

Mark Scheme Scalar/Vector Past Paper Questions

Jan 2002 to Jan 2009

3(a) displacement is a vector ✓
ball travels in opposite directions ✓ Q3 Jan 2003 max(1)

(b) velocity is rate of change of displacement
average speed is rate of change of distance
velocity is a vector [or speed is a scalar]
velocity changes direction any two ✓ ✓ (2)

(c)(i) $a = \frac{(-6.0 - 8.0)}{0.10}$ ✓
 $= (-)140. \text{m s}^{-1}$ ✓ (allow C.E. for incorrect values of Δv)

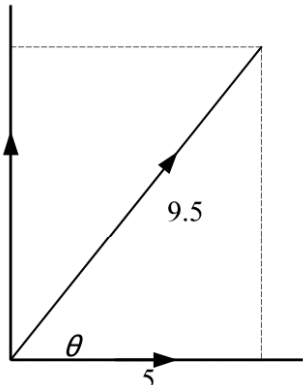
(c)(ii) $F = 0.45 \times (-)140 = (-)63 \text{ N}$ ✓ (allow C.E for value of a)

(c)(iii) away from wall ✓
at right angles to wall ✓
[or back to girl ✓ ✓]
[or opposite to direction of velocity at impact ✓ ✓] (5)
(8)

1

(a)(i) a quantity that has magnitude only
[or has no direction] ✓ Q1 Jan 2004

(ii) any two: e.g. energy ✓
temperature ✓ (3)

(b)(i)  scale ✓
5 N and 9.5 N ✓
correct answer (8.1 N ± 0.2 N) ✓

[or $9.5^2 = 5.0^2 + F^2$ ✓
 $F^2 = 90.3 - 25$ ✓
 $F = 8.1 \text{ N}$ ✓ (8.07 N)]

(ii) $\cos \theta = \frac{5.0}{9.5}$
gives $\theta = 58^\circ$ ✓ ($\pm 2^\circ$ if taken from scale diagram) (4)
(7)

Question 2

Q2 Jan 2005

- (a) vector quantities have direction (as well as magnitude) and scalar quantities do not ✓ (1)
- (b) vector: e.g. velocity, acceleration, momentum ✓
 scalar: e.g. mass, temperature, energy ✓ (2)
- (c)(i) addition of forces (12 + 8) ✓
 (use of $F = ma$ gives) $a = \frac{(12+8)}{6.5} = 3.1 \text{ m s}^{-2}$ ✓ (3.08 m s^{-2})
- (ii) subtraction of forces (12 - 8) ✓
 $a = \frac{(12-8)}{6.5} = 0.62 \text{ m s}^{-2}$ ✓ (0.615 m s^{-2}) (4)
 (7)

Question 2		Q2 Jan 2009	
(a)	(i) vector has direction and a scalar does not ✓ (ii) scalar examples; any two e.g. speed, mass, energy, time, power vector examples; any two e.g. displacement, velocity, acceleration, force or weight ✓✓✓ for 4 correct, ✓✓ for 3 correct, ✓ for 2 correct		4
(b)	(i) horizontal component (= 2.8 cos 35) = 2.3 (kN) (2293.6) ✓ vertical component (= 2.8 sin 35) = 1.6 (kN) (1606.0) ✓ (ii) power = force × velocity or 2.3 kN × 8.3 m s^{-1} ✓ (ecf from 2 (b)(i)) = 1.9×10^4 (19037 or 19100) ✓ ecf W (or J s^{-1}) ✓ (or 19 W (or kJ s^{-1}))		5
(c)	(area of cross-section of cable =) $\pi \times (\frac{1}{2} 0.014)^2$ ✓ = $1.5(4) \times 10^{-4} (\text{m}^2)$ ✓ stress (= F/A) = $\frac{2800 \text{ N}}{1.54 \times 10^{-4} \text{ m}^2}$ (allow ecf here if attempt to calculate area) ✓ = $1.8(2) \times 10^7$ ✓ ecf Pa (or N m^{-2}) ✓		5
Total			14

1(a)(i) rate of change of velocity

$$\left[\text{or } a = \frac{\Delta v}{t} \right] \checkmark$$

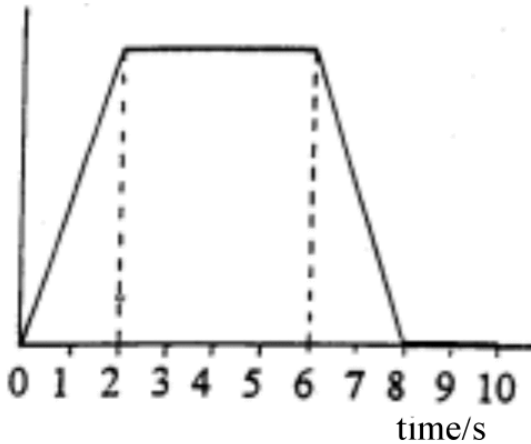
Q1 Jan 2002

(ii) (acceleration) has (magnitude and) direction \checkmark (2)

(b)(i) (acceleration) is the gradient (or slope) of the graph \checkmark

(ii) (displacement) is the area (under the graph) \checkmark (2)

(c) velocity



graph to show:

(linear) increase to $t = 2.0 \pm 0.2 \text{ s}$ \checkmark
uniform velocity between 2.0 s and 6.0 s \checkmark
(linear) decrease from $6.0 \pm 0.2 \text{ s}$ to 8.0 s \checkmark
zero velocity after $t = 8.0 \text{ s}$ \checkmark

(4)

(8)