



Gr 12 Physics

Prelim Exam

30 August 2021

Memo

1.1 A

1.2 B

1.3 A

1.4. A

1.5 B

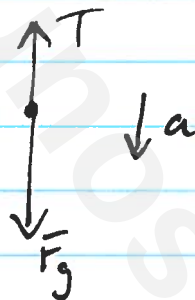
1.6 D

1.7 B

1.8 D

1.9 A

1.10 A



$$\frac{GM}{r^2}$$

$$\frac{G \cdot 3M}{(2r)^2}$$

$$\frac{3}{4}$$

2.1.1 Moving South, slowing down. ✓
Uniform acceleration North. ✓

2.2 Rate of change of velocity. ✓✓

2.3.2

$$V_f = 0$$

$$V_i = 14$$

$$\Delta t = 22$$

$$V_f = V_i + a \Delta t \quad \checkmark$$

$$0 = 14 + a(22) \quad \checkmark$$

$$a = -0,636$$

$$a = 0,64 \text{ m.s}^{-2}, \text{ South.} \quad \checkmark$$

~~2.1.3 Change in position~~ ✓

2.2.4 $\Delta x_{\text{res}} = \frac{1}{2} b_1 h + \frac{1}{2} (b_1 + b_2) h \quad \checkmark$

$$= \frac{1}{2} (10)(-20) \checkmark + \frac{1}{2} (18 + 72)(14) \checkmark$$

$$= -100 + 630$$

$$= 530 \text{ m, North} \quad \checkmark$$

OR

$$\Delta x_{\text{res}} = \frac{1}{2} b_1 h + \frac{1}{2} b_2 h + l \cdot b + \frac{1}{2} b_3 h$$

$$= \frac{1}{2} (10)(-20) + \frac{1}{2} (32)(4) + 18(14) + \frac{1}{2} (22)(14)$$

$$= -100 + 224 + 252 + 154.$$

$$= 530 \text{ m, North}$$

2.2.5

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

$$= \frac{124}{60} \checkmark$$

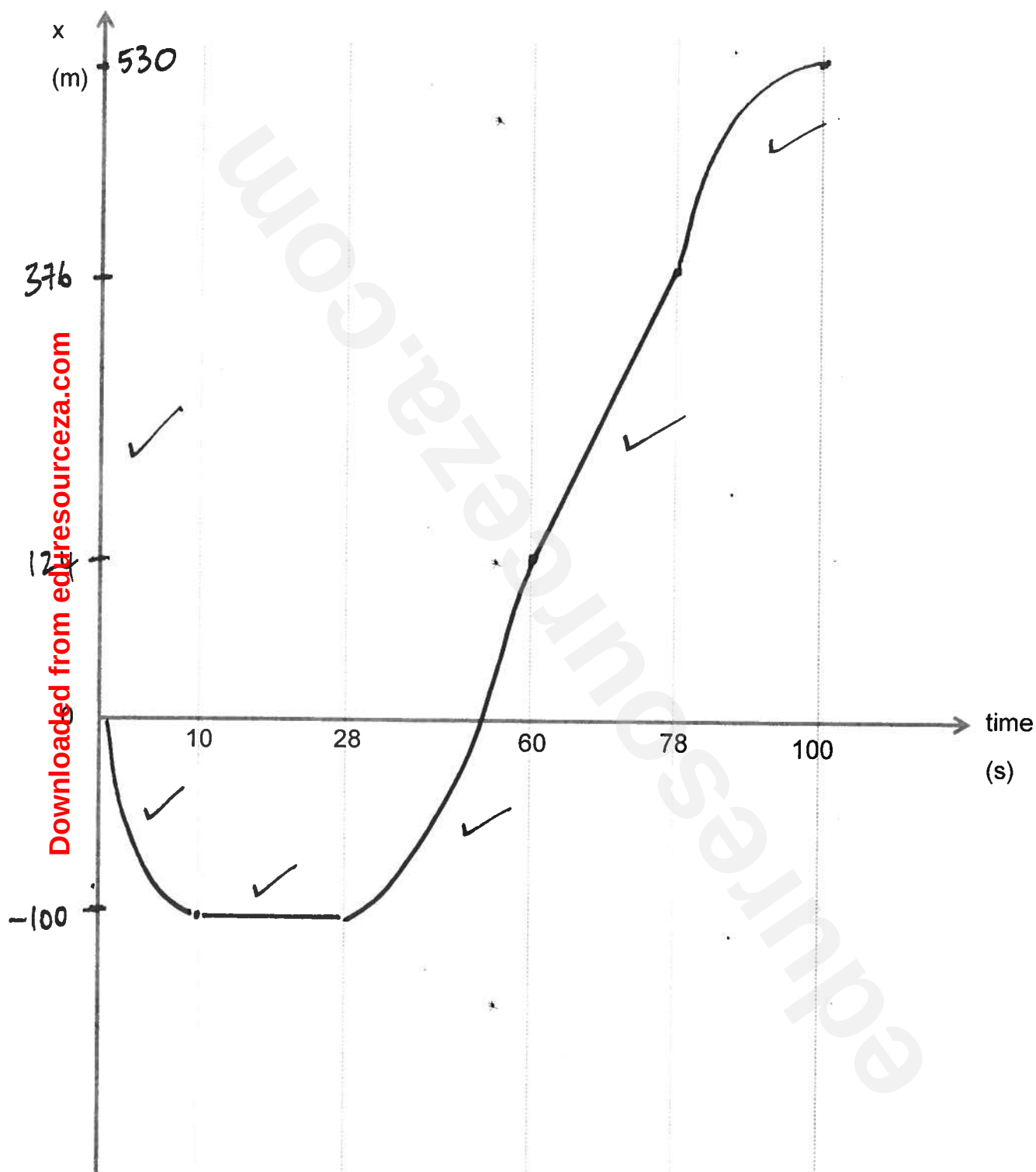
$$= 2,07 \text{ m.s}^{-1} \checkmark (\text{North}).$$

2.2.6

B $\checkmark$ or C or BC

QUESTION 2.7

Position vs. time graph for car



3.1.1

$$\Delta t = 8s$$

$$v = 0,25$$

$$\begin{aligned}\Delta x &= v_i \Delta t \quad \checkmark \\ &= 0,25(8) \quad \checkmark \\ &= 2m\end{aligned}$$

$$\therefore 4m \quad \checkmark$$

3.1.2

$$\Delta t = 2s$$

$$\begin{aligned}\Delta x &= 6 - 2 \\ &= 4.\end{aligned}$$

$$\begin{aligned}v &= \frac{\Delta x}{\Delta t} \\ &= \frac{4}{2} \\ &= 2m \cdot s^{-1} \quad \checkmark \checkmark\end{aligned}$$

3.2.

$$V_i = 30$$

$$\Delta t = 1,2$$

$$\begin{aligned}\Delta x &= V_i \Delta t \\ &= 30(1,2) \\ &= 36 \text{ m} \checkmark\end{aligned}$$

bakkeie

$$V_i = 30$$

$$V_f = 0$$

$$\Delta t = t$$

$$a = ?$$

$$\Delta x = \left(\frac{V_i + V_f}{2} \right) \Delta t$$

$$119 - 36 = 83$$

83

$$\Delta x = 3,6 \text{ m} \checkmark$$

Cow

$$V_i = V_f = 3$$

$$\Delta t = t$$

$$a = 0$$

$$\Delta x = V_i \Delta t$$

$$\Delta x_{\text{bakkeie}} + 20 + \Delta x_{\text{cow}} = 83 - 3,6$$

$$\begin{aligned}\left(\frac{30+0}{2} \right) t + 20 + 3t &= 83 - 3,6 \\ 18t + 20 + 3t &= 79,4 \\ 21t &= 59,4 \\ t &= 2,83\end{aligned}$$

$$V_f = V_i + a \Delta t$$

$$0 = 30 + a(2,83)$$

$$a = -9,09$$

$$a = 9,09 \text{ m} \cdot \text{s}^{-2}, \text{ West.} \checkmark$$

3.3.1



$$\Delta t = 4,612$$

$$g = -9,8$$

$$\Delta x = -12$$

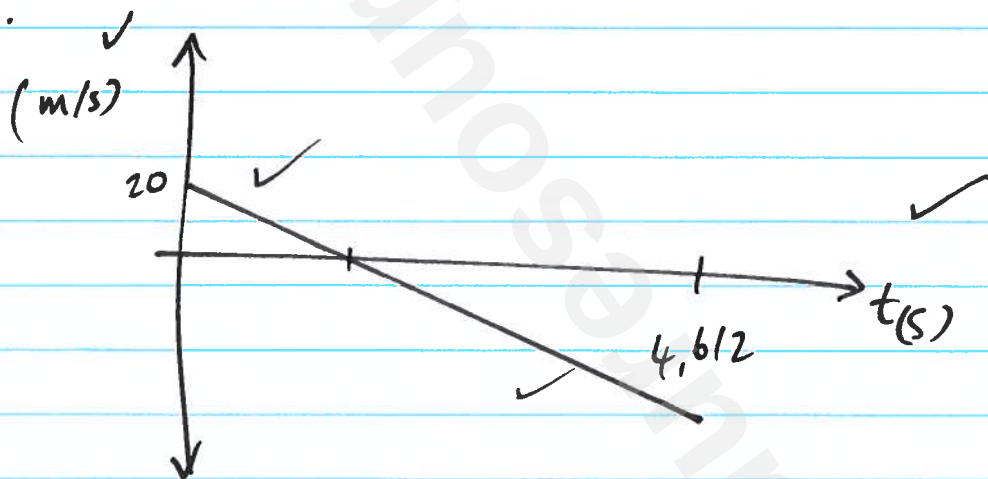
$$V_i = ?$$

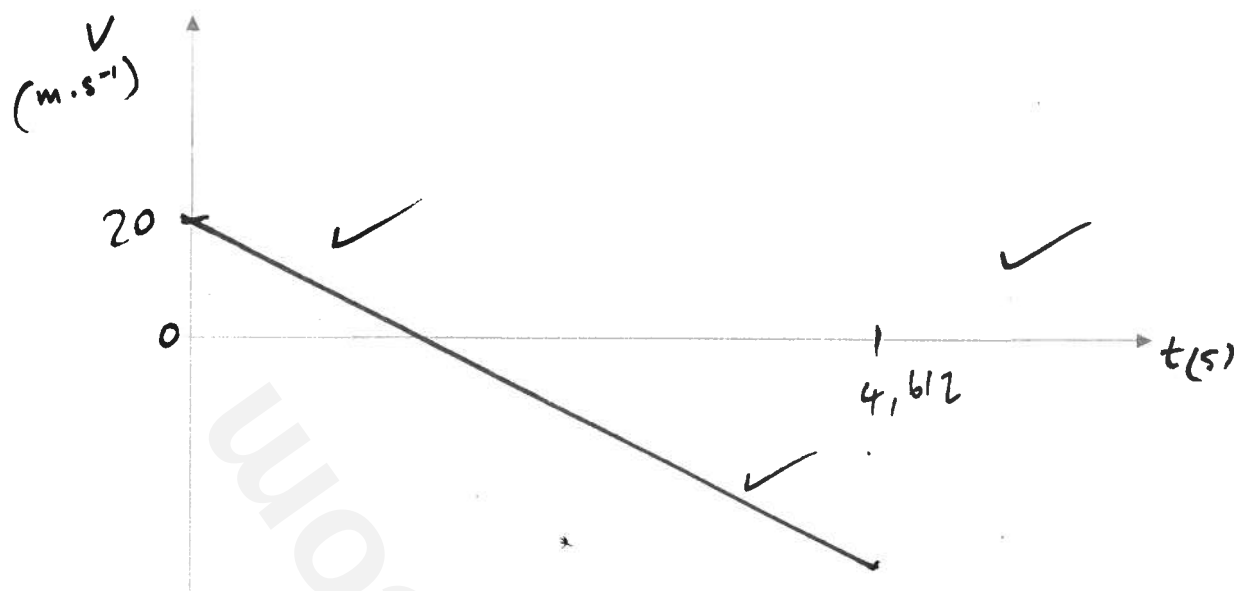
$$\Delta x = V_i \Delta t + \frac{1}{2} a \Delta t^2 \quad \checkmark$$

$$-12 \checkmark = V_i (4,612) + \frac{1}{2} (-9,8) (4,612)^2 \checkmark$$

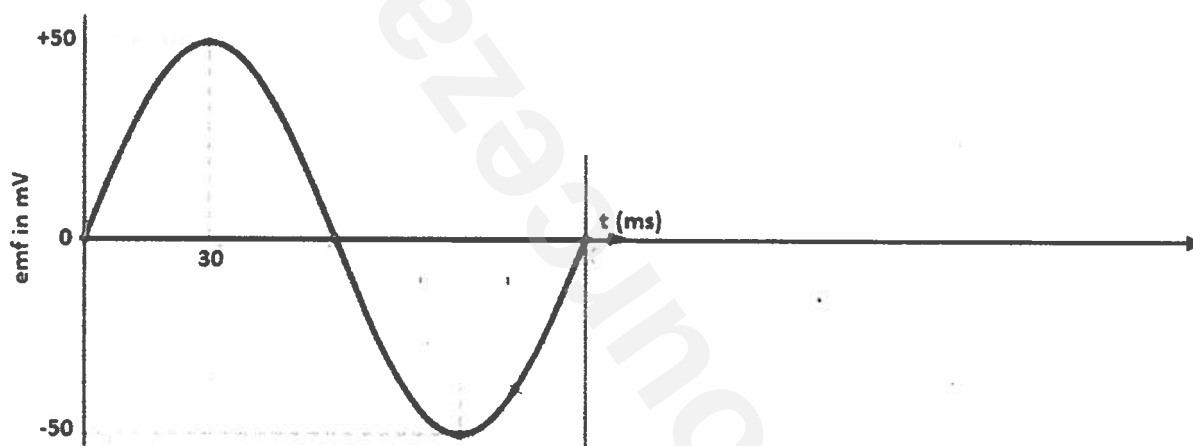
$$V_i = 20 \text{ m.s}^{-1} \quad \checkmark$$

3.3.2.





ANSWER SHEET for question 10.1.3



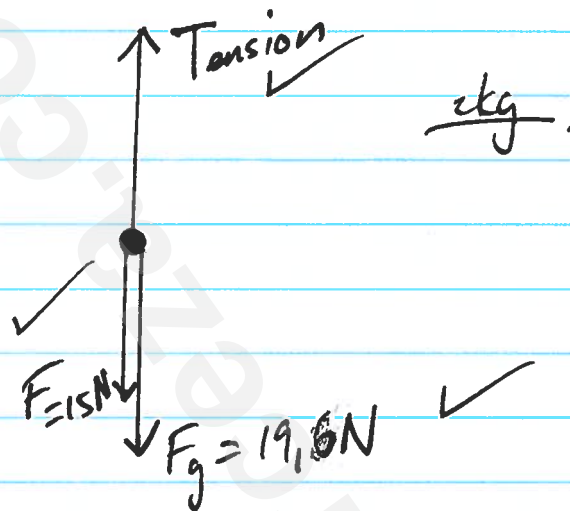
ANSWER SHEET for question 10.1.6



3.1 An object continues in a state of rest or uniform velocity unless acted upon by a net force. ✓✓

3.2 0 N ✓

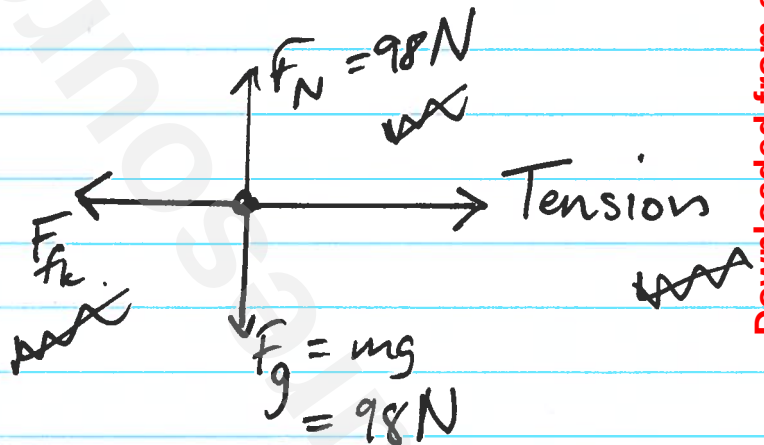
3.3



$$F = F_{\text{applied}}$$

3.4.

10 kg



2 kg

$$F_{\text{net}} = F_g + F - T \quad \checkmark$$

$$ma = 19,6 + 15 - T$$

$$2(1,2) = 34,6 - T \quad \checkmark$$

$$T = 32,2 \text{ N} \quad \checkmark$$

4.5

10 kg

$$F_{\text{net}} = T - F_{fk} \checkmark$$

$$ma = 32,2 - \mu_k F_N$$

$$10(1,2) = 32,2 - \mu_k(98) \checkmark$$

$$98\mu_k = 20,2$$

$$\mu_k = 0,206 \checkmark$$

0,21

4.6

~~4.5~~

$$\mu_k < \mu_s \checkmark$$

~~4.6~~ 4.7

No change. $\checkmark$

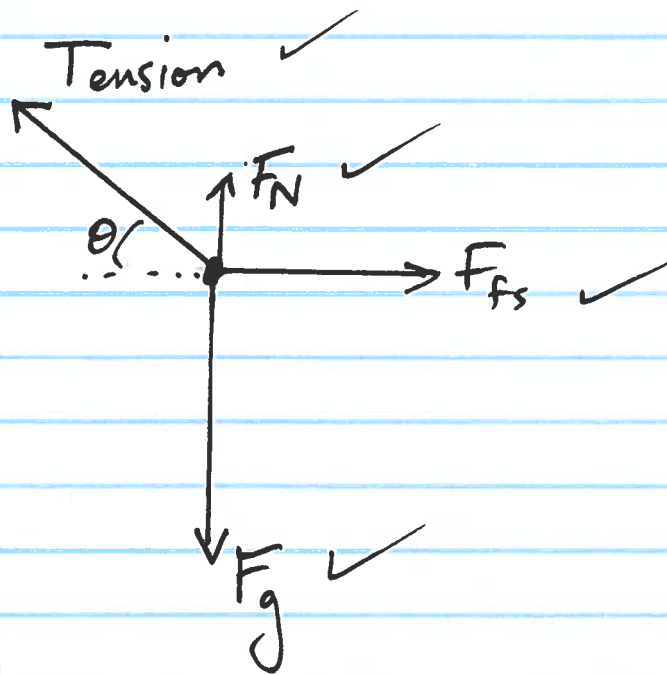
F_{fk} depends only on the 2 surfaces
and

the normal force on the block.

Neither of these 2 factors changed.

$\checkmark$

5.1



5.2

$$F_{fs}^{\max} = \mu_s F_N \quad \checkmark$$

$$120 = 0,34 F_N \quad \checkmark$$

$$F_N = 352,94 \text{ N} \quad \checkmark$$

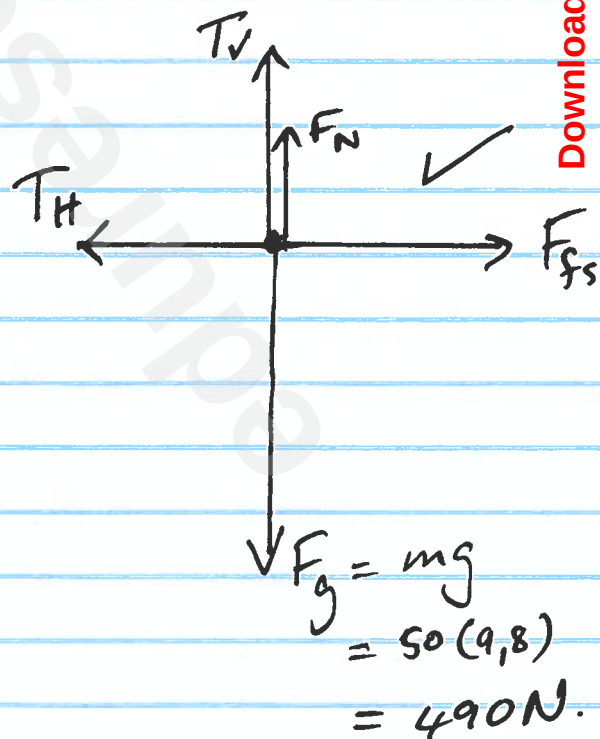
5.3

$$F_{\text{net vert}} = 0$$

$$T_V + F_N = F_g \quad \checkmark$$

$$T_V + 352,94 = 490 \quad \checkmark$$

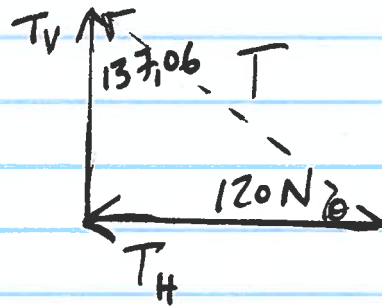
$$T_V = 137,06 \text{ N}$$



5.4 $T_H = 120 \text{ N}$

$$\tan \theta = \frac{137,06}{120} \quad \checkmark$$

$$\theta = 48,8^\circ \quad \checkmark$$

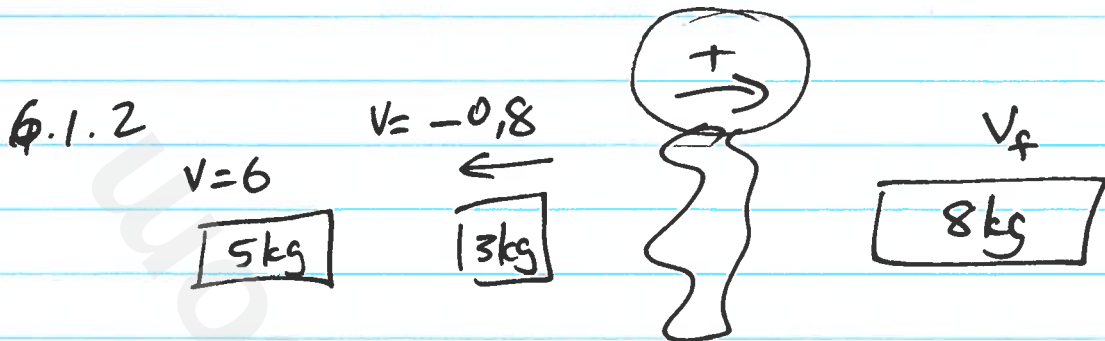


5.5. $T^2 = T_v^2 + T_H^2$

$$= (137,06)^2 + (120)^2 \quad \checkmark$$

$$T = 182,17 \text{ N.} \quad \checkmark$$

Q.1.1 The total linear momentum of an isolated system is conserved. ✓✓



$$p_{ti} = p_{tf} \quad \checkmark$$

$$mv_i + mv_i = Mv_f$$

$$5(6) + 3(-0,8) \checkmark = 8v_f \quad \checkmark$$

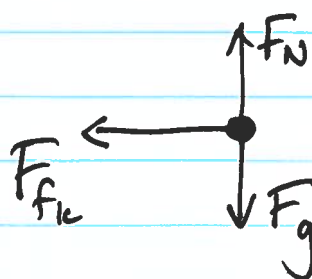
$$27,6 = 8v_f$$

$$v_f = 3,45 \text{ m}\cdot\text{s}^{-1} \quad \checkmark$$

Q.1.3 (a)



(b)



$$6.1.4 \quad v_i = 3,45$$

$$v_f = 0$$

$$\Delta t = 0,3$$

$$a = ?$$

$$v_f = v_i + a \Delta t$$

$$0 = 3,45 + a(0,3) \quad \checkmark$$

$$a = -11,5$$

$$a = 11,5 \text{ m/s}^2 \text{ left.}$$

$$F_{\text{net}} = F_{fk}$$

$$ma = F_{fk}$$

$$8(11,5) = F_{fk} \quad \checkmark$$

$$92 \text{ N} = F_{fk} \quad \checkmark$$

→

Q.2.1 The product of the mass and velocity of the object. ✓✓

Q.2.2. Mathew is correct. ✓

* According to $F_{\text{net}} = \frac{\Delta p}{\Delta t}$ ✓

a net force always goes along with a change in momentum. ✓

Between 10 - 20 s there is no change in momentum, ✓

Newton 2. The net force on a body is equal to the rate of change in momentum of the body. ✓

Q.2.3 $\text{impulse} = J = \Delta p$
 $= p_f - p_i$ ✓
 $= -120 - 50$ ✓
 $= -170$

$J = 170 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}$, South. ✓

$$Q.2.4 \quad \Delta p_A = -\Delta p_B \quad \checkmark$$

$$p_f - p_i = -\Delta p_B$$

$$50 - (-120) = -\Delta p_B \quad \checkmark$$

$$-170 = \Delta p_B.$$

$$\therefore \Delta p_B = 170 \text{ kg m.s}^{-1}, \text{ South.} \quad \checkmark$$

OR.

$$p_{tot i} = p_{tot f} \quad \checkmark$$

$$p_{iA} + p_{iB} = p_{fA} + p_{fB}$$

$$-120 + p_{iB} = 50 + p_{fB} \quad \checkmark$$

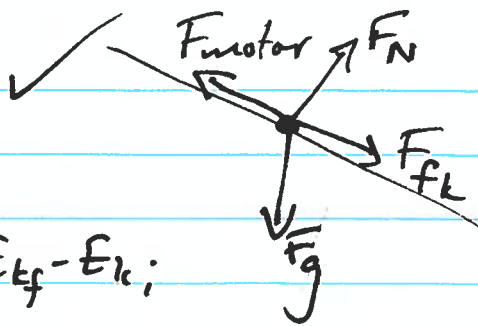
$$-120 - 50 = p_{fB} - p_{iB}.$$

$$-170 = \Delta p_B.$$

$$\Delta p_B = 170 \text{ kg.m.s}^{-1} \text{ South.} \quad \checkmark$$

243

$$W_{\text{net}} = \Delta E_k$$



$$W_{\text{motor}} + W_{F_N} + W_{f_k} + W_{F_g} = E_{kf} - E_{ki};$$

$$2080,39 + 0 - 100x - 1592,5\sqrt{=} \frac{1}{2}mv_f^2$$

$$687,83 - 100x = \frac{1}{2}(65)(3,99)^2$$

$$x = 1,70 \text{ m.}$$

7.1 Electrical $\rightarrow$ Mechanical Energy $\checkmark\checkmark$

7.2 $W = Pt$ $\checkmark$

$$= (860,5)(2,65)$$

$$= 2280,33 \text{ J} \checkmark$$

7.3 The work done by a net force on an object is equal to the change in the kinetic energy of the object. $\checkmark\checkmark$

7.4. $W_f = f \cdot \Delta x \cos \theta$
 $= 100(x) \cos 180^\circ$
 $= -100x$

$$W_{F_g} = -\Delta E_p$$
$$= -(E_{pf} - E_{pi})$$

$$= -E_{pf}$$

$$= -mgh$$

$$= -(65)(9,8)(2,5)$$

$$= -1592,5 \text{ J}$$

8.1.1 The rate of flow of charge ✓✓

8.1.2 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

$$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{4}$$

$$R_p = 2,4 \Omega \quad \checkmark$$

$$R_{ext} = 10$$

$$emf = I(R_{ext} + r) \quad \checkmark$$

$$12 \checkmark = I(10 + 5) \quad \checkmark$$

$$I = 0,8 \text{ A} \quad \checkmark$$

8.1.3 $W_i = I^2 R \Delta t \quad \checkmark$

$$= (0,8)^2 (7,6)(120) \quad \checkmark$$

$$= 583,68 \text{ J} \quad \checkmark$$

8.1.4 $P_i = \frac{V^2}{R}$

$$P \propto \frac{1}{R} \quad \checkmark \quad \begin{matrix} \checkmark \\ \text{the same} \\ \text{in } \textcircled{1} \text{ \& \textcircled{2}} \end{matrix}$$

$$\begin{aligned} V_{||} &= IR_{||} \\ &= 0,8(2,4) \\ &= 1,92 \text{ V} \end{aligned}$$

$\therefore R_2$ will be brighter ✓

$$P_1 = \frac{1,92^2}{6}$$

$$= 0,61 \text{ W}$$

$$P_2 = \frac{(1,92)^2}{4}$$

$$= 0,92 \text{ W.}$$

Brighter

8.1.5 a) Decrease. ✓

b) Increase. ✓

8.1.6. R_{ext} increase ✓

I decrease. ✓

V_{int} decrease since $V_{\text{int}} = I r$
 ✓ $r \equiv \text{constant}$

8.2 Cost = $2,54 \times 2,25 \times \frac{101}{60}$

$$= R 9,62 \quad \checkmark \checkmark \checkmark$$

8.3. $P = \frac{W}{\Delta t}$ } either.

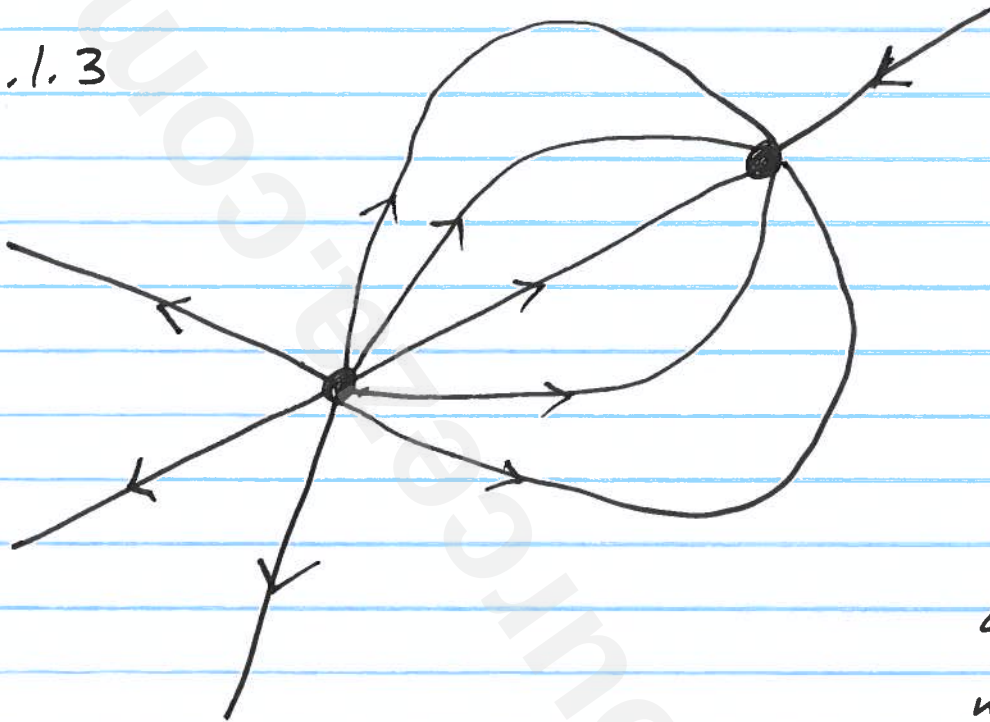
$$0,06 = \frac{5,67}{\Delta t} \quad \checkmark$$

$$\Delta t = 94,5 \text{ h} \quad \checkmark$$

9.1.1 A region of space in which an electric charge experiences a force.

9.1.2 the force per unit positive charge.

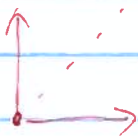
9.1.3



pattern
direction
more lines
at X.

9.1.4 $E_{@p}_x = \frac{kQ_x}{r^2}$ ✓

$$= \frac{9 \times 10^9 (60 \times 10^{-9})}{(0,06)^2}$$
$$= 150\,000 \text{ N.C}^{-1} \text{ East.}$$



$$E_{@p}_x = \frac{9 \times 10^9 (15 \times 10^{-9})}{(0,03)^2}$$
$$= 150\,000 \text{ N.C}^{-1} \text{ North.}$$

$$E_{\text{net}} = 212 \text{ } 132 \text{ N.C}^{-1}, \text{ NE} \checkmark \checkmark$$

(045°)

9.1.5 $F = q E \checkmark$

$$= 7 \times 10^{-6} (212 \text{ } 132) \checkmark$$

$$= 1,48 \text{ N}, \text{ SW} \checkmark$$

(225°)

9.2.1 Every particle in the universe attracts every other particle with a force which is

directly proportional to the product of their masses

and

inversely proportional to the square of the distance between their centres.

✓✓

$$\begin{aligned} 9.2.2. \quad F &= \frac{G M m}{r^2} \quad \checkmark \\ &= \frac{6.7 \times 10^{-11} (1 \times 10^{13}) (100)}{(4000)^2} \quad \checkmark \\ &= 0.00419 \text{ N} \quad \checkmark \end{aligned}$$

$$4.19 \times 10^{-3} \text{ N.}$$

10.1.1 The emf induced is directly proportional to the rate of change of magnetic flux. ✓✓

10.1.2

a) The magnet is moving at its fastest speed downwards at 30ms⁻¹.
this causes the greatest change rate of ✓✓

in flux in the coil $\therefore$ induces emf is MAX. ✓

(b) The magnet is at rest. ✓

$\therefore$ No change in flux ✓

$\therefore$ No induced emf. ✓

10.1.4. The induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux. ✓✓

10.1.5 B ✓

10.2

$$N_p = 480$$

$$N_s = 8,4$$

$$V_p = 240$$

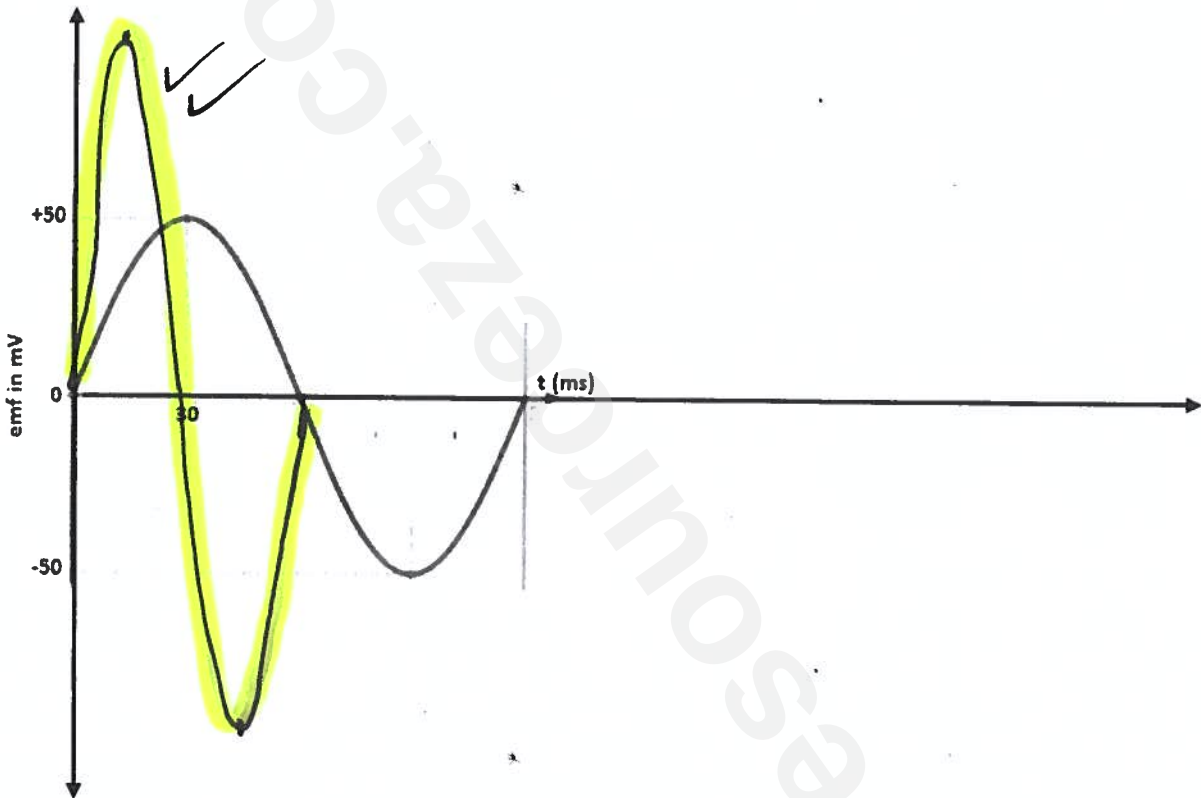
$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$\frac{V_s}{240} = \frac{8,4}{480}$$

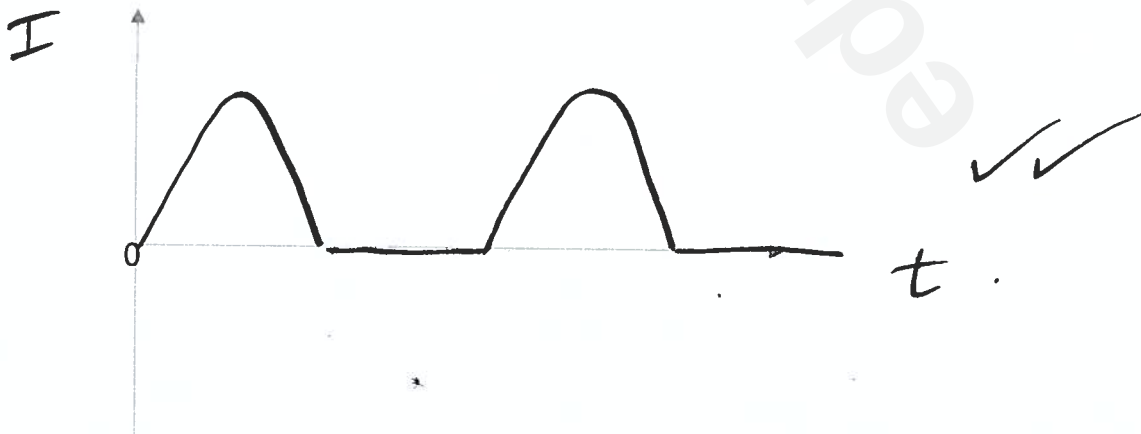
$$V_s = 4,2 \text{ V}$$



ANSWER SHEET for question 10.1.3



ANSWER SHEET for question 10.1.6



11.1.1 Work function ✓

11.1.2. Potassium ✓ It has the
smallest W_0

$$W_0 = \frac{hc}{\lambda_0}$$

$$\therefore W_0 \propto \frac{1}{\lambda_0} \quad \left(h \text{ \& c constant} \right) \quad \checkmark$$

11.1.3 The minimum frequency of incident radiation at which electrons will be emitted from a particular metal. ✓✓

11.1.4. $W_0 = hf_0$ ✓

$$= 6,6 \times 10^{-34} (1,75 \times 10^{15}) \quad \checkmark$$

$$= 1,16 \times 10^{-18} \text{ J} \quad \checkmark$$

11.1.5

$$E = W_0 + E_k \quad \checkmark$$

$$hf = 1,16 \times 10^{-18} + \frac{1}{2} mv^2$$

$$\frac{6,6 \times 10^{-34} f = 1,16 \times 10^{-18} + \frac{1}{2} (9,1 \times 10^{-31}) (5,6 \times 10^5)^2}{\checkmark}$$

$$f = 1,97 \times 10^{15} \text{ Hz} \quad \checkmark$$

11.2.1

$$c = \lambda f \quad \checkmark \checkmark$$

$$3 \times 10^8 = \lambda (2,96 \times 10^{15})$$

$$\therefore \lambda = 1,01 \times 10^{-7} \text{ m} \rightarrow$$

11.2.2

$$E = \frac{hc}{\lambda} \quad \checkmark$$

$$= \frac{6,6 \times 10^{-34} (3 \times 10^8)}{634,6 \times 10^{-9}} \quad \checkmark$$

$$= 3,12 \times 10^{-19}$$

$$= 1,95 \text{ eV} \quad \checkmark$$

$$-1,53 - 1,95 = Y$$

$$Y = -3,48 \text{ eV} \quad \checkmark$$