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 Determine the SI base units of stress.
Show your working.

base units .....[2]

MARKING SCHEME:

(a)	(stress =) force / area **or** $kg\,m\,s^{-2} / m^2$	**B1**
	$= kg\,m^{-1}\,s^{-2}$	**A1**

2 **(a)** State two SI base units other than kilogram, metre and second.

1. .....

2. .....

[1]

(b) Determine the SI base units of resistivity.

base units .....[3]

MARKING SCHEME:

(a)	kelvin, mole, ampere, candela *any two*	**B1**
(b)	use of resistivity = RA / l **and** $V = IR$ (to give $\rho = VA / Il$)	**C1**
	units of V: (work done / charge) kg m^2 s^{-2} (A s)$^{-1}$	**C1**
	units of resistivity: (kg m^2 s^{-3} A^{-1} A^{-1} m) = kg m^3 s^{-3} A^{-2}	**A1**
	or	
	use of $R = \rho L / A$ and $P = I^2R$ (gives $\rho = PA / I^2L$)	**(C1)**
	units of P: kg m^2 s^{-3}	**(C1)**
	units of resistivity: (kg m^2 s^{-3} × m^2) / (A^2 × m) = kg m^3 s^{-3} A^{-2}	**(A1)**

3 State the SI base units of force.

.....[1]

MARKING SCHEME:

	$kgms^{-2}$	A1

4 The force F between two point charges is given by

$$F = \frac{Q_1 Q_2}{4\pi r^2 \varepsilon}$$

where Q_1 and Q_2 are the charges,
r is the distance between the charges,
ε is a constant that depends on the medium between the charges.

Use the above expression to determine the base units of ε.

base units .....[2]

Mark Scheme:

	units for Q: As and for r: m	C1
	units for ε = (As × As)/(kgms^{-2} × m^2) = A^{2}kg^{-1}m^{-3}s^4	A1

5 **(a)** The drag force F_D acting on a sphere moving through a fluid is given by the expression

$$F_D = K\rho v^2$$

where K is a constant,
ρ is the density of the fluid
and v is the speed of the sphere.

Determine the SI base units of K.

base units .....[3]

MARKING SCHEME:

units of F: $kgms^{-2}$	**C1**
units of ρ: kgm^{-3} **and** units of v: ms^{-1}	**C1**
units of K: $kgms^{-2} / [kgm^{-3}(ms^{-1})^2]$ $= m^2$	**A1**

6 **a** Show that the SI base units of power are $kg\,m^2\,s^{-3}$.

[1]

(b) All bodies radiate energy. The power P radiated by a body is given by

$$P = kAT^4$$

where T is the thermodynamic temperature of the body,
A is the surface area of the body
and k is a constant.

(i) Determine the SI base units of k.

base units .....[2]

MARKING SCHEME:

(a)	Correct substitution of base units of all quantities into any correct equation for power. Examples: ($P = E/t$ or W/t gives) $kg\ m^2 s^{-2} / s = kg\ m^2 s^{-3}$ ($P = Fs/t$ or mgh/t gives) $kg\ m\ s^{-2}\ m / s = kg\ m^2 s^{-3}$ ($P = \frac{1}{2}mv^2/t$ gives) $kg\ (m\ s^{-1})^2 / s = kg\ m^2 s^{-3}$ ($P = Fv$ gives) $kg\ m\ s^{-2}\ m\ s^{-1} = kg\ m^2 s^{-3}$ ($P = VI$ gives) $kg\ m^2\ s^{-2}\ A^{-1}\ s^{-1}\ A = kg\ m^2 s^{-3}$	**A1**
(b)(i)	units of A: m^2 **and** units of T: K	**C1**
	units of k: $kg\ m^2 s^{-3} / m^2 K^4$ $= kg\ s^{-3} K^{-4}$	**A1**