SMART EXAM RESOURCES
9702 PHYSICS TOPIC QUESTIONS
TOPIC: PHYSICAL QUANTITIES AND UNITS
SUB-TOPIC: SI UNITS
SUB-SUB-TOPIC: CONVERT BETWEEN UNITS

SET-3-QP-MS

1 **(a)** Use an expression for work done, in terms of force, to show that the SI base units of energy are $\text{kg m}^2\text{ s}^{-2}$.

[2]

(b) **(i)** The energy E stored in an electrical component is given by

$$E = \frac{Q^2}{2C}$$

where Q is charge and C is a constant.

Use this equation and the information in **(a)** to determine the SI base units of C.

SI base units ..... [2]

Mark Scheme:

(a)	(work =) force × displacement	**C1**
	units: kg m s^{-2} × m = kg m^2 s^{-2}	**A1**
b)(i)	units of *Q*: As	**C1**
	units of *C*: kg^{-1} m^{-2} A^2 s^4	**A1**

2 **(a)** **(i)** Define pressure.

.....

..... [1]

(ii) Use the answer to **(a)(i)** to show that the SI base units of pressure are $kg\,m^{-1}\,s^{-2}$.

[1]

(b) A horizontal pipe has length L and a circular cross-section of radius R. A liquid of density ρ flows through the pipe. The mass m of liquid flowing through the pipe in time t is given by

$$m = \frac{\pi(p_2 - p_1)R^4\rho t}{8kL}$$

where p_1 and p_2 are the pressures at the ends of the pipe and k is a constant.

Determine the SI base units of k.

SI base units ..... [3]

Mark Scheme:

(a)(i)	force / area (normal to the force)	**B1**
(a)(ii)	($p = F / A$ so units are) kg m s^{-2} / m^2 = kg m^{-1} s^{-2}	**A1**
(b)	unit of R: m **and** unit of t: s **and** unit of L: m	**C1**
	unit of ρ: kg m^{-3} **or** $\rho = m / V$	**C1**
	base units of k: (kg m^{-1} s^{-2} × m^4 × kg m^{-3} × s) / (kg × m) = kg m^{-1} s^{-1}	**A1**

3 The drag force F_D acting on a sphere falling through a liquid is given by

$$F_D = 6\pi\eta r v$$

where r is the radius of the sphere,
v is the speed of the sphere in the liquid and
η is a property of the liquid called the viscosity.

(a) Show that the SI base units of viscosity are $\text{kg m}^{-1}\text{ s}^{-1}$.

[2]

Mark Scheme:

(a)	units of F: kg m s^{-2}	C1
	units of r: m and units of v: m s^{-1}	A1
	units of η: kg m s^{-2} / (m × m s^{-1}) = kg m^{-1} s^{-1}	