## Physical Quantities \& Units Mark Scheme 2

| Level | International A Level |
| :--- | :--- |
| Subject | Physics |
| Exam Board | CIE |
| Topic | Physical Quantities \& Units |
| Sub Topic |  |
| Paper Type | Theory |
| Booklet | Mark Scheme 2 |


1 (a force: $\mathrm{kg} \mathrm{m} \mathrm{s}^{-2}$ ..... A1
(b) (i) $\quad I^{2}: \mathrm{A}^{2} \quad l: \mathrm{m} \quad x: \mathrm{m}$ ..... C1
$K: \mathrm{kg} \mathrm{m} \mathrm{s}^{-2} A^{-2}$ ..... A1
(ii) curve of the correct shape (for inverse proportionality) ..... M1
clearly approaching each axis but never touching the axis ..... A1
(iii) curving upwards and through origin ..... A1
(a) spacing $=380$ or $3.8 \times 1 \mathrm{a}^{2} \mathrm{pm}$
(b) time $=24 \times 3600$
time $=0.086(0.0864) \mathrm{Ms}$
(c) time $=$ distance $I$ speed $=\begin{gathered}1.5 \times 10^{11} \\ 3 \times 10^{8}\end{gathered}$ $=500(\mathrm{~s})=8.3 \mathrm{~min}$
(d) momentum and weight
(e) (i) arrow to the right of plane direction \{about $4^{\circ}$ to $24^{\circ}$ )
(ii) scale diagram drawn
or use of cosine formula ,,$l=250^{2}+36^{2}-2 \times 250 \times 36 \times \cos 45^{\circ}$
or resolving $v=\left[\left(36 \cos 45^{\circ}\right)^{2}+\left(250-36 \sin 45^{\circ}\right)\right]^{112}$
resultant velocity $=226$ (220-240 for scale diagram) $\mathrm{ms}^{-1}$
allow one mark for values 210 to 219 or 241 to $250 \mathrm{~ms}^{-1}$ or use of formula $(v=51068) v=230(.226) \mathrm{ms}^{-1}$ A1 [2][1]
[1]
(a (i) $V$ units: $\mathrm{m}^{3}$ (allow metres cubed or cubic metres) A1
(ii) Pressure units: $\mathrm{kg} \mathrm{m} \mathrm{s}^{-2} / \mathrm{m}^{2}$ (allow use of $P=\rho g h$ ) M1 Units: $\mathrm{kg} \mathrm{m}^{-1} \mathrm{~s}^{-2}$

A0
(b) $V / t$ units: $\mathrm{m}^{3} \mathrm{~s}^{-1}$ B1
Clear substitution of units for $P, r^{4}$ and $l$ M1

$$
C=\frac{\pi P r^{4}}{8 V t^{-1} l}=\frac{\mathrm{kgm}^{-1} \mathrm{~s}^{-2} \mathrm{~m}^{4}}{\mathrm{~m}^{3} \mathrm{~s}^{-1} \mathrm{~m}}
$$

Units: $\mathrm{kg} \mathrm{m}^{-1} \mathrm{~s}^{-1}$
(8 or $\pi$ in final answer-1. Use of dimensions max 2/3)
(a) scalar has magnitude/size, vector has magnitude/size and direction
(b) acceleration, momentum, weight B2
(-1 for each addition or omission but stop at zero)
(c) (i) horizontally: $7.5 \cos 40^{\circ} / 7.5 \sin 50^{\circ}=5.7(45) / 5.75$ not 5.8 N
(ii) vertically: $\quad \sin 40^{\circ} / 7.5 \cos 50^{\circ}=4.8(2) \mathrm{N}$
(d) either correct shaped triangle
correct labelling of two forces, three arrows and two angles
or correct resolving: $T_{2} \cos 40^{\circ}=T_{1} \cos 50^{\circ}$
$T_{1} \sin 50^{\circ}+T_{2} \sin 40^{\circ}=7.5$
$T_{1}=5.7(45)(\mathrm{N})$
A1
$T_{2}=4.8(\mathrm{~N})$
A1
(allow $\pm 0.2 \mathrm{~N}$ for scale diagram)
(a scalar has only magnitude
B1 vector has magnitude and direction
(b) kinetic energy, mass, power all three underlined
(c) (i) $s=u t+1 / 2 a t^{2}$
$15=0.5 \times 9.81 \times t^{2}$
C1
$T=1.7 \mathrm{~s}$
A1
if $g=10$ is used then -1 but only once on paper
(ii) vertical component $v_{\mathrm{v}}$ :
$v_{v}{ }^{2}=u^{2}+2$ as $=0+2 \times 9.81 \times 15$ or $v_{v}=u+a t=9.81 \times 1.7(5)$
$v_{v}=17.16$
C1
resultant velocity: $v^{2}=(17.16)^{2}+(20)^{2}$ $v=26 \mathrm{~m} \mathrm{~s}^{-1}$

A1
If $u=20$ is used instead of $u=0$ then $0 / 3$
Allow the solution using:
initial (potential energy + kinetic energy) = final kinetic energy
(iii) distance is the actual path travelled
displacement is the straight line distance between start and finish points (in that direction) / minimum distance

6 (a length, current, temperature, amount of substance, (luminous intensity) any three, 1 each
(b) (i) $F: \mathrm{kg} \mathrm{m} \mathrm{s}^{-2}$

B1
$\rho: \mathrm{kg} \mathrm{m}^{-3}$
B1
$v: \mathrm{m} \mathrm{s}^{-1}$
B1
(ii) some working e.g. $\mathrm{kg} \mathrm{m} \mathrm{s}^{-2}=\mathrm{m}^{2} \mathrm{~kg} \mathrm{~m}^{-3}\left(\mathrm{~m} \mathrm{~s}^{-1}\right)^{k}$ M1 hence $k=2$

$8 \quad$ (a allow $0.05 \mathrm{~mm} \rightarrow 0.15 \mathrm{~mm}$
(b) allow $0.25 \mathrm{~s} \rightarrow 0.5 \mathrm{~s}$
B [1]
(c) allow $8 \mathrm{~N} \rightarrow 12 \mathrm{~N}$
B
ignore number of significant figures
$9 \quad 10^{-9}$ ..... B1
c ..... B1
mega ..... B1
tera ..... B1[4]

10 (a e.g. time (s), current (A), temperature (K), amount of substance (mol), luminous intensity (cdl)
1 each, max 3 ..... B3



unit of pressure: $\quad \mathrm{kg} \mathrm{m}^{-3} \mathrm{~m} \mathrm{~s}^{-2} \mathrm{~m} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots$

(allow $4 / 5$ for solution in terms of only dimensions)

