



Gr 12 Physical Sciences

Physics Memo.

Prelim 2019

1.1 A

1.2 B

1.3 A

1.4 A

1.5 B

1.6 B ✓

1.7 DX A $g = \frac{GM}{r^2} = \frac{9.4}{(\frac{1}{2})^2} = \frac{1.4}{\frac{1}{4}} = 5.6$

1.8 C

1.9 C

1.10 B

2.1.1 BC ✓ ✓

2.1.2 AB ✓, ✓ DE ✓ ✓

2.1.3 CD ✓ ✓

2.2 $a_{AB} = \text{gradient} = \frac{\Delta v}{\Delta t}$ ✓ ✓

$$= \frac{10}{40} \quad \checkmark \quad \checkmark$$

$$= 0,25 \text{ m.s}^{-2}, \text{ South} \quad \checkmark$$

OR $v_f = v_i + a \Delta t$

$$25 = 15 + a(40)$$

$$a = 0,25 \text{ m.s}^{-2}, \text{ South.}$$

2.3 ? Change in position ✓ ✓

2.4.1 $\Delta x_{\text{TOT}} = \text{area under } v \text{ vs } t \text{ graph} \quad \checkmark$

$$= (l.b + \frac{1}{2}bh) + l.b + \frac{1}{2}bh + \frac{1}{2}bh + l.b$$

$$= 40 \cdot 15 + \frac{1}{2}(40)(10) + 30(25) + \frac{1}{2}(25)(35) \quad \checkmark$$
$$+ \frac{1}{2}(14)(-10) + 16(40) \quad \checkmark$$

$$= (600 + 200) + 750 + 437,5 - 70 - 160$$

$$= 800 + 750 + 437,5 - 70 - 160$$

$$= 1987,5 - 230$$

$$= 1757,5 \text{ m, South.} \quad \checkmark \quad \checkmark$$

$$2.4.2 \quad \bar{v} = \frac{\Delta x}{\Delta t} \quad \checkmark$$

$$= \frac{1550}{70} \quad \checkmark$$

$$= 22,14 \text{ m.s}^{-1}, \text{ South} \quad \checkmark$$

$$2.5 \quad a_{cd} = \frac{\Delta v}{\Delta t}$$

$$= \frac{-25}{35}$$

$$= -0,714 \quad \checkmark$$

$$v_i = 25$$

$$v_f = 15$$

$$\Delta t = ?$$

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

$$15 = 25 + (-0,714) \Delta t \quad \checkmark$$

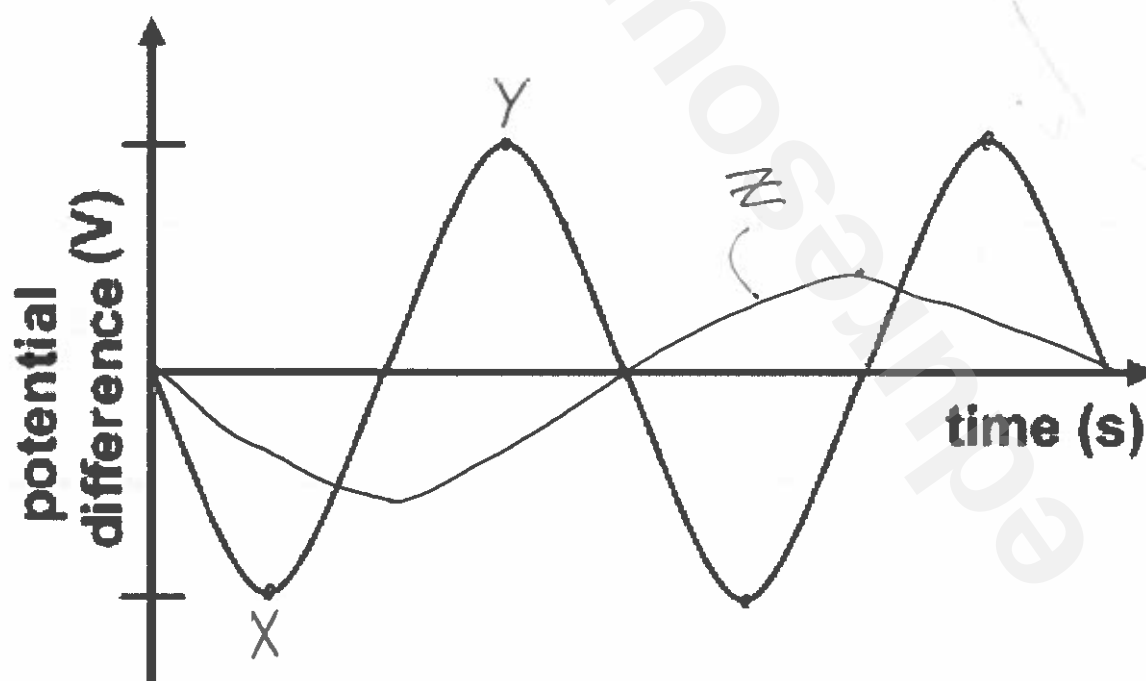
$$\Delta t = 14$$

$$\therefore t_x = 84 \text{ s} \quad \checkmark \quad \checkmark$$

NAME: _____

8.1

10.2.3 & 10.2.4



✓✓ any 2 points

one revolution ✓
half amplitude ✓
half frequency ✓

$$\begin{aligned}
 3.1.1 \quad \Delta x &= v_i \Delta t \\
 &= 22,75 (0,78) \\
 &= 17,745 \quad \checkmark
 \end{aligned}$$

$\therefore$ bike is 47,255 m from the donkey. $\checkmark$

$$\begin{aligned}
 3.1.2 \quad v_i &= 22,75 \\
 \Delta x &= ? \\
 a &= -5 \\
 v_f &= 0
 \end{aligned}$$

$$\begin{aligned}
 v_f^2 &= v_i^2 + 2a\Delta x \quad \checkmark \\
 0 &= (22,75)^2 + 2(-5)\Delta x \quad \checkmark
 \end{aligned}$$

$$\Delta x = 51,76 \text{ m} \quad \checkmark$$

The bike need a minimum of 51,76 m to stop. $51,76 > 47,255 \text{ m}$

$\therefore$

$\therefore$ Will NOT stop in time.

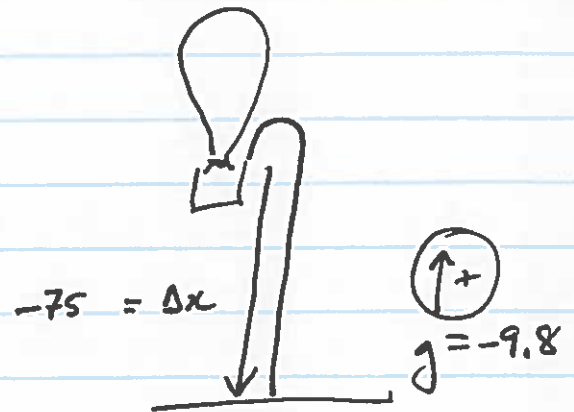
3.2.1 $9,8 \text{ m} \cdot \text{s}^{-2}$, downwards ✓

3.2.2. $v_i = ?$

$$\Delta t = 6,47$$

$$g = -9,8$$

$$\Delta x = -75$$



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

$$-75 \checkmark = v_i (4,47) + \frac{1}{2} (-9,8) (4,47)^2 \quad \checkmark$$

$$v_i = 5,12 \text{ m} \cdot \text{s}^{-1} \quad \checkmark$$

$\longrightarrow$

3.2.3 Balloon

$$\Delta x = v_i \Delta t$$

$$= (5,12)(2)$$

$$= 10,24 \text{ m} \quad \checkmark \text{ upwards}$$

$$x = 10,24 \text{ m above point of release.}$$

Stone

$$\Delta x = ?$$

$$v_i = 5,12$$

$$g = -9,8$$

$$\Delta t = 2$$

$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$= (5,12)(2) + \frac{1}{2} (-9,8)(2)^2 \quad \checkmark$$

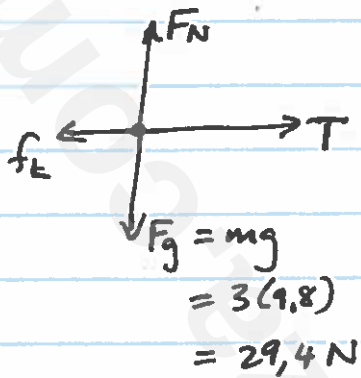
$$= -9,36 \quad \checkmark$$

$$\therefore x = 9,36 \text{ m below point of release.}$$

$$\text{Distance between} = 19,6 \text{ m} \quad \checkmark$$

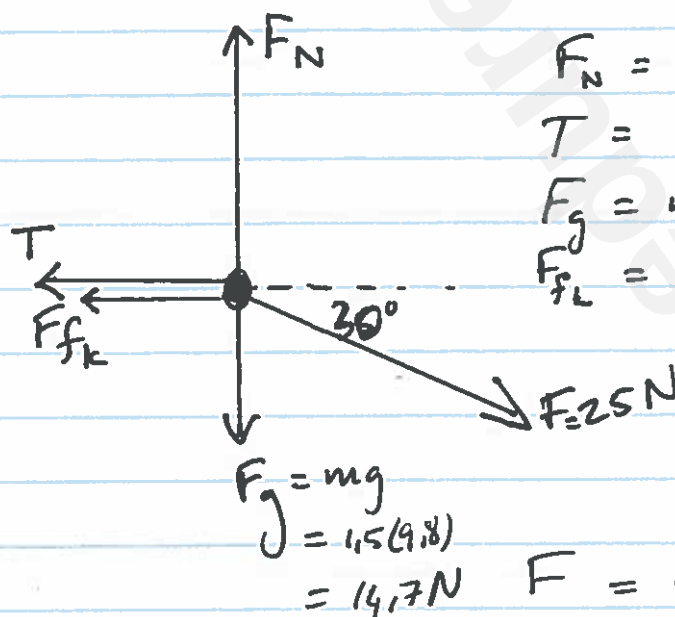
4.1

4.2



$$\begin{aligned}
 f_k &= \mu_k F_N \quad \checkmark \\
 &= (0.15)(29.4) \quad \checkmark \\
 &= 4.41 \text{ N} \quad \checkmark
 \end{aligned}$$

4.3



F_N = normal force ✓
 T = tension ✓
 F_g = weight ✓
 F_{fk} = kinetic friction ✓

F = applied force. ✓

$$4.4. \quad F_N = F \sin 30^\circ + F_g \quad \checkmark$$

$$= 25 \sin 30^\circ + 14,7$$

$$= 12,5 + 14,7$$

$$= 27,2 \text{ N}$$

$$\therefore f_k = \mu_k F_N$$

$$= 0,15 (27,2) \quad \checkmark$$

$$= 4,08 \text{ N} \quad \checkmark$$

4.4.2

$$m = 3 \text{ kg}$$

$$m = 1,5$$

$$\begin{aligned} F_{\text{net}} &= T - f_k \quad \checkmark \\ ma &= T - 4,41 \\ 3a &= T - 4,41 \quad \checkmark \end{aligned}$$

$$\begin{aligned} F_{\text{net}} &= F \cos 30^\circ - T - f_k \quad \checkmark \\ ma &= 21,65 - T - 4,08 \\ 1,5a &= 17,57 - T \quad \checkmark \end{aligned}$$

$$T - 4,41 = 2(17,57 - T)$$

$$3T = 35,14 + 4,41$$

$$3T = 39,55 \quad 39,55$$

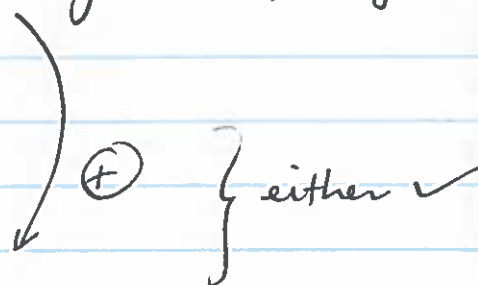
$$T = 13,18 \text{ N} \quad \checkmark$$

$$\begin{aligned}
 5.1. \quad \Delta p &= m(v_f - v_i) \quad \checkmark \\
 &= 2400 (0 - 15) \quad \checkmark \\
 &= -36000
 \end{aligned}$$



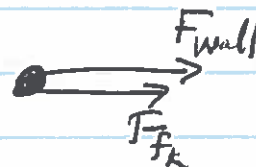
$$\therefore \text{impulse} = 36000 \text{ kg}\cdot\text{m}\cdot\text{s}^{-1}, \text{ right } \checkmark$$

$$\begin{aligned}
 5.2 \quad F_{\text{net}} &= \frac{\Delta p}{\Delta t} \\
 &= \frac{36000}{0.64}
 \end{aligned}$$



$$= 56250 \text{ N, right } \checkmark$$

$$\therefore F_{\text{net}} = F_{\text{wall}} + F_{fk}$$



$$56250 = F_{\text{wall}} + 17640 \quad \checkmark$$

$$F_{\text{wall}} = 38610 \text{ N, right } \checkmark$$

5.3

5.4 Equal₁ ^{in magnitude}, but opposite in direction. $\checkmark$

5.5 A crumple zone will extend the time of the collisions. ✓

$$\text{since } F_{\text{net}} = \frac{\Delta p}{\Delta t}$$

$F_{\text{net}} \propto \frac{1}{\Delta t}$ assuming no bouncing back with crumple zone as well. ✓
 $\therefore \Delta p$ constant

$\therefore F_{\text{net}}$ is smaller

$\therefore F_{\text{wall}}$ is smaller, since $F_{\text{wall}} = F_t - F_k$ ✓
 F_k constant

5.6 Newton's First Law: object will continue its state of motion ✓

$\therefore$ furniture will slide to the left until it hits the inside of the truck. ✓

6.1



$$P_{\text{tot } i} = P_{\text{tot } f} \quad \checkmark$$

$$m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_B v_{Bf}$$

$$3v_i + 0 \quad \checkmark = 3(-0.5) + 6(2.25) \quad \checkmark$$

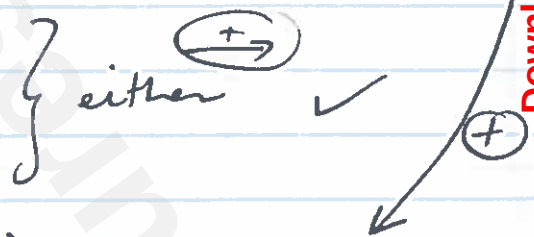
$$v_i = 4 \text{ m.s}^{-1} \quad \checkmark, \text{ right}$$

6.3. $F_{\text{net}} = \frac{\Delta p}{\Delta t}$

$$= \frac{m(v_f - v_i)}{\Delta t}$$

$$= \frac{3((-0.5) - 4)}{0.01} \quad \checkmark$$

$$= 1350 \text{ N} \quad \checkmark$$



OR

$$= \frac{6(2.25 - 0)}{0.01}$$

$$= 1350 \text{ N}$$

6.4. Down the slope ✓✓

6.5.

6.6

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

$$W_{F_g} + W_{f_k} + W_{F_N} = E_{k_f} - E_{k_i}$$

$$-\Delta E_p + f_k \Delta x \cos \theta + 0 = 0 - \frac{1}{2} m v_i^2$$

$$-(mgh_f - mgh_i) + 10 \left(\frac{0,12}{\sin \theta} \right) \cos 180^\circ = -\frac{1}{2} (6) (2,25)^2$$

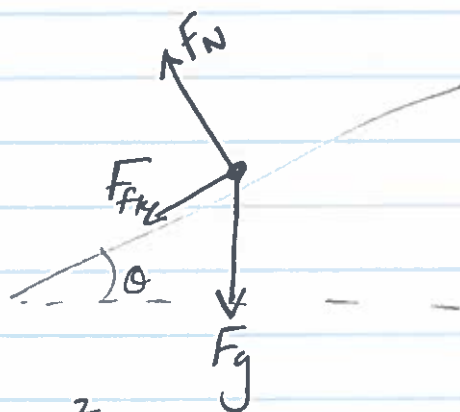
$$-(6)(9,8)(0,12) - \frac{1,2}{\sin \theta} = -15,1875 \quad \sin \theta = \frac{0,12}{\Delta x}$$

$$-7,056 + 15,1875 = \frac{1,2}{\sin \theta}$$

$$8,1315 = \frac{1,2}{\sin \theta}$$

$$\sin \theta = \frac{1,2}{8,1315}$$

$$\theta = 8,49^\circ \quad \checkmark$$



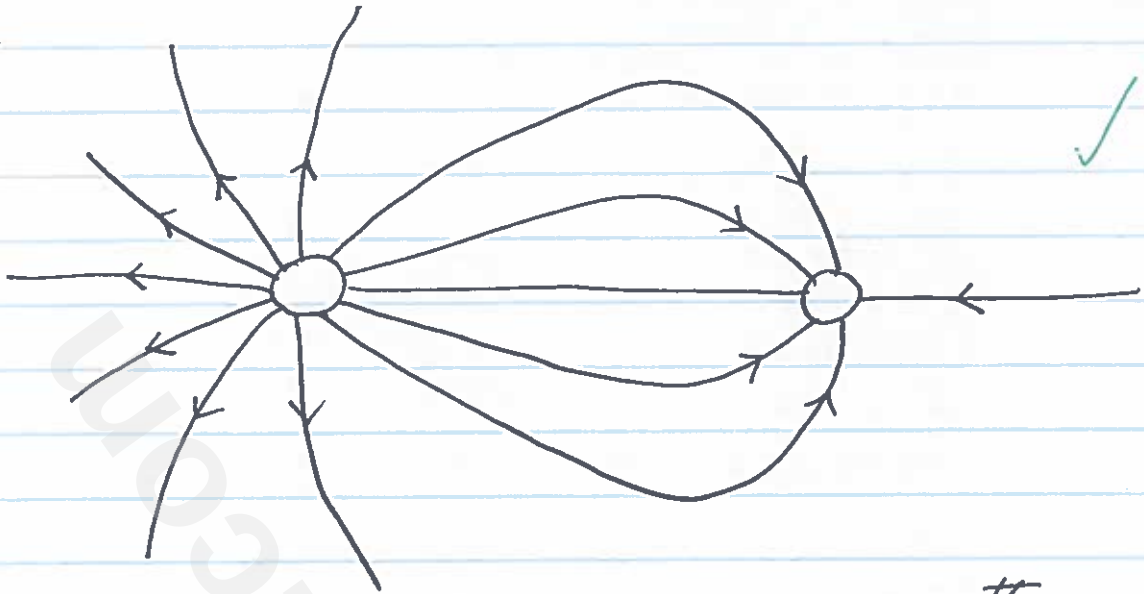
7.1

$$\begin{aligned} 7.2 \quad F &= \frac{G m_1 m_2}{r^2} \quad \checkmark \\ &= \frac{6,7 \times 10^{-11} (6,42 \times 10^{23}) (5,98 \times 10^{24})}{(2,25 \times 10^8)^2} \quad \checkmark \\ &= 5,08 \times 10^{15} \text{ N} \quad \checkmark \end{aligned}$$

$$\begin{aligned} 7.3. \quad g &= \frac{G M}{r^2} \quad \checkmark \\ &= \frac{6,7 \times 10^{-11} (6,42 \times 10^{23})}{(3380000)^2} \quad \checkmark \\ &= 3,77 \text{ m.s}^{-2} \quad \checkmark \end{aligned}$$

$$\begin{aligned} 7.4 \quad F_g &= m g \\ &= 500 (3,77) \\ &= 1885 \text{ N} \quad \checkmark \end{aligned}$$

8.1



pattern ✓
direction ✓
more lines ✓
on q₁ ✓

8.2

8.3

$$\begin{aligned}
 E_{\text{at } p} &= \frac{k Q_A}{r^2} \quad \checkmark \\
 \text{due to } A &= \frac{9 \times 10^9 (9 \times 10^{-9})}{(0,6)^2} \quad \checkmark \\
 &= 225 \text{ N.C}^{-1} \text{ right}
 \end{aligned}$$

$$\begin{aligned}
 E_{\text{at } p} &= \frac{k Q_B}{r^2} \\
 \text{due to } B &= \frac{9 \times 10^9 (1,2 \times 10^{-9})}{(0,2)^2} \quad \checkmark \\
 &= 270 \text{ N.C}^{-1} \text{ left}
 \end{aligned}$$

$$E_{\text{net}} = 45 \text{ N.C}^{-1} \text{ left} \quad \checkmark \quad \checkmark$$

$$8.4 \quad F_{\text{net}} = q E_{\text{net}} \quad \checkmark$$

$$= (1,6 \times 10^{-19}) (45) \quad \checkmark$$

$$= 7,2 \times 10^{-18} \text{ N, right } \checkmark$$

9.1 Rate of flow of charge. ✓✓

$$\begin{aligned} 9.2 \quad P &= I^2 R \\ &= (2,31)^2 (10) \\ &= 53,36 \text{ W} \end{aligned} \quad \begin{array}{l} \checkmark \\ \checkmark \\ \checkmark \end{array}$$

$$\begin{aligned} 9.3 \quad \text{emf} &= I (R_{\text{ext}} + r) \\ 30 &= 2,31 (R_{\text{ext}} + r) \\ R_{\text{ext}} &= 11,99 \, \Omega \end{aligned} \quad \begin{array}{l} \checkmark \\ \checkmark \\ \checkmark \end{array}$$

$$\begin{aligned} R_{\text{ext}} &= 10 \, \Omega + R \\ 11,99 &= 10 + R \\ R &= 1,99 \, \Omega \end{aligned} \quad \checkmark$$

$$9.4 \quad 0 \text{ V} \quad \checkmark$$

$$\begin{aligned} 9.5 \quad V_{\text{ext}} &= I R_{\text{ext}} \\ &= (2,31)(11,99) \\ &= 27,69 \text{ V} \end{aligned} \quad \begin{array}{l} \checkmark \\ \checkmark \\ \checkmark \end{array}$$

9.6 A material's opposition to the flow of electric current. ✓✓

9.7 R_{ext} will increase ✓

I will decrease ✓

P will decrease. ✓ $P = I^2 R$ ✓

$P \propto I^2$ (R of motor constant)

9.8.1 $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

$$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{5} \quad \checkmark$$

$$R_p = 3,33 \, \Omega \quad \checkmark$$

$$R_{ext} = 13,33$$

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

$$30 = I (13,33 + 1) \quad \checkmark$$

$$I = 2,09 \, A \quad \checkmark$$

9.8.2 $V_1 = I \cdot R_p \quad \checkmark$

$$= (2,09)(3,33) \quad \checkmark$$

$$= 6,97 \, V \quad \checkmark$$

10.1.1 Stronger magnets
Increase current
More coils } any 2 ✓✓

10.1.2 B to A ✓

10.2.1 B ✓

10.2.2.

10.2.3 & 10.2.4 ON ANSWER SHEET

10.3 $N_p = 200$ $N_s = 50$

10.3.1

10.3.2. Step-down ✓

10.3.3 A transformer works on the principle of mutual induction. Induction requires a change in flux. AC current produces a changing magnetic field, hence changing flux.

OR to induce an emf in secondary coil a changing magnetic flux is required.

10.3.4
$$\frac{V_p}{N_p} = \frac{V_s}{N_s} \quad \checkmark$$

$$\frac{220V}{200} = \frac{V_s}{50} \quad \checkmark$$

$$\underline{55V} = V_s \quad \checkmark$$

11.1.1 Minimum amount of energy needed to emit an electron from the surface of a metal. ✓✓

11.1.2 frequency of incident radiation ✓✓

11.1.3 $f_0 = 1,05 \times 10^{15}$

$$\begin{aligned} W_0 &= hf_0 \\ &= (6,6 \times 10^{-34}) (1,05 \times 10^{15}) \\ &= 6,93 \times 10^{-19} \text{ J} \end{aligned} \quad \begin{matrix} \checkmark \\ \checkmark \\ \checkmark \end{matrix}$$

X $\equiv$ Zinc ✓

11.1.4. $E = W_0 + E_{k \max}$ ✓

$$\frac{hc}{\lambda} = W_0 + \frac{1}{2}mv^2$$
$$\frac{(6,6 \times 10^{-34})(3 \times 10^8)}{475 \times 10^{-9}} = W_0 + \frac{1}{2}(9,1 \times 10^{-31})(2,77 \times 10^5)^2$$

$$4,168 \times 10^{-19} = W_0 + 3,491 \times 10^{-20}$$

$$3,82 \times 10^{-19} \text{ J} = W_0 \quad \checkmark$$

$\therefore$ Metal is Sodium ✓

11.2.1

6 ✓✓

11.2.2

$$\lambda = 485,29 \times 10^{-9}$$

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

$$= \frac{(6,6 \times 10^{-34})(3 \times 10^8)}{485,29 \times 10^{-9}}$$

$$= 4,08 \times 10^{-19} \text{ J}$$

$$\therefore E = 2,55 \text{ eV}$$

11.2.2

$$E_4 \rightarrow E_2$$

$$\left(\text{or } n=4 \text{ to } n=2 \right)$$