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St Andrews College & DSG Physics P1 Trial Exam 2020 MEMO

QUESTION 1

1.1	B	1.2	B	1.3	D	1.4	C	1.5	C
1.6	B	1.7	D	1.8	A	1.9	C	1.10	D
									[10 X 2 = 20]

QUESTION 2

2.1.1 the rate of change of velocity / change of velocity in a specific time ✓✓ (2)

2.1.2 $a = \frac{\Delta y}{\Delta x}$

$$= \frac{42 - 0}{6 - 0} \checkmark$$

$$= 7 \text{ m/s}^2 \checkmark \text{ forwards / South } \checkmark \quad (4)$$

2.1.3 the cars reach the same velocity ✓ (1)

2.1.4 Area = $(\frac{1}{2}bh) + (l \times b)$

$$= (\frac{1}{2})(2)(28) \checkmark + (4)(28) \checkmark$$

$$= 28 + 112$$

$$= 140 \text{ m } \checkmark \quad (3)$$

2.1.5 $S_s = (\frac{1}{2}bh)$

$$= (\frac{1}{2})(6)(42)$$

$$= 126 \text{ m } \checkmark$$

$$140 - 126$$

$$= 14 \text{ m difference } \checkmark$$

$$= \text{catches up in 1 second } \checkmark$$

So... catches up at 7 seconds ✓ (4)

2.1.6 to cross = $\frac{12}{1,5}$

$$= 8 \text{ seconds } \checkmark$$

$$S = v t$$

$$= (28)(8) \checkmark$$

$$= 224 \text{ m } \checkmark \quad (4)$$

2.2.1 time of acceleration ✓✓ (2)

2.2.2 heading ✓
label axes ✓
units ✓
scales ✓
plotting ✓
line of best fit ✓ (6)

2.2.3 gradient = $\frac{\Delta y}{\Delta x}$
= $\frac{19 - 0}{2,4 - 0}$ ✓
= 7,9 m/s² ✓ ✓ points on graph (5)

2.2.4 $v = at + u$ ✓ (1)

2.2.5 gradient = acceleration ✓✓ (2)

QUESTION 3

3.1 the rate of change of displacement / position ✓✓ (2)

3.2 $39\,045 - 2\,516$
= 36 529 m
 $v^2 = u^2 + 2as$ ✓
 $373^2 = 0^2 + 2a(36\,529)$ ✓
 $a = 1,9 \text{ m/s}^2$ ✓ downward ✓ (4)

3.3 As he enters the atmosphere, he experiences drag forces (air resistance) ✓✓ (2)

3.4 $s = \frac{1}{2}(u + v)t$ OR $v = u + at$
 $36\,259 = \frac{1}{2}(0 + 373)t$ ✓ $373 = 0 + (1,9)t$ ✓
 $t = 195,5 \text{ seconds}$ ✓ $t = 195,5 \text{ seconds}$ ✓ (3)

3.5 The camera would fall alongside him. According to Newton's 1st Law, it will not change its motion until acted on by external forces. ✓✓ (3)

3.6 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. ✓✓ (2)

3.7 $F_{\text{net}} =$ Downloaded from eduresourceza.com

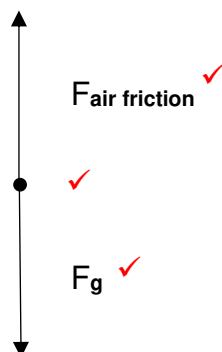
$$F_g + F_{\text{par}} = ma$$

$$(90)(-9,8) + 2\,250 = (90)a$$

$$a = 15,2 \text{ m/s}^2 \text{ (upwards)}$$

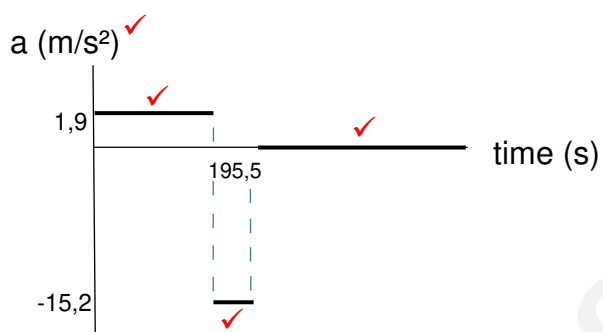
(4)

3.8



(3)

3.9



(4)

3.10 $F = \frac{\Delta p}{\Delta t}$

$$= \frac{m(v - u)}{\Delta t}$$

$$= \frac{90(0 - 30)}{0,8}$$

$$= 3\,375 \text{ N OR } 3\,375 \text{ N}$$

(3)

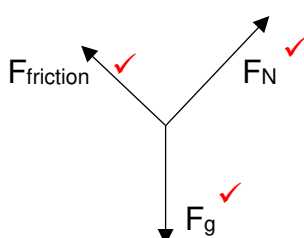
3.11 Bending his knees increases the time it takes to stop (Δp stays the same)
increased time = decrease in force.

(3)

[33]

QUESTION 4

4.1.1



(3)

4.1.2 The perpendicular force exerted by a surface on an object in contact with it. ✓✓ (2)

$$\begin{aligned}
 4.1.3 \quad F_N &= F_g \cos 40^\circ \\
 &= (30 \times 9,8) \cos 40^\circ \\
 &= 225,22 \text{ N perpendicular to the slope.}
 \end{aligned}
 \quad (3)$$

$$\begin{aligned}
 4.1.4 \quad F_{\text{fric}} &= \mu \cdot F_N \\
 &= (0,4)(225,22) \\
 &= 90,09 \text{ N}
 \end{aligned}
 \quad (3)$$

$$\begin{aligned}
 4.1.5 \quad F_{\text{Net}} &= F_{\parallel} - F_{\text{fric}} \\
 &= (30)(9,8)\sin 40^\circ - 90,09 \\
 &= 98,89 \text{ N} \\
 98,89 &= ma \\
 98,89 &= 30a \\
 a &= 3,3 \text{ m/s}^2 \text{ down the slope}
 \end{aligned}
 \quad (5)$$

$$\begin{aligned}
 4.1.6 \quad \Delta x &= \frac{1,8}{\sin 40^\circ} \\
 &= 2,8 \text{ m} \\
 W &= Fs \\
 &= (90,09)(2,8) \\
 &= 252,25 \text{ J}
 \end{aligned}
 \quad (4)$$

$$\begin{aligned}
 4.1.7 \quad v^2 &= u^2 + 2as \quad \text{OR} \quad F_{\text{NET}} \cdot s = \Delta E_K = \frac{1}{2} mv^2 - \frac{1}{2} mu^2 \\
 &= 0^2 + 2(3,3)(2,8) \quad 98,89(2,8) = \frac{1}{2} (30)v^2 - 0 \\
 &= 4,29 \text{ m/s}^2 \quad v = 4,29 \text{ m/s}
 \end{aligned}
 \quad (4)$$

$$\begin{aligned}
 \text{OR} \quad (E_P + E_K)_{1,8\text{m}} - E_f &= (E_P + E_K)_{0\text{m}} \\
 mgh + 0 - 252,25 &= 0 + \frac{1}{2} mv^2 \\
 (30)(9,8)(1,8) - 252,25 &= \frac{1}{2} (30)v^2
 \end{aligned}$$

4.2.1 The total linear momentum of an isolated system remains constant (in any direction) (2)

$$\begin{aligned}
 4.2.2 \quad m_1 u_1 + m_2 u_2 &= m_1 v_1 + m_2 v_2 \\
 (30)(4,29) + (25)(0) &= (30)v_1 + (25)(3) \\
 v_1 &= 1,79 \text{ m/s forward}
 \end{aligned}
 \quad (4)$$

4.2.3 They experience the same force; equal in magnitude but opposite in direction. (2)

4.2.4 They experience the same change in momentum. $\Delta p = F \cdot t$ (same force over the same time) (2)

QUESTION 5

5.1 Force per unit positive charge ✓✓ (2)

$$\begin{aligned}
 5.2 \quad E &= \frac{F}{q} \\
 &= \frac{0,0032}{3,2 \times 10^{-6}} \\
 &= 1\,000 \text{ N/C}
 \end{aligned}$$

(3)

5.3 Q ✓ (1)

5.4 the force between two charges is directly proportional to the product of the charges and inversely proportional to the distance between the charges squared ✓ (2)

$$\begin{aligned}
 5.5 \quad F &= \frac{kQ_1Q_2}{r^2} & \text{OR} \quad E &= \frac{kQ}{r^2} \\
 0,0032 &= \frac{(9 \times 10^9)(3,2 \times 10^{-6})(6,4 \times 10^{-6})}{r^2} & 1000 &= \frac{(9 \times 10^9)(6,4 \times 10^{-6})}{r^2} \\
 r^2 &= 57,6 & r^2 &= 57,6 \\
 r &= 7,6 \text{ m} & r &= 7,6 \text{ m}
 \end{aligned}$$

(4)

$$\begin{aligned}
 5.6 \quad \tan \Theta &= \frac{0,0032}{(0,005)(9,8)} \\
 \Theta &= 3,74^\circ
 \end{aligned}$$

(3)

[15]**QUESTION 6**

6.1 The total energy supplied per coulomb of charge by the cell ✓✓ (2)

6.2.1 0A ✓

6.2.2 24V ✓

6.2.3 0V ✓ (3)

6.3 A material's opposition to the flow of electric current ✓✓ (2)

$$\begin{aligned}
 6.4 \quad \frac{1}{R_p} &= \frac{1}{20} + \frac{1}{30} \\
 R_p &= 12 \, \Omega
 \end{aligned}$$

(2)

$$\begin{aligned}
 6.5 \quad V_{\text{term}} &= IR \\
 21,6 &= I(12 + 15) \\
 I &= 0,8 \text{ A}
 \end{aligned}$$

(4)

6.6 $V_{\text{term}} = \text{emf} - Ir$ OR $\text{emf} = I(R + r)$ Downloaded from eduresourceza.com

$$21,6 = 24 - (0,8)r \quad 24 = 0,8(27 + r) \quad r = 3 \, \Omega \quad (3)$$

6.7 $I_3 = \frac{20}{50} \times 0,8$ $V_{//} = V_{\text{term}} - V_{15\Omega}$ OR $I_{30\Omega} = \frac{V_{//}}{R_{30}}$

$$= 0,32 \, \text{A} \quad = 21,6 - (0,8)(15) \quad = \frac{9,6}{30} \quad = 0,32 \, \text{A} \quad (3)$$

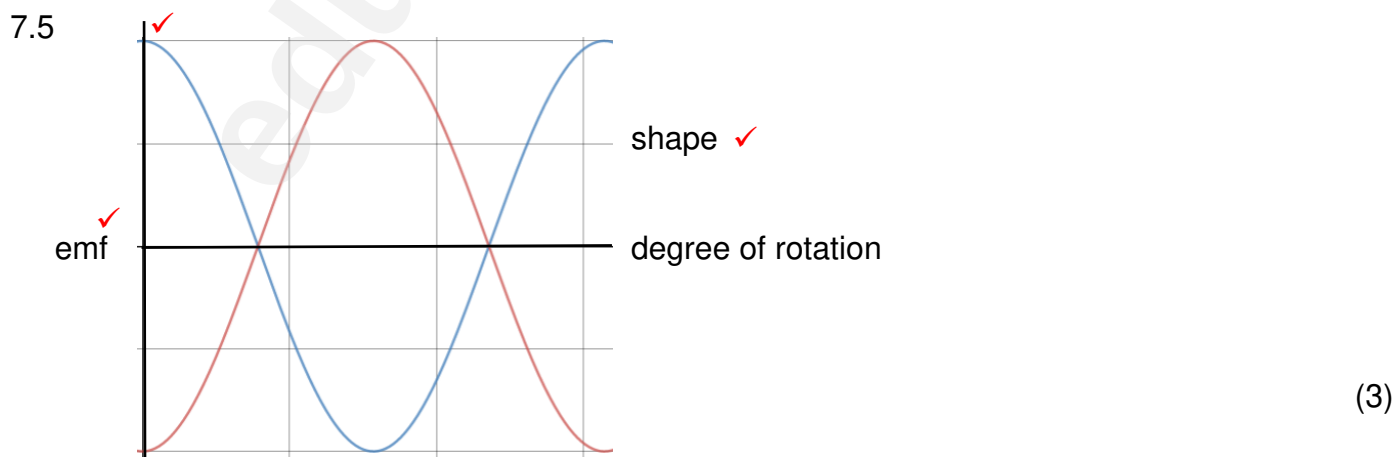
6.8 $P = I^2 R$ OR $P = \frac{V^2}{R} = \frac{12^2}{15} = 9,6 \, \text{W}$ OR $P = VI = (12)(0,8) = 9,6 \, \text{W}$

$$= (0,8)^2(15) \quad = 9,6 \, \text{W} \quad (3)$$

- 6.9.1 decrease ✓
 6.9.2 increase ✓
 6.9.3 increase ✓
 6.9.4 increase ✓ (4)
- [26]**

QUESTION 7

- 7.1 AC generator ✓ (1)
 7.2 mechanical energy ✓ to electrical energy ✓ (2)
 7.3 Y to X ✓ (1)
 7.4 the emf induced is directly proportional ✓ to the rate of change of magnetic flux ✓ (2)



- 7.6 When force and magnetic field are perpendicular, magnetic flux is at a minimum (zero) which means that emf is at a maximum. (2)

7.7 from AC to DC ✓ **Downloaded from eduresourceza.com** (1)

7.8.1 step-up transformer ✓ (1)

7.8.2 the higher the voltage ✓ when transporting electricity, the lower the energy loss. ✓ (2)

7.9 $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

$$\frac{V_s}{240} = \frac{50}{1\,600}$$

$$V_s = 7,5 \text{ V}$$

[19]

QUESTION 8

8.1 the minimum amount of energy needed to emit an electron from the surface of a metal. ✓✓ (2)

8.2 $hf = W_0 + Ek$
 $(6,6 \times 10^{-34})(5,8 \times 10^{15}) = W_0 + \frac{1}{2}(9,1 \times 10^{-31})(2,6 \times 10^6)^2$
 $3,828 \times 10^{-18} = W_0 + 3,0758 \times 10^{-18}$
 $W_0 = 7,522 \times 10^{-19} \text{ J}$ (5)

8.3 $\frac{7,522 \times 10^{-19}}{1,6 \times 10^{-19}}$
 $= 4,7 \text{ eV}$ Copper (3)

8.4 Beryllium and gold (2)

8.5 wavelength is short
high energy
biggest difference (drop) ✓
A ✓ (2)

8.6 $-13,6 - 0,8$
 $= -12,8$
 $E = \frac{hc}{\lambda}$
 $-12,8 = \frac{(4,125 \times 10^{-15})(3 \times 10^8)}{\lambda}$ OR $12,8 \times 1,6 \times 10^{-19} = \frac{(6,6 \times 10^{-34})(3 \times 10^8)}{\lambda}$
 $\lambda = 9,6679 \times 10^{-8} \text{ m}$
 $= 96,7 \text{ nm}$ (4)