Answer **all** the questions in the spaces provided.

1 **(a)** Define *force*.

.....[1]

(b) State the SI base units of force.

.....[1]

(c) 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]

[Total: 4]

Answer **all** the questions in the spaces provided.

1 **(a)** Distinguish between vector and scalar quantities.

.....

.....

..... [2]

(b) The electric field strength E at a distance x from an isolated point charge Q is given by the equation

$$E = \frac{Q}{x^2 b}$$

where b is a constant.

(i) Use the definition of electric field strength to show that E has SI base units of $kg\,m\,A^{-1}\,s^{-3}$.

[2]

(ii) Use the units for E given in **(b)(i)** to determine the SI base units of b.

SI base units of b ..... [2]

[Total: 6]

Answer **all** the questions in the spaces provided.

1 **(a)** Distinguish between vector and scalar quantities.

.....

.....

..... [2]

(b) The electric field strength E at a distance x from an isolated point charge Q is given by the equation

$$E = \frac{Q}{x^2 b}$$

where b is a constant.

(i) Use the definition of electric field strength to show that E has SI base units of $kg\,m\,A^{-1}\,s^{-3}$.

[2]

(ii) Use the units for E given in **(b)(i)** to determine the SI base units of b.

SI base units of b ..... [2]

[Total: 6]

Answer **all** the questions in the spaces provided.

1 **(a)** Define *velocity*.

.....

..... [1]

(b) The drag force F_D acting on a car moving with speed v along a straight horizontal road is given by

$$F_D = v^2Ak$$

where k is a constant and A is the cross-sectional area of the car.

Determine the SI base units of k.

SI base units ..... [2]

(c) The value of k, in SI base units, for the car in **(b)** is 0.24. The cross-sectional area A of the car is $5.1\,m^2$.

The car is travelling with a constant speed along a straight road and the output power of the engine is 4.8×10^4 W. Assume that the output power of the engine is equal to the rate at which the drag force F_D is doing work against the car.

Determine the speed of the car.

speed = ... $m\,s^{-1}$ [3]

[Total: 6]

Answer **all** the questions in the spaces provided.

1 **(a)** The ampere, metre and second are SI base units.

State **two** other SI base units.

1. .....

2. .....
[2]

(b) The average drift speed v of electrons moving through a metal conductor is given by the equation:

$$v = \frac{\mu F}{e}$$

where e is the charge on an electron
F is a force acting on the electron
and μ is a constant.

Determine the SI base units of μ.

SI base units .....[3]

[Total: 5]

Answer **all** the questions in the spaces provided.

1 **(a)** Complete Fig. 1.1 by putting a tick (✓) in the appropriate column to indicate whether the listed quantities are scalars or vectors.

quantity	scalar	vector
acceleration		
force		
kinetic energy		
momentum		
power		
work		

Fig. 1.1 [2]

(b) A floating sphere is attached by a cable to the bottom of a river, as shown in Fig. 1.2.

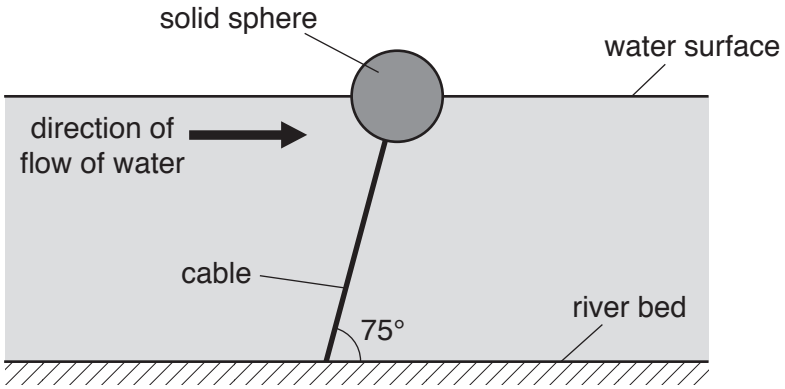

Fig. 1.2

The sphere is in equilibrium, with the cable at an angle of 75° to the horizontal. Assume that the force on the sphere due to the water flow is in the horizontal direction.

The radius of the sphere is 23 cm. The sphere is solid and is made from a material of density 82 kg m^{-3}.

(i) Show that the weight of the sphere is 41 N.

[2]

Answer **all** the questions in the spaces provided.

1 **(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]