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Grade 12 Physics Trials Paper 1 2021 MEMO

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

[20]

2.1.1 speed is the rate of change of distance✓✓. Scalar. ✓ (3)

2.1.2 velocity is the rate of change of displacement/position. ✓✓ Vector.✓ (3)

2.1.3 The displacement from A to C (50 m) is less than the distance from A to C (90 m) ✓therefore average velocity will be different (or less than) average speed. ✓ (2)

2.1.4 The direction of the velocity✓ changes✓ between A and C. (2)

2.1.5 $AD = \sqrt{50^2 + 110^2} = 120,83 \text{ m}✓$
 $\tan\theta = \frac{110}{50}$ or $\tan\theta = \frac{50}{110}$
 $\theta = 65,56^\circ$ $\theta = 24,44^\circ$
 Bearing = $180^\circ - 65,56^\circ = 114,44^\circ✓$ Bearing = $90^\circ + 24,44^\circ = 114,44^\circ$
 Displacement = 120,83 m ✓on a bearing of $114,44^\circ✓$ (4)

2.2.1 Acceleration is the rate of change of velocity. ✓ ✓ (2)

2.2.2 $a = \text{gradient} = \frac{\Delta v}{\Delta t} = \frac{42-0}{6-0} ✓✓ = 7 \text{ m.s}^{-2} ✓ \text{South} ✓$ (4)

2.2.3 The cars are travelling at the same speed/velocity. ✓ (1)

2.2.4 Distance = area under graph
 $= \left(\frac{1}{2} \times 2 \times 28\right) ✓ + (4 \times 28) ✓$
 $= 140 \text{ m}✓$ (3)

2.2.5 At 6 s the sports car has travelled $\frac{1}{2} \times 6 \times 42 = 126 \text{ m}✓$
 The difference is $140 - 126 = 14 \text{ m.} ✓$ Difference in velocity between the two cars is 14 m.s^{-1}
 $\Delta x = \Delta vt$
 $14 = 14t$
 $t = 1 \text{ s}✓$
 Therefore the cars are next to each other after 7 s.(6s + 1s) ✓ (4)

Or $t_s = \frac{x-126}{42} = t_e = \frac{x-140}{28}$
 $x = 168 \text{ m}$ (when they meet)
 $\frac{168-140}{28} = 1 \text{ s} \quad 6 \text{ s} + 1 \text{ s} = 7 \text{ s}$

2.3.1 $a = 9,8 \text{ m} \cdot \text{s}^{-2}$ ✓ downwards ✓
 (2)

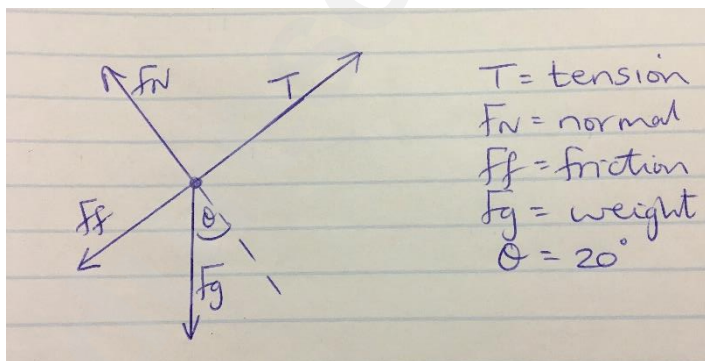
2.3.2.1 $v_f^2 = v_i^2 + 2a\Delta x$ ✓
 $(-3,2)^2 = 6^2 + 2(-9,8)\Delta x$ ✓
 $10,24 = 36 + 19,6\Delta x$ ✓
 $\Delta x = 1,31 \text{ m}$ ✓ (4)

2.3.2.2 $v_f = v_i + a\Delta t$ ✓
 $-8 \text{ ✓} = -0,5 + (-9,8)\Delta t$ ✓
 $\Delta t = \frac{-7,5}{-9,8} = 0,77 \text{ s}$ ✓ (4)

2.3.3 On answer sheet. (5)
[43]

- 3.1 When a net force, F_{net} , is applied to an object of mass, m , it accelerates in the direction of the net force. The acceleration, a , is directly proportional to the net force and inversely proportional to the mass. -1 if leave out word net ✓ ✓
 (2)

3.2



(5)

- 3.3 The perpendicular force exerted by a surface on an object in contact with it. ✓ ✓

(2)

3.4 $F_N = mg \cos \theta$
 $= 3 \times 9,8 \times \cos 20^\circ$ ✓
 $= 27,63 \text{ N}$ ✓

$$\begin{aligned}
 F_f &= \mu F_N \checkmark \\
 &= 0,1 \times 27,63 \\
 &= 2,76 \text{ N} \quad \checkmark
 \end{aligned}
 \tag{4}$$

$$\begin{aligned}
 3.5.1 \quad F_{net} &= ma \\
 F_g // \text{slope} - T &= ma \checkmark \\
 3(9,8)\sin 40^\circ - T &= 3a \\
 18,9 - T &= 3a \checkmark
 \end{aligned}
 \tag{2}$$

if no subbing only one mark

$$\begin{aligned}
 3.5.2 \quad T - F_f - F_g // \text{slope} &= ma \checkmark \\
 T - 2,76 - 3(9,8)\sin 20^\circ &= 3a \checkmark \\
 T - 12,82 &= 3a \quad \checkmark
 \end{aligned}
 \tag{3}$$

no subbing and simplication -1, if left
out one of the forces also -1

$$\begin{aligned}
 3.5.3 \quad T - 12,82 &= 18,9 - T \checkmark \\
 T &= 15,86 \text{ N} \quad \checkmark
 \end{aligned}
 \tag{2}$$

coe only if correct physics

$$3.6 \quad a = 1,01 \text{ m} \cdot \text{s}^{-2} \quad \checkmark \quad \checkmark \tag{2}$$

3.7 As the angle decreases, $\sin \theta$ decreases, $\checkmark$ therefore $F_g // \text{slope}$ decreases, $\checkmark$ therefore F_{net} decreases therefore acceleration decreases $\checkmark$ as acceleration is directly proportional to F_{net} . $\checkmark$

(4)
[26]

4.1 Product of the net force and the contact time./change in momentum (not RATE of as that is net force) $\checkmark \checkmark$

(2)

$$\begin{aligned}
 4.2 \quad p_{before} &= p_{after} \checkmark \\
 p_{before} &= mv_P + mv_Q \\
 &= m(10) + m(-15) \quad \checkmark \\
 &= -5m \\
 \\
 p_{after} &= m(-6) + mv_Q \quad \checkmark \\
 -5m &= -6m + mv_Q \\
 1m &= mv_Q \\
 v_Q &= 1 \text{ m} \cdot \text{s}^{-1} \quad \checkmark \text{East} \checkmark
 \end{aligned}
 \tag{5}$$

$$\begin{aligned}
 4.3 \quad E_{K \text{ before}} &= \frac{1}{2}mv_P^2 + \frac{1}{2}mv_Q^2 \\
 &= \frac{1}{2}m(10)^2 + \frac{1}{2}m(-15)^2 \\
 &= 50m + 112,5m \\
 &= 162,5m \checkmark \\
 \\
 E_{K \text{ after}} &= \frac{1}{2}m(-6)^2 + \frac{1}{2}m(1)^2 + 28,8 \checkmark \\
 &= 18m + 0,5m + 28,8
 \end{aligned}$$

$$= 18,5m + 28,8 \checkmark$$

$$E_{K\text{before}} = E_{K\text{after}} \checkmark$$

$$162,5m = 18,5m + 28,8$$

$$144m = 28,8$$

$$m = 0,2 \text{ kg} \checkmark$$

(5)

$$4.3.2 \quad F_{\text{net}} \cdot t = \Delta p \checkmark$$

$$F_{\text{net}} = \frac{0,2(-6-10)}{1,8-1,2} \checkmark \checkmark \text{ (correct subbing values from graph) – only coe from Q4.3.1 mass if correct values from graph}$$

$$F_{\text{net}} = \frac{-3,2}{0,6} = (-)5,33 \text{ N} \checkmark$$

(4)

[16]

5.1 In the absence of air resistance or any external forces, the mechanical energy of an object is constant. $\checkmark \quad \checkmark$

(2)

$$5.2 \quad E_{\text{mech at } 50\text{m}} = (2000 \times 9,8 \times 50) + \left(\frac{1}{2} \times 2000 \times 10^2\right) \checkmark$$

$$= 1\,080\,000 \text{ J}$$

$$E_{\text{mech at unknown height}} = (2000 \times 9,8 \times h) + \left(\frac{1}{2} \times 2000 \times 0^2\right) \checkmark$$

$$1\,080\,000 = 19\,600h \checkmark$$

$$h = 55,1 \text{ m} \checkmark$$

(4)

$$5.3 \quad E_{\text{mech @ } 54\text{m}} = E_k + E_p = 0 + (2000 \times 9,8 \times 54) = 1\,058\,400 \text{ J} \checkmark \checkmark$$

$$\checkmark W_f = 1\,058\,400 - 1\,080\,000 = -21\,600 \text{ J} \checkmark$$

(4)

$$5.4 \quad \sin 22,6^\circ = \frac{4}{x}$$

$$x = \frac{4}{\sin 22,6^\circ} = 10,41 \text{ m} \checkmark \quad \checkmark \text{ (write or wrong no part marks)}$$

(2)

$$5.5 \quad W = f \Delta x \checkmark$$

$$-21\,600 = f(10,41) \quad \checkmark \text{ coe Q 5.3 and Q 5.4 if correct formula}$$

$$f = (-)2\,074,93 \text{ N} \checkmark$$

(3)

[15]

6.1.1 The force acting per unit mass. $\checkmark \checkmark$

(2)

$$6.1.2 \quad g = \frac{F}{m}$$

$$3 \checkmark = \frac{F}{1500} \checkmark$$

$$F = 4\,500 \text{ N} \checkmark$$

$$\text{Or} \quad F = \frac{Gm_1m_2}{r^2} = \frac{(6,7 \times 10^{-11})(1,9 \times 10^{27})(1500)}{(2 \times 10^8)^2} \checkmark = 4\,773,75 \text{ N} \checkmark$$

(3)

6.1.3 Distance is halved therefore force is 4✓ times greater. ✓ (2)

$$6.2 \quad E \text{ due to } A = \frac{kQ_A}{r^2} = \frac{(9 \times 10^9)(Q_A)}{\left(\frac{20}{1000}\right)^2} \checkmark$$

$$E \text{ due to } B = \frac{kQ_B}{r^2} = \frac{(9 \times 10^9)(28 \times 10^{-12})}{\left(\frac{12}{1000}\right)^2} \checkmark = 1750$$

$$E_{\text{net}} = E \text{ due to } A + E \text{ due to } B \checkmark$$

$$805 = \frac{(9 \times 10^9)Q_A}{4 \times 10^{-4}} + 1750$$

$$Q_A = -4,2 \times 10^{-11} \text{ C} \checkmark$$

(4)
[11]

7.1.1 Potential difference is the work done per unit positive charge. ✓✓ (2)

7.1.2 *emf* is the total energy supplied per coulomb of charge by the cell. ✓✓ (2)

$$7.1.3 \quad R_T = \frac{\text{product}}{\text{sum}} = \frac{20 \times (20+20)}{20+(20+20)} = \frac{20 \times 40 \checkmark}{20+40 \checkmark} = 13,33 \, \Omega \quad \checkmark \quad (3)$$

$$\begin{array}{ll} 7.1.4 \quad emf = V_{\text{ext}} + V_{\text{lost}} & V_{\text{ext}} = IR \checkmark \\ 220 = V_{\text{ext}} + 20 & 200 \checkmark = I(13,33) \checkmark \\ V_{\text{ext}} = 200 \, V & I = 15 \, A \quad \checkmark \end{array} \quad (4)$$

$$\begin{array}{ll} 7.1.5 \quad V_{\text{lost}} = Ir \checkmark & \text{or} \quad emf = I(R + r) \\ 20 = 15r \checkmark & 220 = 15(13,33 + r) \\ r = 1,33 \, \Omega \checkmark & r = 1,33 \, \Omega \end{array} \quad (3)$$

$$\begin{array}{l} 7.1.6 \quad W = VIt \checkmark \\ \quad \quad = 200 \times 15 \times (8 \times 60 \times 60) \checkmark \\ \quad \quad = 86\,400\,000 \, J \checkmark \end{array} \quad (4)$$

$$7.1.7 \quad P = \frac{W}{t} = \frac{86\,400\,000}{8 \times 60 \times 60} = 3000 \, W \checkmark \quad \text{or } P = VI = 200 \times 15 = 3000 \, W$$

$$\text{Cost} = 3 \checkmark \times 8 \times R2,09 \checkmark = R50,16 \checkmark \quad (4)$$

$$7.2.1 \quad 2R \checkmark$$

$$7.2.2 \quad 1/2R \checkmark \quad (2) \quad [24]$$

8.1.1 A power supply (battery) ✓
Split-ring commutator ✓ (2)

8.1.2 electrical ✓ to mechanical ✓ (2)

8.1.3 clockwise ✓ (1)

8.2.1 upwards ✓ ✓ (2)

8.2.2 Newton's third law. ✓
When the conductor experienced an upward force from the magnetic field, it exerted an oppositely directed force of equal magnitude downwards. ✓ ✓ (3)

8.2.3 $F = 2,516 - 2,5 ✓ = 0,016 \text{ N} ✓$ (2)

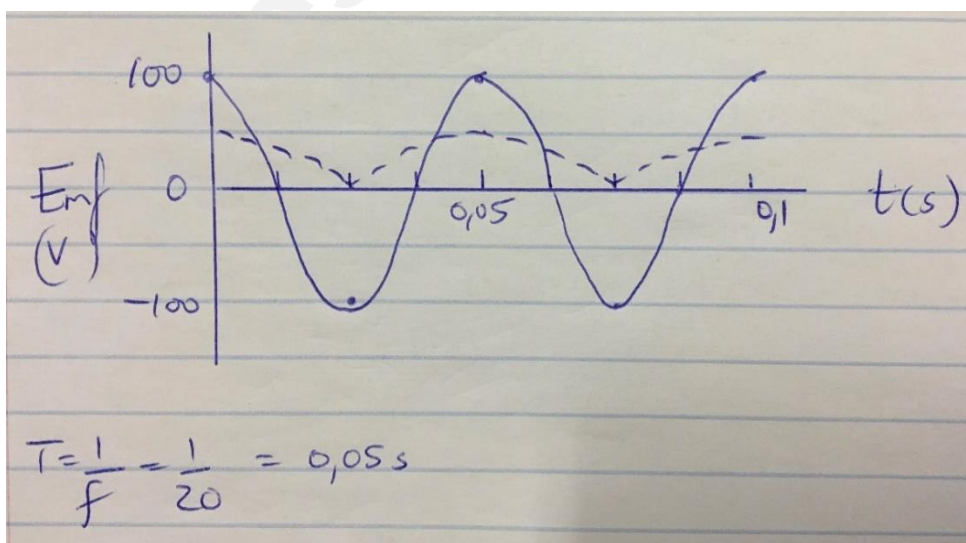
8.2.4 $F = IB \sin \theta ✓$ (1)

8.3.1 $\phi = BA \cos \theta ✓$
In this position, $\theta = 90^\circ$, and $\cos 90^\circ = 0$
therefore, flux is zero. ✓ (2)

8.3.2 anti-clockwise ✓ (1)

8.3.3 The emf induced is directly proportional to the rate of change of magnetic flux. ✓ ✓ (2)

8.3.4 axes ✓, two waves ✓, 100 V max ✓ and time values ✓



8.3.5 a) diodes ✓ (1)

- b) full-wave rectification✓ or AC to DC ✓ (2)
- c) one wave in 0,1 s✓
only direct current (above line) ✓
emf must halve. ✓ (3)

[28]

9.1 Threshold frequency is the minimum frequency of incident radiation at which electrons will be emitted from a particular metal. ✓ ✓ (2)

9.2 Graph on Answer Sheet. (5)

9.3.1 Gradient = $\frac{\Delta y}{\Delta x} = \frac{(8-14) \times 10^{-19}}{(2,4-3,2) \times 10^{15}}$ ✓✓ = $6,4 \times 10^{-34} \text{ J.s}$ ✓✓ shown on graph (4)

9.3.2 $\lambda = \frac{c}{f}$ ✓ = $\frac{3 \times 10^8}{1 \times 10^{15}}$ ✓ = $3 \times 10^{-7} \text{ m}$ ✓ (3)

9.3.3 $W = hf_o = (7,5 \times 10^{-34})(1,35 \times 10^{15} \text{ ✓}) = 1,01 \times 10^{-18} \text{ J} \text{ ✓} = 6,33 \text{ eV}$ ✓
(3)

[17]

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GRADE 12 PHYSICAL SCIENCE ANSWER SHEET

Examination number:

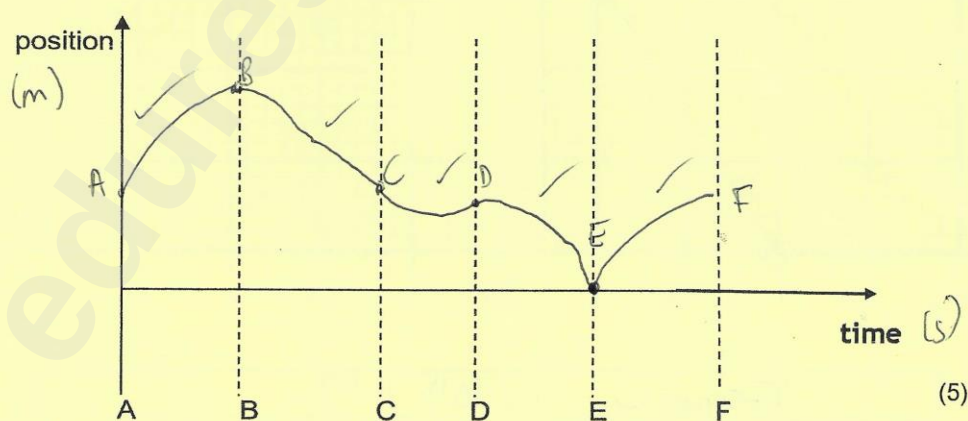
M	E	M	0								
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QUESTION 1 MULTIPLE CHOICE

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

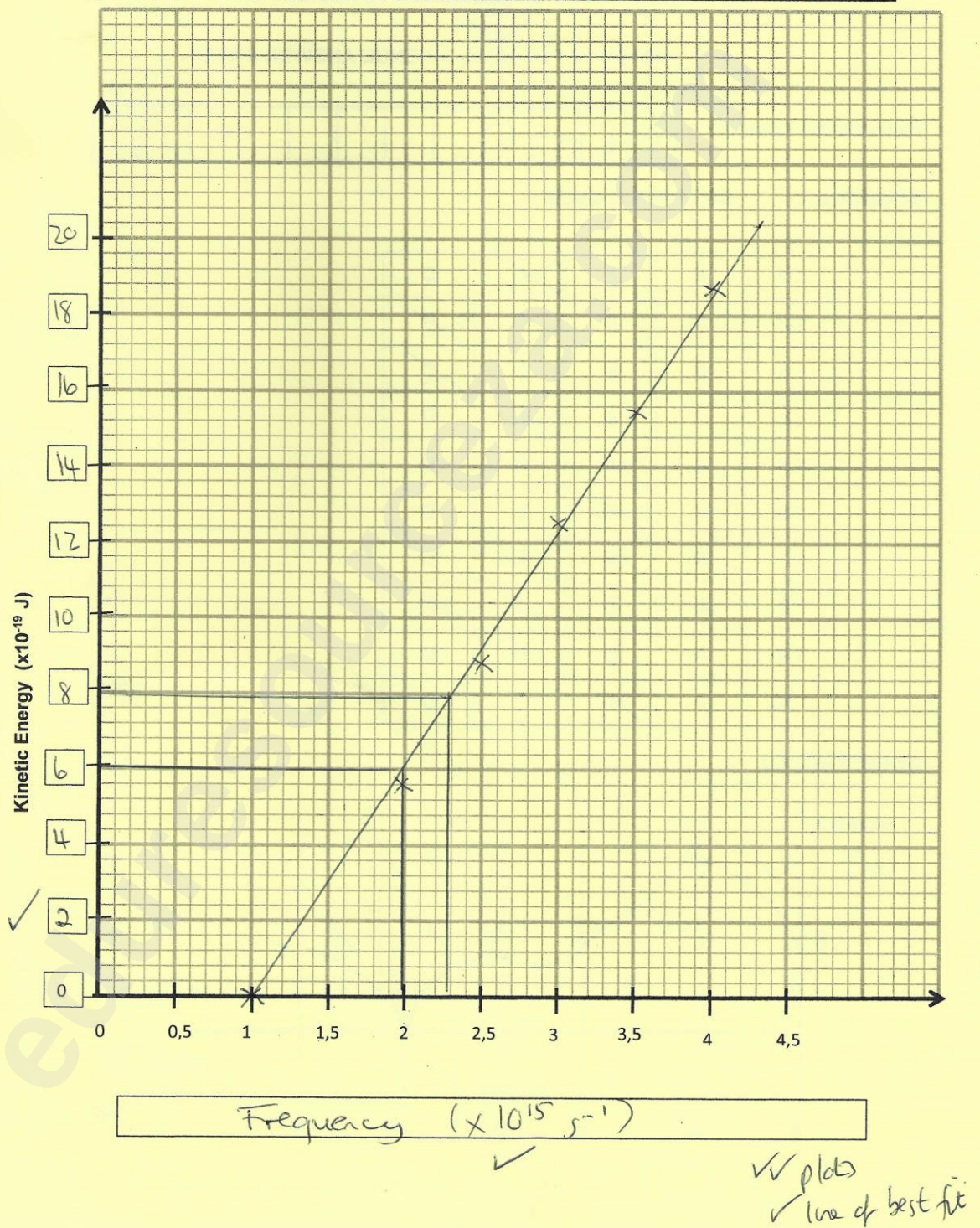
[20]

QUESTION 2.3.3



QUESTION 9.2

Graph to show the relationship between kinetic energy of ejected electrons and frequency



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