Physical Quantities & Units

Question paper 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Physical Quantities & Units
Sub Topic	
Paper Type	Theory
Booklet	Question paper 2

Time Allowed: **83 minutes**

Score: **/69**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** State the SI base units of force.

.....[1]

(b) Two wires each of length l are placed parallel to each other a distance x apart, as shown in Fig. 1.1.

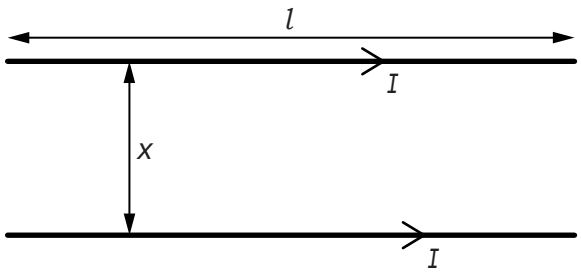

Fig. 1.1

Each wire carries a current I. The currents give rise to a force F on each wire given by

$$F = \frac{KI^2l}{x}$$

where K is a constant.

(i) Determine the SI base units of K.

units of K ..... [2]

(ii) On Fig. 1.2, sketch the variation with x of F. The quantities I and l remain constant.

Fig. 1.2 [2]

(iii) The current I in both of the wires is varied.

On Fig. 1.3, sketch the variation with I of F. The quantities x and l remain constant.

Fig. 1.3 [1]

2 **(a)** The spacing between two atoms in a crystal is 3.8×10^{-10} m. State this distance in pm.

spacing = ... pm [1]

(b) Calculate the time of one day in Ms.

time = ... Ms [1]

(c) The distance from the Earth to the Sun is 0.15 Tm. Calculate the time in minutes for light to travel from the Sun to the Earth.

time = ... min [2]

(d) Underline all the vector quantities in the list below.

distance energy momentum weight work [1]

(e) The velocity vector diagram for an aircraft heading due north is shown to scale in Fig. 1.1. There is a wind blowing from the north-west.

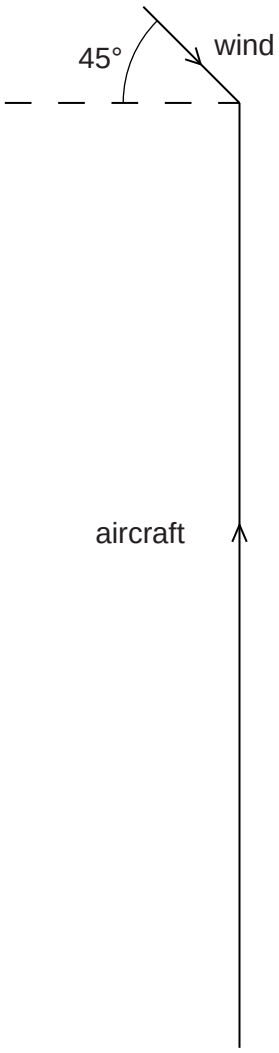

Fig. 1.1

The speed of the wind is 36 m s^{-1} and the speed of the aircraft is 250 m s^{-1}.

(i) Draw an arrow on Fig. 1.1 to show the direction of the resultant velocity of the aircraft. [1]

(ii) Determine the magnitude of the resultant velocity of the aircraft.

resultant velocity = ... m s^{-1} [2]

3 **(a)** **(i)** State the SI base units of volume.

base units of volume ..... [1]

(ii) Show that the SI base units of pressure are $kg\,m^{-1}s^{-2}$.

[1]

(b) The volume V of liquid that flows through a pipe in time t is given by the equation

$$\frac{V}{t} = \frac{\pi P r^4}{8Cl}$$

where P is the pressure difference between the ends of the pipe of radius r and length l. The constant C depends on the frictional effects of the liquid.

Determine the base units of C.

base units of C ..... [3]

4 **(a)** Distinguish between scalars and vectors.

.....

.....[1]

(b) Underline **all** the vector quantities in the list below.

acceleration kinetic energy momentum wer eight [2]

(c) A force of 7.5 N acts at 40° to the horizontal, as shown in Fig. 1.1.

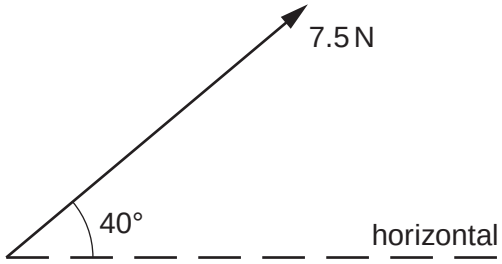

Fig. 1.1

Calculate the component of the force that acts

(i) horizontally,

horizontal component = ... N [1]

(ii) vertically.

vertical component = ... N [1]

(d) Two strings support a load of weight 7.5 N, as shown in Fig. 1.2.

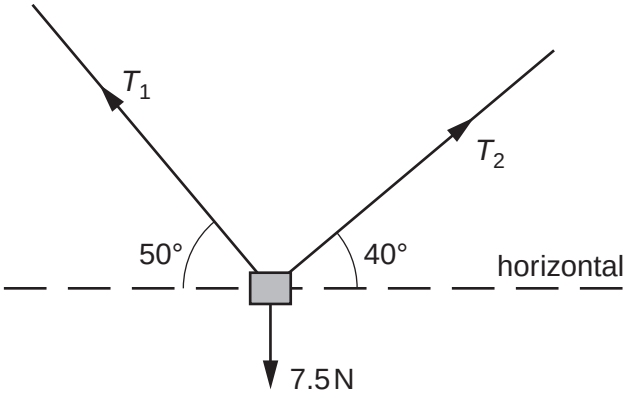

Fig. 1.2

One string has a tension T_1 and is at an angle 50° to the horizontal. The other string has a tension T_2 and is at an angle 40° to the horizontal. The object is in equilibrium. Determine the values of T_1 and T_2 by using a vector triangle or by resolving forces.

T_1 = ... N

T_2 = ... N

[4]

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

.....

.....

..... [2]

(b) In the following list, underline **all** the scalar quantities.

acceleration force kinetic energy mass power weight [1]

(c) A stone is thrown with a horizontal velocity of $20\,m\,s^{-1}$ from the top of a cliff 15 m high. The path of the stone is shown in Fig. 1.1.

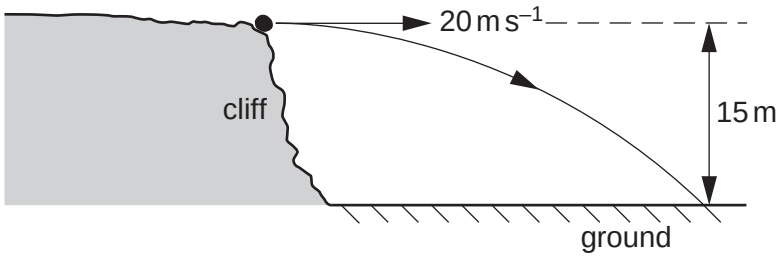

Fig. 1.1

Air resistance is negligible.

For this stone,

(i) calculate the time to fall 15 m,

time = ... s [2]

(ii) calculate the magnitude of the resultant velocity after falling 15 m,

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

(iii) describe the difference between the displacement of the stone and the distance that it travels.

.....

.....

..... [2]

6 **(a)** Two of the SI base quantities are mass and time. State three other SI base quantities.

1. .....

2. .....

3. .....

[3]

(b) A sphere of radius r is moving at speed v through air of density ρ. The resistive force F acting on the sphere is given by the expression

$$F = Br^2\rho v^k$$

where B and k are constants without units.

(i) State the SI base units of F, ρ and v.

F .....

ρ .....

v .....

[3]

(ii) Use base units to determine the value of k.

k = ... [2]

7 **(a)** **(i)** Distinguish between vector quantities and scalar quantities.

.....

.....

.....[2]

(ii) State whether each of the following is a vector quantity or a scalar quantity.

1. temperature

.....[1]

2. acceleration of free fall

.....[1]

3. electrical resistance

.....[1]

(b) A block of wood of weight 25 N is held stationary on a slope by means of a string, as shown in Fig. 1.1.

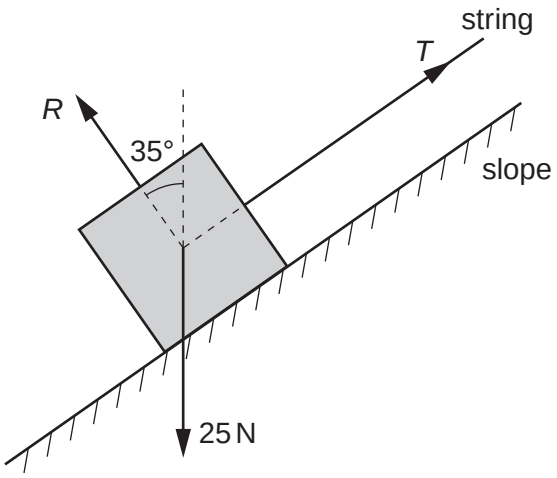

Fig. 1.1

The tension in the string is *T* and the slope pushes on the block with a force *R* that is normal to the slope.

Either by scale drawing on Fig. 1.1 or by calculation, determine the tension *T* in the string.

T = ... N [3]

8 Make estimates of the following quantities.

(a) the thickness of a sheet of paper

thickness = ... mm [1]

(b) the time for sound to travel 100 m in air

time = ... s [1]

(c) the weight of 1000 cm^3 of water

weight = ... N [1]

9 A unit is often expressed with a prefix. For example, the gram may be written with the prefix 'kilo' as the kilogram. The prefix represents a power-of-ten. In this case, the power-of-ten is 10^3.

Complete Fig. 1.1 to show each prefix with its symbol and power-of-ten.

prefix	symbol	power-of-ten
kilo	k	10^3
nano	n	.....
centi	.....	10^{-2}
.....	M	10^6
.....	T	10^{12}

Fig. 1.1

[4]

10 **(a)** Two of the SI base quantities and their units are mass (kg) and length (m).

Name three other SI base quantities and their units.

1. quantity ..... unit .....

2. quantity ..... unit .....

3. quantity ..... unit .....

[3]

(b) The pressure p due to a liquid of density ρ is related to the depth h by the expression

$$p = \rho g h,$$

where g is the acceleration of free fall.

Use this expression to determine the derived units of pressure. Explain your working.

[5]