Mark Scheme Scalar/Vector Past Paper Questions

Jan 2002 to Jan 2009

Q3 Jan 2003

3(a) displacement is a vector ✓
ball travels in opposite directions ✓ $_{max}(1)$

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

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

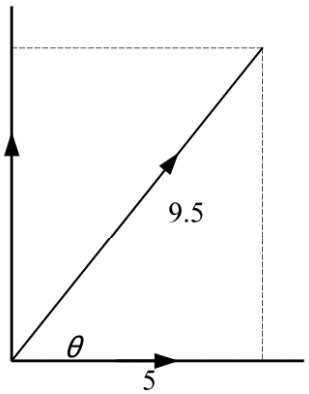
(c)(iii) away from wall ✓
at right angles to wall ✓
[or back to girl ✓ ✓]
[or opposite to direction of velocity at impact ✓ ✓] (5)
(8)

Q1 Jan 2004

1
(a)(i) a quantity that has magnitude only
[or has no direction] ✓

(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 $9.5^2 = 5.0^2 + F^2$ ✓
$F^2 = 90.3 - 25$ ✓
$F = 8.1$ N ✓ (8.07 N)]

(ii) $\cos\theta = \dfrac{5.0}{9.5}$
gives $\theta = 58°$ ✓ (± 2° 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) $a = \dfrac{(12+8)}{6.5} = 3.1\ \text{m s}^{-2}$ ✓ $(3.08\ \text{m s}^{-2})$

(ii) subtraction of forces $(12 - 8)$ ✓
$a = \dfrac{(12-8)}{6.5} = 0.62\ \text{m s}^{-2}$ ✓ $(0.615\ \text{m s}^{-2})$ *(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) × 10^{-4} (m^2) ✓ stress (= F/A) = $\dfrac{2800\ \text{N}}{1.54\times10^{-4}\ \text{m}^2}$ (allow ecf here if attempt to calculate area) ✓ = 1.8(2) × 10^7 ✓ ecf **Pa** (or N m^{-2}) ✓	**5**
		Total	**14**

Q1 Jan 2002

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

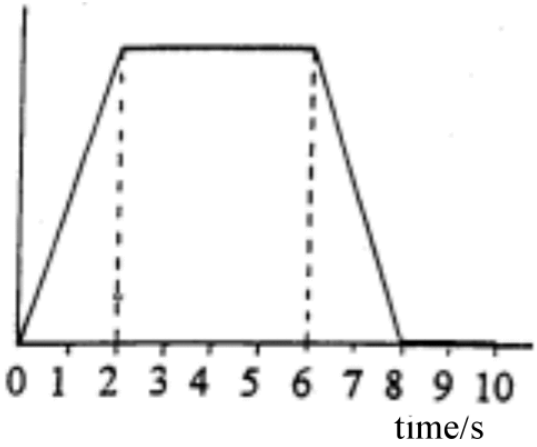
[or $a = \frac{\Delta v}{t}$] ✓

(ii) (acceleration) has (magnitude and) direction ✓ (*2*)

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

(ii) (displacement) is the area (under the graph) ✓ (*2*)

(c) velocity



graph to show:

(linear) increase to $t = 2.0 \pm 0.2$ s ✓
uniform velocity between 2.0 s and 6.0 s✓
(linear) decrease from 6.0 ± 0.2 s to 8.0 s ✓
zero velocity after $t = 8.0$ s ✓

(*4*)
(*8*)