Section A

1. A
2. B
3. A
4. D
5. B
6. D
7. D
8. A
9. B
10. A

Section B

Question 1

(a) (i) *either* rate of change of displacement
      or   (change in) displacement / time (taken)

   (ii) speed has magnitude only
         velocity has magnitude and direction

(b) (i) idea of area under graph / use of $s = \dfrac{(u+v)}{2} \times t$

$$s = \dfrac{(18+32)}{2} \times 2.5$$
$$= 62.5 \text{ m}$$

   (ii) $a = (18 - 32)/2.5\ (= -5.6)$
         $F = ma$
         $F = 1500 \times (-)\,5.6 = (-)\,8400\,\text{N}$

(c) arrow labelled A and arrow labelled F both to the left

Question 2

(a) a body/mass/object continues (at rest or) at constant/uniform velocity unless acted on by a <u>resultant</u> force

(b) (i) weight <u>vertically</u> down
normal/reaction/contact (force) perpendicular/normal <u>to the slope</u>

 (ii) 1. acceleration = gradient or $(v - u)/t$ or $\Delta v / t$
= $(6.0 - 0.8)/(2.0 - 0.0)$ = $2.6\ \mathrm{m\,s^{-2}}$

  2. $F = ma$
= 65×2.6
= $169\ \mathrm{N}$ (allow to 2 or 3 s.f.)

  3. weight component seen: $mg\sin\theta$ (218 N)
$218 - R = 169$
$R = 49\ \mathrm{N}$ (require 2 s.f.)

Question 3

(a) scalar has magnitude only
vector has magnitude and direction

(b) (i) $v^2 = 0 + 2 \times 9.81 \times 25$ (or using $\frac{1}{2}mv^2 = mgh$)
$v = 22(.1)\ \mathrm{m\,s^{-1}}$

 (ii) $22.1 = 0 + 9.81 \times t$ (or $25 = \frac{1}{2} \times 9.81 \times t^2$)
$t\ (=22.1/9.81) = 2.26\ \mathrm{s}$ or $t\ [=(5.097)^{1/2}] = 2.26\ \mathrm{s}$

 (iii) horizontal distance $= 15 \times t$
$= 15 \times 2.257 = 33.86$ (allow $15 \times 2.3 = 34.5$)

(displacement)^2 = (horizontal distance)^2 + (vertical distance)^2
$= (25)^2 + (33.86)^2$

displacement = 42 (42.08) m (allow 43 (42.6) m, allow 2 or more s.f.)

 (iv) distance is the actual (curved) path followed by ball
displacement is the straight line/minimum distance P to Q

Question 4

(a) temperature
current
(allow amount of substance and luminous intensity)

(b) base units of force constant: $kg\,m\,s^{-2}\,m^{-1}$ or $kg\,s^{-2}$
base units of time and mass: s and kg
base units of C: $s\,(kg\,s^{-2}/kg)^{1/2}$ cancelling to show no units

Question 5

(a) pressure = force / area (normal to the force) [clear ratio essential]

(b) (i) $P = mg/A = (5.09 \times 9.81)/A$

$A = (\pi d^2/4) = \pi \times (9.4 \times 10^{-2})^2/4$ $(= 0.00694\,m^2)$

$P = 49.93/0.00694$
$= 7200\,(7195)\,Pa$ (minimum of 2 s.f. required)

(ii) $\Delta P/P = \Delta m/m + 2\Delta d/d$

$= 0.01/5.09 + (2 \times 0.1)/9.4$ $(= 0.0020 + 0.021$ or $2.3\%)$

$\Delta P = 170\,(165$ to $167)\,Pa$

(iii) $P = 7200 \pm 200\,Pa$

Question 6

(a) (i) amplitude scale reading 2.2 (cm)
amplitude $= 2.2 \times 2.5 = 5.5\,mV$

(ii) time period scale reading = 3.8 (cm)
time period $= 3.8 \times 0.5 \times 10^{-3} = 0.0019\,(s)$

frequency $f = 1/0.0019 = 530\,(526)\,Hz$

(iii) uncertainty in reading $= \pm 0.2$ in 3.8 (cm) or 5.3% or 0.2 in 7.6 (cm)
or 2.6% [allow other variations of the distance on the x-axis]

actual uncertainty = 5.3% of 526 = 27.7 or 28 Hz
or 2.6% of 526 = 13 or 14

(b) frequency $= 530 \pm 30\,Hz$ or $530 \pm 10\,Hz$