Mark schemes

Q1.

(a) $W = 25\,000 \times 9.8$

1

$= 245\,000$ (N)

1

(b) $p = \frac{1\,960\,000}{49}$

1

$= 40\,000$

1

Pa

1

(c) B

1

(d) $a = \frac{1.3 - 0.7}{5.0}$

1

$= 0.12$ (m/s^2)

1

(e) $\frac{0.21}{0.84} \times 100$

1

25%

1

(f) force (applied to the spring) = spring constant × extension
or
$F = k \times e$

1

(g) $336 = k \times 0.21$

1

$\frac{336}{0.21} = k$

1

$k = 1600$ (N/m)

1

(h) $v^2 - 0 = 2 \times 9.8 \times 0.95$

1

$v^2 = 18.62$

allow $v = \sqrt{(18.62)}$

1

$v = 4.3150\ldots$

1

$= 4.3$ (m/s)

allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses the values in the question

1

[18]

Q2.

(a) 0 (N)

1

the child isn't accelerating (vertically)

MP2 dependent on MP1

or

upwards forces are equal to the downwards forces

allow forces are balanced

1

(b) work done = force × distance

or

$W = F \times s$

1

(c) $35 = F \times 2.8$

1

$$F = \frac{35}{2.8}$$

1

$F = 12.5$ (N)

allow 13 (N)

1

(d) the resistive force has decreased

allow friction (between the wheels and the floor) has decreased

1

so the resultant force increases

1

(e) moment = force × distance

or

$M = F \times d$

1

(f) 7.5 cm = 0.075 m

1

$M = 2.0 \times 0.075$

allow a correct substitution of an incorrectly / not converted value of d

1

$M = 0.15$ (Nm)

allow an answer consistent with an incorrectly / not converted value of d

1

(g) gear B rotates in the opposite direction (to gear A)
or
gear B rotates clockwise
or
gear B rotates faster than gear A

1

(because) gear A exerts a force on gear B
or
(because) gear A causes a moment about the pivot of gear B

1

[14]

Q3.

(a) 1.5 cm

1

(b) any **one** from:
- clamp the stand to the desk
- wear safety goggles / glasses
- stand up / away from apparatus
- limit the total mass used
- have masses over the base of the stand

1

(c) $W = 0.050 \times 9.8$

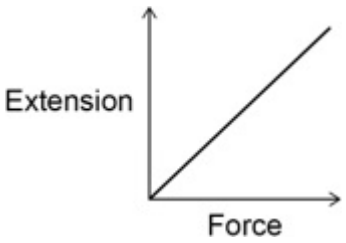
1

$W = 0.49$ (N)

*do **not** accept 0.50 (N) alone*

1

(d)



1

(e) $k = \frac{2.0}{0.080}$

1

$k = 25$ (N/m)

1

[7]

Q4.

(a) 7.1 (cm)

allow 7.0 to 7.3 (cm)

1

497 (m)

allow 70 × their measurement of displacement

1

(b) 0 (N)

1

(c) constant velocity

allow constant speed (in a straight line)

*do **not** accept stationary*

*allow constant acceleration if a **mathematical error** in (b) gives a non-zero value for resultant force*

1

(d) any **one** from:

- tension
- normal contact (force)
- upthrust

allow lift, thrust and water resistance

allow normal reaction (force)

ignore drag

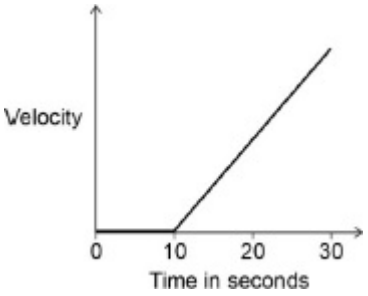
1

(e) horizontal line drawn to 10s along the *x*-axis

1

line with a positive gradient starting from 10 s

allow an upward curving line with increasing gradient starting from 10 s



1

[7]

Q5.

(a) gravitational force

1

(b) air resistance

1

(c) the resultant force on the hailstones is zero

1

(d) line extrapolated to 80 mm

allow a straight line

1

46 (m/s)

allow 44 − 48 but not if inconsistent with their extrapolated line

1

(e) it has a greater weight

1

(f) 0.48 (N)

1

(g) upwards

allow up

ignore north

1

[8]

Q6.

(a) centre of mass

1

(b) weight is directly proportional to mass

1

(c) reading from balance = 1.1 kg

1

mass = $\frac{1.1}{5}$ = 0.22 kg

allow correct calculation using incorrectly read value from the balance

1

(d) weight = 0.22 × 9.8

*allow ecf from part **(c)***

1

2.156 (N)

allow correct answer to 2 or 3 sig figs

1

(e) 0.015 m

1

(f) spring constant = $\frac{6.0}{0.015}$

*allow ecf from part **(e)***

1

400 (N/m)

1

(g) returns to its original length/shape

allow returns to 3.5 cm

1

[10]