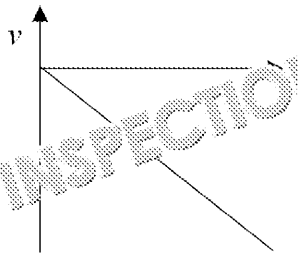
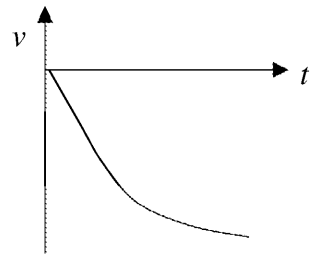
1. quantity with magnitude **[1]**
and direction **[1]**

2. (a) change in displacement **[1]**
(b) (i)



v on vertical axis and t on horizontal; ignore presence or absence of units if correct **[1]**
straight line through origin **[1]**
negative gradient **[1]**

(ii)



graph starting as above in (i) **[1]**
gradient decreasing in magnitude, possibly becoming zero **[1]**

3. (a) (i) $(\text{resultant})^2 = 6.3^2 + 4.5^2$ **[1]**
$(\text{resultant}^2) = 59.94$ **[1]**
resultant = 7.7(4) N **[1]**

(ii) $\tan^{-1}\left(\frac{4.5}{6.3}\right)$ **[1]**

Accept use of sin or cos with answer from (i)
= 35.5° **[1]**

(b) velocity / displacement **[1]**

4. (a) N cm / newton centimetres **[1]**
(b) (i) 10 000 × 14 **[1]**
= 140 000 (Nm) or 1.4×10^5 (Nm) **[1]**
5000 × 9 **[1]**
– 45 000 (Nm) or 4.5×10^4 (Nm) **[1]**
45 000 + 140 000 = 185 000 Nm or 1.85×10^5 Nm **[1]**
(ii) Anticlockwise moment = 185 000 (Nm)
$= W \times 9.5$ or $\frac{185,000}{9.5}$ **[1]**
= 1.9(5) × 10^4 N *[illegible]*
Accept values to 2 or 3 s.f. not in standard form

5. (a) use o
$v = 0$
$s = -$
1
Can
11.5
(b) use o
corre
Allo
time
total

6. *control va*
independe
dependent
graph
distance /
time squar
value of g

7. (a) speed
distan
time
(b) assu
use o
takin
and *s*
(c) frictio
the p
not fr

8. density =
0.896 × 4.
= 4.08 g
Answer m

9. (a) mom
= 38
mom
= 49
total
(Ns /
after
= 10
speed
= 4.0
(b) total
+ (0.
total
= 85
so co

10. (a) $W = Fs\cos\theta$ or $630 \times 1200 \times \cos 26°$ **[1]**
= 680 kJ / 679 kJ **[1]**
Accept answer in J in standard form to 2 or 3 s.f.
(b) tension will increase **[1]**
a resultant force is required to accelerate a mass / $F = ma$ **[1]**
the existing tension / tension of 630 N must be balanced by friction as there is n

11. $\frac{1}{2}mv^2 = mg\Delta h$ **[1]**
m shown to cancel on both sides **[1]**
equation rearranged in terms of v to show that m does not appear in the final eq
dependent – time taken [1]

12. (a) ΔL or $k = \frac{F}{\Delta L}$ or $\frac{73}{0.025}$ **[1]**
2900 / 2920 / 2.9(2) × 10^3 **[1]**
Nm^{-1} **[1]**
(b) $\frac{1}{2}F\Delta L$ or $\frac{1}{2}k(\Delta L)^2$ or substitution **[1]**
0.91 (3) J **[1]**
(c) 0.003 (kg) seen as mass of nail **[1]**
$0.91(3) = \frac{1}{2}mv^2$ or $0.91(3) = 0.5 \times 0.003v^2$ or rearrangement or equating en
v = 24(.7) ms^{-1} **[1]**

13. (a) (i) vernier (scale) **[1]**
(ii) 1.02 mm **[1]**
(b) original/unstretched length of the wire **[1]**
cross-sectional area / diameter of the wire **[1]**
masses attached / load used to stretch / weigh[illegible] to wire **[1]**
(c) (for eye protection) in case the wire brea[illegible]

Preview of Answers Ends Here