11. A crash-test report says that impulse and momentum can be directly compared. Use I = Ft and p = mv to show that they have the same S.I. base units. [2 marks]

12. Energy transferred is given by E = VQ. Potential difference has base units kg m^2 s^{-3} A^{-1} and charge has units A s. Show that the equation gives the base units of energy. [2 marks]

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D. Homogeneous equations

13. Use S.I. base units to show that P = Fv is homogeneous, where P is power, F is force and v is speed. [2 marks]

14. For a simple harmonic oscillator, $a = -\omega^2 x$. Show that the base units of a and $\omega^2 x$ are the same. [2 marks]

15. A trainee writes $s = at$ as the distance travelled from rest. Use units to show why the equation is not homogeneous. Then check that $s = \frac{1}{2}at^2$ is homogeneous. [3 marks]

16. A vehicle damping model uses $F = bv$. A supplier gives b the units kg m s^{-1}. Use base units to decide whether this can be correct and state the correct units for b. [3 marks]

17. Two energy models are proposed: $E = mc$ and $E = mc^2$. Use S.I. base units to decide which expression can have the units of energy. [2 marks]

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