

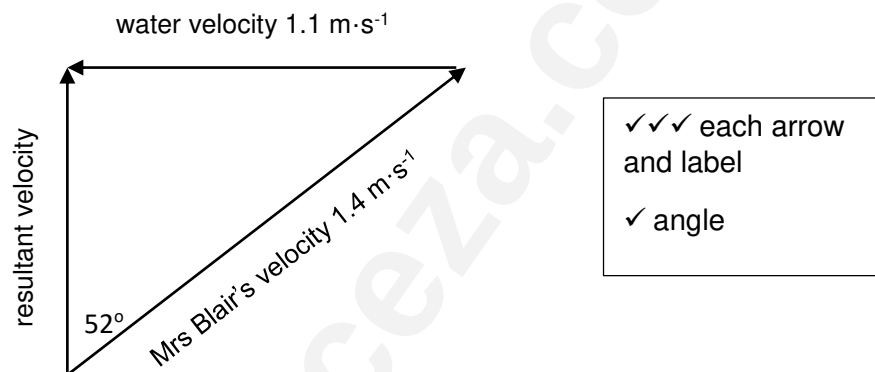


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- 1.1 A
- 1.2 B
- 1.3 B
- 1.4 B
- 1.5 C
- 1.6 D
- 1.7 D
- 1.8 C
- 1.9 C
- 1.10 C

[2 x 10 = 20]

2.1



(4)

2.2 Define resultant vector as *the single vector which has the same effect as the original vectors acting together*

(2)

2.3 $1,4^2 - 1,1^2 = x^2$ ✓✓ subs

$x = 0.866 \text{ m} \cdot \text{s}^{-1}$ ✓ at 90° to the river bank directly across. ✓

(4)

2.4

$$v = \frac{\Delta x}{\Delta t} \quad \checkmark$$

$$0,866 = 89/t \quad \checkmark \checkmark$$

$t = 102,8 \text{ s}$ ✓ therefore yes she makes it (only award this mark if they compare to the 5 mins using same unit) ✓

(5)

[15]

3.1 The velocity of the ball increases to $5 \text{ m} \cdot \text{s}^{-1}$ from zero ✓ over the *first 8 seconds* then the velocity decreases to zero ✓ again over the *next two seconds*.

Between *10 & 16 seconds* the velocity of the ball increases again to $15 \text{ m} \cdot \text{s}^{-1}$ ✓ in the opposite direction ✓. ✓ for mentioning all the time intervals for each motion.

(5)

3.2 $x = \text{area} = \frac{1}{2} b \times h + \frac{1}{2} b \times h$ ✓ ($x = \text{area}$ has to be stated for the formula mark)
 $= \frac{1}{2} 8 \times 5$ ✓ + $\frac{1}{2} 2 \times 5$ ✓
 $= 25 \text{ m}$ ✓

(4)

3.3 $v_f = v_i + at$ ✓ Downloaded from eduresourceza.com OR $a = \frac{\Delta v}{\Delta t}$

$0 = 5 + 2a$ ✓✓

$= \frac{0 - 5}{10 - 8}$

$a = -2,5 \text{ m} \cdot \text{s}^{-2}$

$= -2,5 \text{ m} \cdot \text{s}^{-2}$

$a = 2,5 \text{ m} \cdot \text{s}^{-2}$ towards P ✓

$a = 2,5 \text{ m} \cdot \text{s}^{-2}$ towards P ✓ (4)

3.4 $E_k = \frac{1}{2}mv^2$ ✓

$= \frac{1}{2} (0,4) (15)^2$ ✓ subs ✓ conv

$= 45 \text{ J}$ ✓

(4)

3.5 Furthest point from P is 25 m.

Acceleration is $2,5 \text{ m} \cdot \text{s}^{-2}$ at 10 s.

$x = v_i t + \frac{1}{2}at^2$ ✓

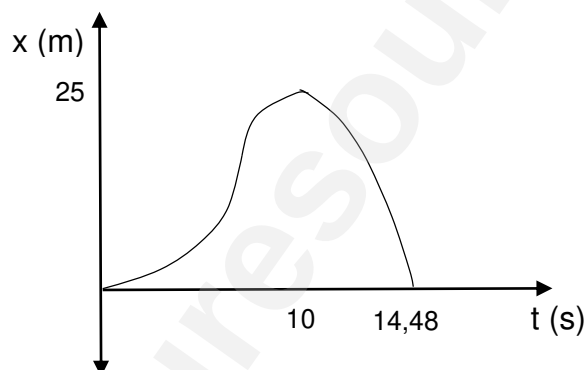
$25 = 0 + \frac{1}{2} (2,5) t^2$ ✓✓ (subs)

$t = 4,48 \text{ s}$

$t = 10 + 4,48 = 14,48 \text{ s}$ ✓

(5)

3.6



✓✓✓ shape

✓ y axis value

✓ x axis values

-1 incorrect labels and/
or no units

(5)

[27]

4.1 $19,4 \text{ m} \cdot \text{s}^{-1}$.

(1)

4.2 In the absence of air resistance or any external forces, the mechanical energy of an object is constant.

(2)

4.3 $E_k = \frac{1}{2} mv^2$ ✓ (both eqs) Downloaded from eduresourceza.com

$= \frac{1}{2} 5740 (19,4)^2$ ✓✓ subs

$= 1080153,2 \text{ J}$

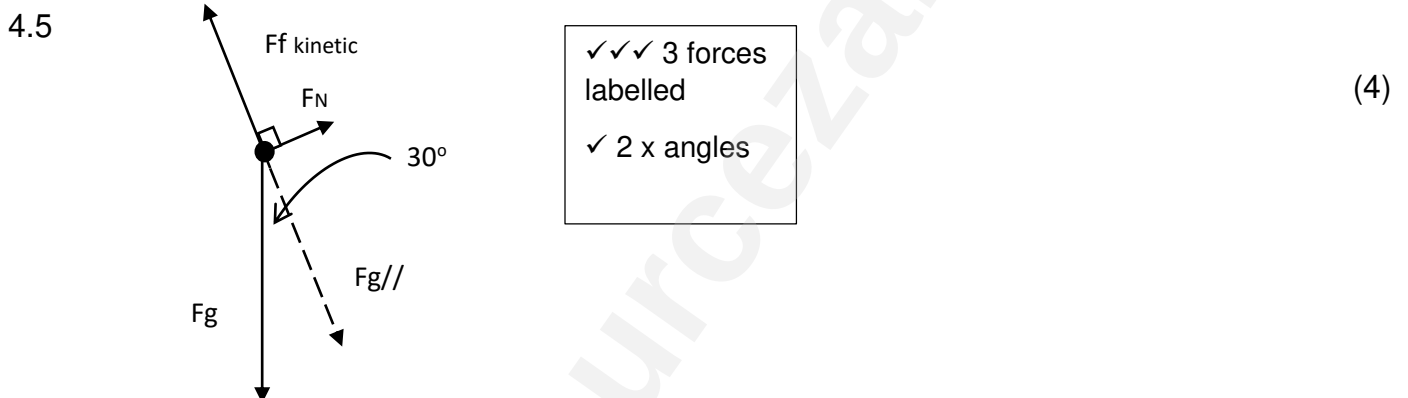
If the law of conservation of Em holds then $E_k \text{ max at X} = E_p \text{ max at C}$.

$E_p = mgh$

$1080153,2$ ✓ (mark for equating E_p and E_k – not for answer value) $= 5740 \times 9,8 \times h$ ✓

$h = 19,2 \text{ m}$ ✓ (6)

4.4 If $h = 41 \text{ m}$ then $E_{p\text{max}}$ would equal 2306332 J , thus the rollercoaster should have been travelling at $28,35 \text{ m}\cdot\text{s}^{-1}$. ✓✓ (substantiating with a calc). Thus mechanical energy is not conserved and the roller-coaster lost energy ✓ due to friction ✓ on the way down. (Can also use a calc to show the energy lost due to friction) (4)



4.6 $\Delta E_k = F_{\text{net}} \Delta x$ ✓ (W-E theorem acknowledged)

$\frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2 = (F_{g//} - F_{fk}) \Delta x$ (formula extrapolated)

$\frac{1}{2} (5740)(18)^2 - 0 = ((5740 \times 9,8) \sin 70^\circ - F_{fk}) \cdot 20$ ✓

$F_{fk} = 6365,59 \text{ N up slope}$ ✓ (6)

4.7 $F_{fk} = \mu F_N$ ✓

$6365,59$ ✓ (coe) $= \mu ((5740 \times 9,8) \cos 70^\circ)$ ✓

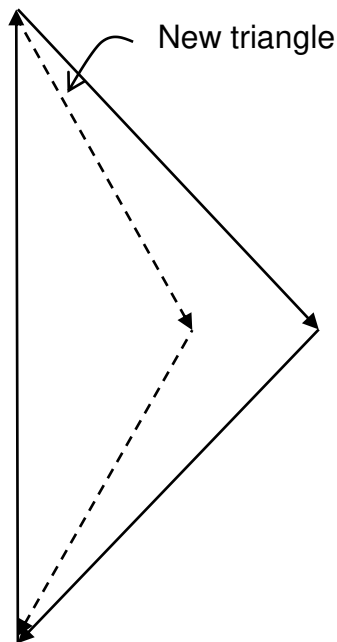
$\mu = 0,33$ ✓ (4)

4.8 She is experiencing inertia on her body – Newton's first law ✓ – the seat is pushing you forwards at such a rate that your body experiences inertia ✓ as it is resisting a change in motion and this feels like you are being pushed from the front ✓ (mark for an explanation). (3)

- 5.1 Equilateral triangle, so $F_g = 1,96 \text{ N}$
 Thus T on one side = $1,96 \text{ N}$ ✓
 Total $T = 3,92 \text{ N}$ ✓

(2)

5.2



Force on screw will not change ✓
 The angle between the chain and the vertical with a longer chain will be smaller ✓
 Components will be shorter ✓
 Thus with a longer chain, the tension will be less ✓.

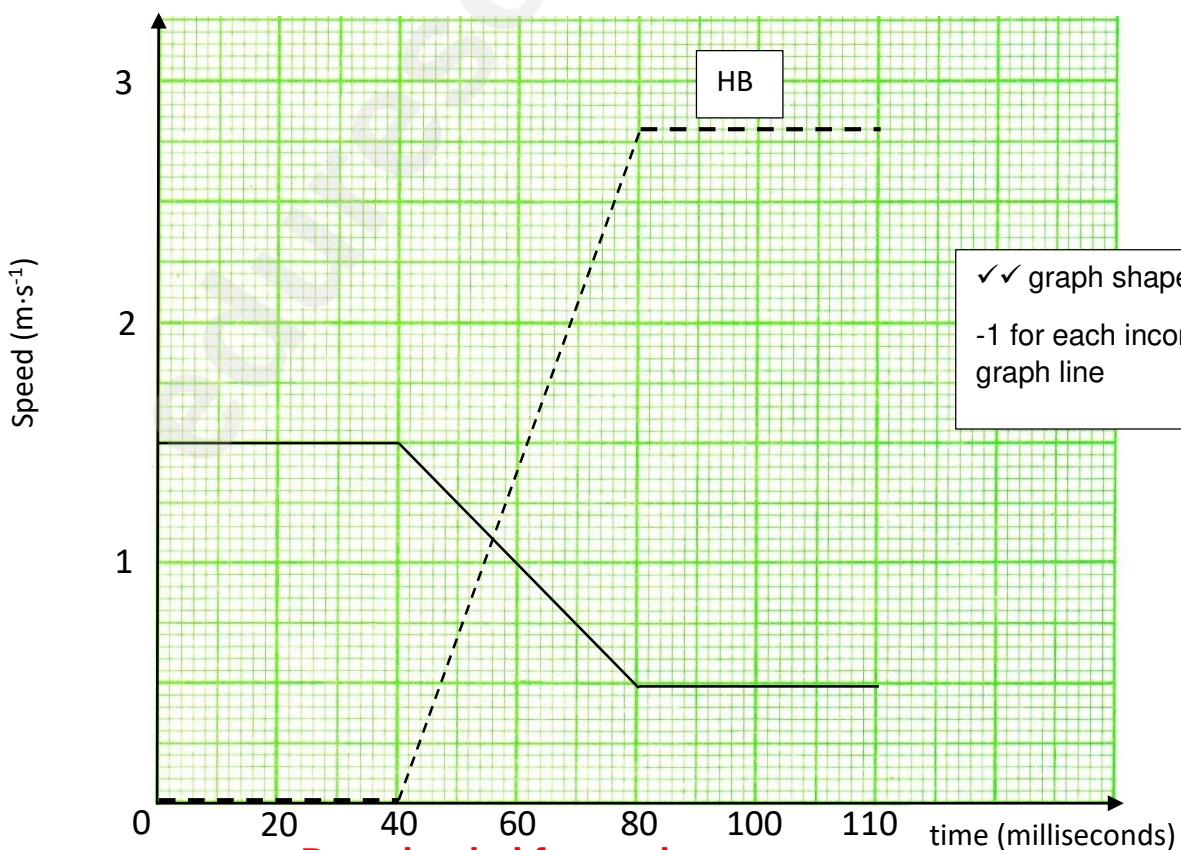
(4)

[6]

- 6.1 calculating the speed of horsebox afterwards:
 $p_{\text{before}} = p_{\text{after}}$ ✓
 $3100 \times 1,5 + 0 = 3100 \times 0,5 + 1100 v$ ✓✓✓ (subs)
 $v = 2,82 \text{ m} \cdot \text{s}^{-1}$ ✓

(5)

6.2



✓✓ graph shape (coe)
 -1 for each incorrect graph line

(2)

- 6.3 $F = \Delta p/t \checkmark = \frac{3100(0,5) - 3100(1,5)}{0,04} \checkmark \text{ (subs)} \checkmark \text{ (conv)}$ work out values for horsebox and interpret the sign $(p_f - p_i)$ $\checkmark$
 $F = 77500 \text{ N towards bakkie/forwards/right} \checkmark$ (5)
- 6.4 Is a collision in which only momentum is conserved. (2)
- 6.5 Calculate the E_k of the horsebox and of the bakkie before the collision $\checkmark$ and compare (to see initial is greater) $\checkmark$ it to the E_k of the horsebox and bakkie after the collision $\checkmark$ (has to be of both vehicles or -1) (3)
- 6.6 E_k isn't conserved because kinetic energy can be lost $\checkmark$ to internal energy/heat/sound/deformation $\checkmark$ etc. (2)

[19]

- 7.1.1 Two point charges in free space or air exert forces on each other. The force is directly proportional to the product of the charges and inversely proportional to the square of the distance between the charges. (2)
- 7.1.2 $12,5 \times 10^9$ electrons (2)
- 7.1.3 $F = k \frac{q_1 q_2}{r^2} \checkmark$
 $= \frac{9 \times 10^9 \times (7 \times 10^{-12})^2}{(11 \times 10^{-2})^2} \checkmark \checkmark$
 $= 3,6 \times 10^{-11} \text{ N} \checkmark$ (5)
- 7.2.1 $9,8 \times 89\% = 8,72 \text{ m} \cdot \text{s}^{-2} \checkmark \checkmark$ (2)
- 7.2.2 $g = G \frac{M}{r^2} \checkmark$
 $8,72 \checkmark = \frac{6,7 \times 10^{-11} \times 5,97 \times 10^{24}}{r^2} \checkmark$
 $r = 6772770 \text{ m} \checkmark$
distance to ISS = $6772770 - 6371000 = 401770 \text{ m} \checkmark$ (5)

[16]

- 8.1 mechanical/ kinetic to electrical. (1)
- 8.2 Faraday's law states that the emf induced is directly proportional to the rate of change of magnetic flux. (2)
- 8.3 curved lines running from N to S ✓
 Arrow on field lines from N to S ✓
 Field lines 'extending' to the coils ✓ (3)
- 8.4 The magnets turn inside the coils ✓ This creates a **changing** magnetic flux in the coil over time ✓ and thus an emf is induced in the coil ✓. (3)
- 8.5 $emf = -N \frac{\Delta\phi}{\Delta t}$
 More turns on the coil are experiencing a change in magnetic flux over a time period. Different angles mean that there is always a coil moving perpendicular to the field and experiencing maximum (rate of) change of flux. Thus increasing the emf because emf $\propto$ change in flux over time (formula).
 OR
 By increasing the number of turns on the coil it increases the flux linkage ΦN . Coils at different angles mean that the magnetic flux is a maximum more often than just twice in a 360° turn.
 ✓ referring to number of 'coils' correctly (N effect)
 ✓ referring to angles / and maximising change in flux in set up
 ✓ linking to a formula or part thereof & mention the generation of a greater emf. (3)
- 8.6 $C = \frac{P}{L^2 \rho v^3}$ (rearranging the formula)
 $= \frac{kg \cdot m^2 \cdot s^{-3}}{m^2 \cdot kg \cdot m^{-3} \cdot (m \cdot s^{-1})^3}$ ✓
 $= \frac{kg \cdot m^2 \cdot s^{-3}}{m^2 \cdot kg \cdot s^{-3}}$ thus they cancel out ✓ (4)
- 8.7 $P = VI$ ✓
 $2\,000\,000 \text{ ✓ (conv)} = 700 \times I \text{ ✓ (subs)}$
 $I = 2857,14 \text{ A ✓}$ (4)
- 8.8 $P = VI$
 $2\,000\,000 = 7000 I \text{ ✓}$
 $I = 285,7 \text{ A ✓}$ (2)
- 8.9 $P = I^2 R$ ✓
 The higher voltage creates a lower current ✓.
 Current has to be as low as possible in order for power (or energy) to not be lost to resistance ✓ in the lines.
 This is important because power loss is proportional to current squared ✓. (4)

9.1

Switch combinations	Total circuit resistance
A open. B closed	R
A open. B open	$2 R$
A closed. B closed	$R/2$
A closed. B open	$2R/3$

(3)

$$9.2.1 \quad \frac{1}{R_{//}} = \frac{1}{R_1} + \frac{1}{R_2} \quad \checkmark$$

$$\frac{1}{R_{//}} = \frac{1}{20} + \frac{1}{40} \quad \checkmark \checkmark$$

$$R_{//} = 13,33 \, \Omega \quad \checkmark$$

(4)

$$9.2.2 \quad V_{\text{ext}} = I R_{\text{ext}} \quad \checkmark$$

$$200 \text{ (calc)} \quad \checkmark = I \times 13,33 \quad \checkmark$$

$$I = 15 \text{ A} \quad \checkmark$$

(4)

$$9.2.3 \quad \text{emf} = I (R + r) \quad \checkmark$$

$$220 = 15 (13,33 + r) \quad \checkmark \checkmark$$

$$r = 1,34 \, \Omega \quad \checkmark$$

$$\text{OR} \quad V_{\text{lost}} = I r_{\text{int}} \quad \checkmark$$

$$20 = 15 r \quad \checkmark \checkmark$$

$$r = 1,34 \, \Omega \quad \checkmark$$

(4)

$$9.2.4 \quad W = VIt \quad \checkmark$$

$$= 220 \times 15 \times (8 \times 60 \times 60) \quad \checkmark \checkmark \checkmark$$

$$= 95\,040\,000 \text{ J} \quad \checkmark$$

$$\text{OR} \quad W = I^2 R t$$

$$= 15^2 \times (13,33 + 1,34) \times (8 \times 60 \times 60)$$

$$= 94\,867\,200 \text{ J} \quad (\text{or thereabouts})$$

(5)

$$9.2.5 \quad P = W/t \quad \checkmark$$

$$= 95\,040\,000 / (8 \times 60 \times 60) \quad \checkmark$$

$$= 3300 \text{ W} \quad \checkmark$$

$$P = I^2 (R + r)$$

$$= 15^2 \times (13,33 + 1,34)$$

$$= 3300 \text{ W}$$

$$V_{\text{lost}} = I r$$

$$20 = 15 r$$

$$r = 1,33 \, \Omega$$

$$= 3,3 \text{ kW} \times 8 \times 1,50 \quad \checkmark \checkmark$$

$$= R\,39,60 \quad \checkmark$$

(6)

[26]

10.1

(4)

$d \text{ (m)}$	$t^2 (s^2) \checkmark$	$\frac{d}{t^2} \checkmark$ (whole column coe)
0,2	0,039	5,13
0,3	0,061	4,92
0,4	0,078	5,13
0,5	0,099	5,05
0,6	0,120	5,00

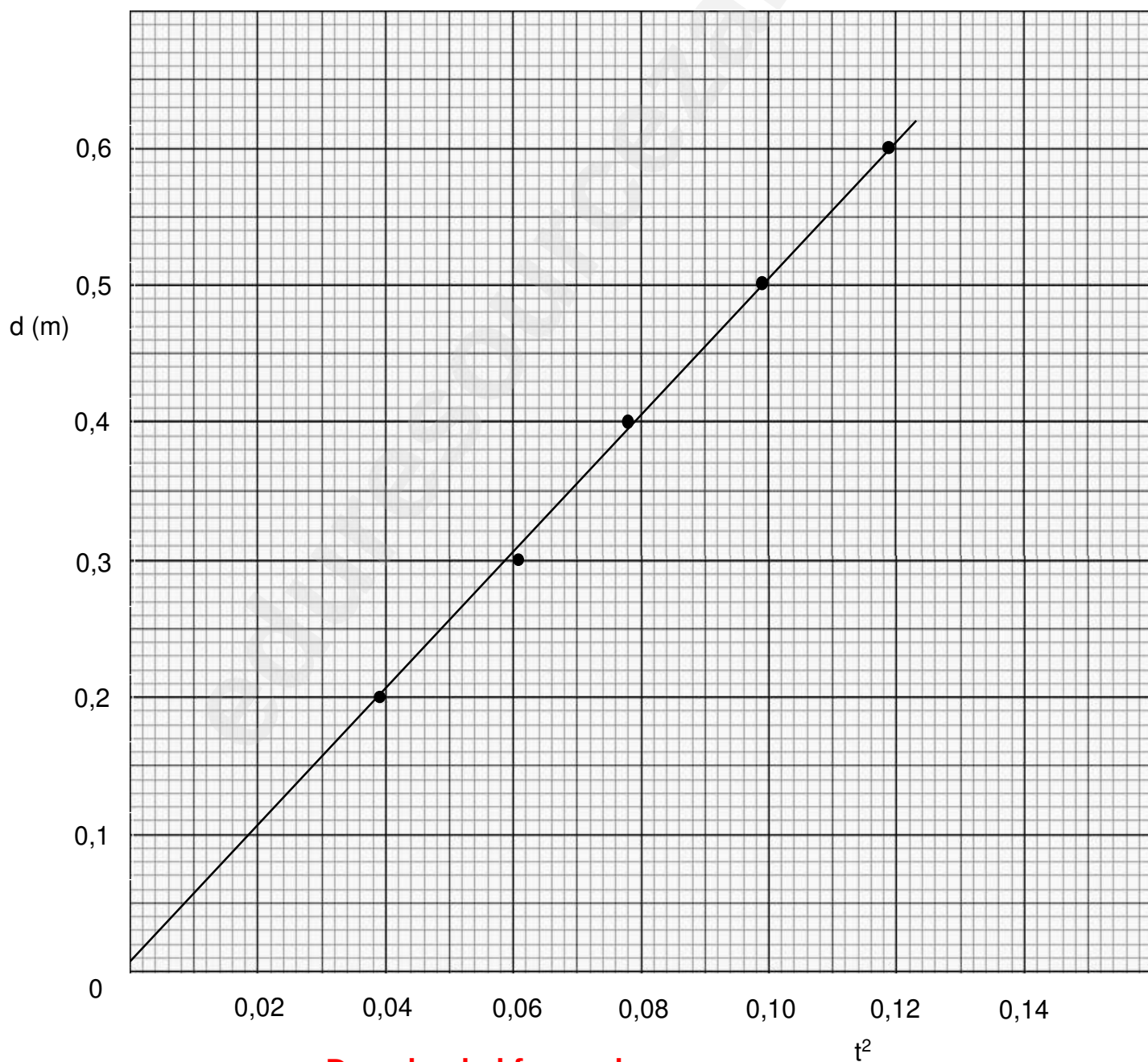
✓✓ for recording
data from graph.
Minus marks for
incorrect data

10.2 $k = 5,05$

(1)

10.3 Correct through certain points. No marks if through origin.

(1)



10.4 The distance fallen is not 'd' due to the ball's own diameter being part of 'd'. (1)

10.5 $m = \Delta y / \Delta x$
 $= \frac{0,6 - 0,4}{0,119 - 0,078}$ ✓
 $= 4,88$ ✓ ✓ for showing points on graph. (4)

10.6 $\frac{d}{dt^2} = \text{gradient}$ ✓

gradient = $\frac{1}{2} a$ ✓

4,88 ✓ = $\frac{1}{2} a$

$a = 9,8 \text{ m.s}^{-2}$ ✓

(4)
[15]

TOTAL = 200 MARKS