



eduresourceza.com

Hilton College P1 2020

Question 1

1.1 D

1.2 D

1.3 D

1.4 B

1.5 B

1.6 A

1.7 C

1.8 B

1.9 B

1.10 B

Question 2

2.1 Acceleration – rate of change of velocity ✓✓ (2)

2.2 A-B and D-E, F-G, C-F, C-E, D-F ✓✓ accept 0-2s; 6-8s, 10-12s any 2 (2)

2.3 C-D, D-E ; E-F ✓✓ any 2 (2)

2.4 C-D ✓✓ (2)

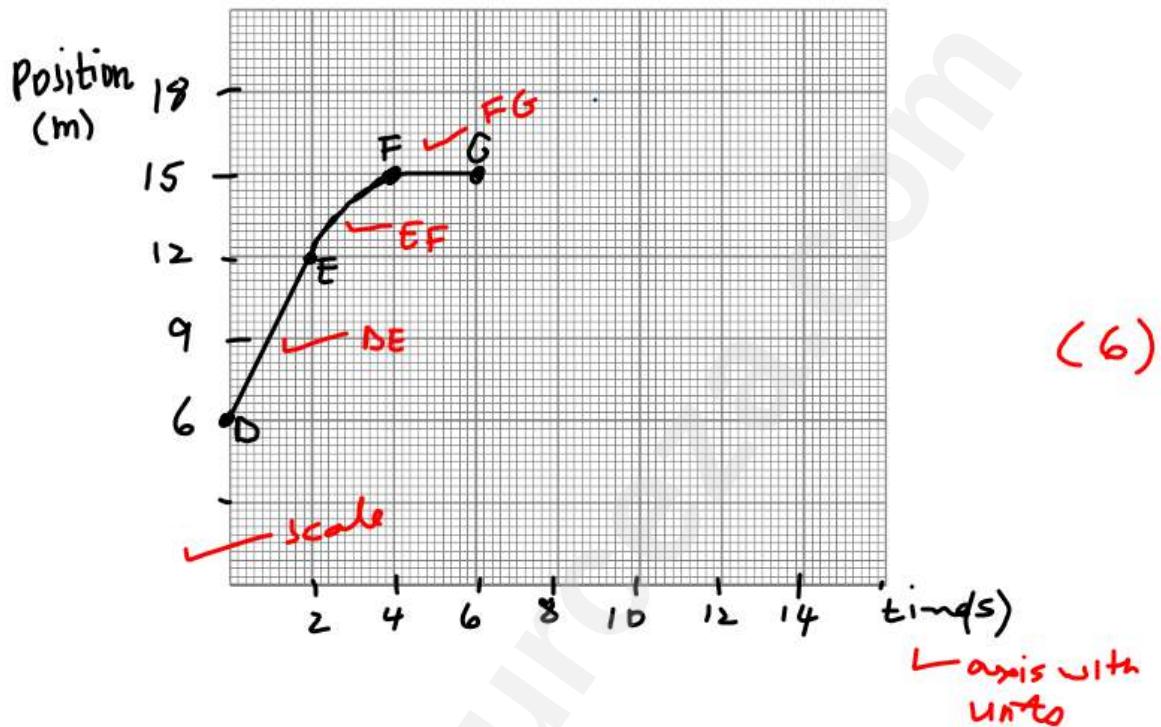
2.5 canoeist is at rest ✓ (1)

2.6 $m = \frac{0-3}{10-8} \checkmark \checkmark$
 $= -\frac{3}{2}$
 $= -1.5 \text{ m.s}^{-2}$
 $\therefore 1.5 \text{ m.s}^{-2} \checkmark \text{ North } \checkmark$ (4)

2.7 Area = $lxb + \frac{1}{2}b \cdot h$
 $= 2 \times 3 \checkmark + \frac{1}{2}(2)(3) \checkmark$
 $= 6 + 3$
 $= 9 \text{ m } \checkmark \text{ North } \checkmark$ (4)

2.8

Position-time graph of a canxist ✓ heading



- SUBTRACT 1 MARK IF GRAPH STARTS AT THE ORIGIN.

2.9.1. Free-fall- falling under the influence of gravity. ✓ (1)

2.9.2. $v_f = v_i + g\Delta t$ ✓

$$0 = 10 + (-9,8)\Delta t \quad \checkmark$$

$$\Delta t = 1,02 \text{ s} \quad \checkmark \quad (3)$$

2.9.3. $t = 4,5 - 2(1,02) = 2,459 \text{ s}$ ✓

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \checkmark \\ &= (-10)(2,459) + \frac{1}{2} (-9,8)(2,459)^2 \quad \checkmark \\ &= -54,22 \text{ m} \Rightarrow 54,22 \text{ m above the ground} \quad \checkmark \end{aligned} \quad (4)$$

Or

$$\begin{aligned} \Delta y &= v_i \Delta t + \frac{1}{2} g \Delta t^2 \quad \checkmark \\ &= (10)(4,5) \quad \checkmark + \frac{1}{2} (-9,8)(4,5)^2 \quad \checkmark \\ &= -54,22 \text{ m} \Rightarrow 54,22 \text{ m above the ground} \quad \checkmark \end{aligned}$$

$$\begin{aligned}
 2.9.3. \quad \Delta x &= v \cdot \Delta t \checkmark \\
 &= 10 \times 4,5 \checkmark \\
 \text{Height} &= 45\text{m} + 54,22 \checkmark \\
 &= 99,22 \text{ m above the ground} \checkmark
 \end{aligned}$$

[35]**Question 3**

3.1 *an object continues in a state of rest or uniform (moving with constant) velocity unless it is acted upon by a net or resultant force* $\checkmark \checkmark$ (2)

- 3.2
- The water was traveling at the same velocity as the car $\checkmark$
 - Water has mass and therefore has inertia. $\checkmark$
 - When the breaks were applied, the water maintained its inertia $\checkmark$

any two (2)

$$\begin{aligned}
 3.3 \quad \Delta P &= m(v_f - v_i) \checkmark \\
 &= 300 \text{ kg}(0 - 5,5555) \text{ m} \cdot \text{s}^{-1} \checkmark \\
 &= -1666.67 \\
 &= 1\,666.67 \text{ kg} \cdot \text{m} \cdot \text{s}^{-1} \checkmark \text{South} \checkmark
 \end{aligned}$$

(4)

$$\begin{aligned}
 3.4 \quad F &= \frac{\Delta P}{\Delta t} \checkmark \\
 &= \frac{1666.67}{1.8} \checkmark \\
 &= 925.92 \text{ N} \checkmark
 \end{aligned}$$

(3)

3.5 Equal to $\checkmark$ (1)

$$\begin{aligned}
 3.6 \quad F_{g//} &= m \cdot g \cdot \sin \theta \checkmark \\
 &= (300)(9.8) \sin 35^\circ \\
 &= 1\,686.31 \text{ N} \checkmark
 \end{aligned}$$

(2)

$$\begin{aligned}
 3.7 \quad F_{net} &= m \cdot a \checkmark \\
 F_{g//} - F_f - F_T &= m \cdot a \\
 1686.31 - \mu \cdot N \checkmark - 500 &= 300(0.80) \checkmark \\
 1686.31 - \mu \cdot (300 \times 9.8 \cos 35^\circ \checkmark) - 50 &= 300 \times 0.8 \\
 \mu &= 0.39 \checkmark
 \end{aligned}$$

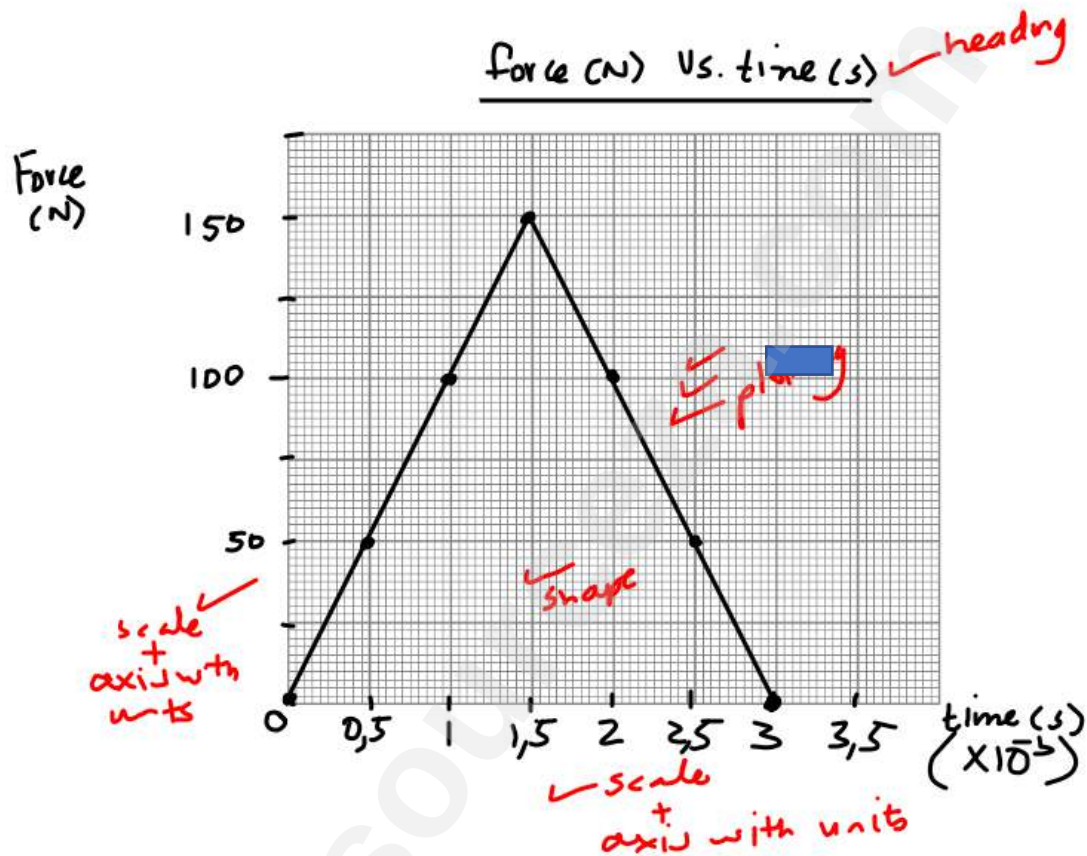
(5)

[19]

Question 4

4.1 the product of the net force and the contact time ✓✓ (2)

4.2



(6)

$$\begin{aligned}
 4.3 \quad \text{Area} &= \frac{1}{2}b \cdot h + \frac{1}{2}b \cdot h \\
 &= \frac{1}{2}(150)(1,5 \times 10 - 3) \checkmark + \frac{1}{2}(150)(1,5 \times 10 - 3) \checkmark \\
 &\approx 0,23 \text{ kg} \cdot \text{m} \cdot \text{s}^{-1} / \text{N} \cdot \text{s} \checkmark \quad (3)
 \end{aligned}$$

4.4 impulse ✓ DO NOT ACCEPT CHANGE IN MOMENTUM (1)

4.5.1 The total linear momentum of an isolated system remains constant. ✓✓ (2)

$$\begin{aligned}
 4.5.2 \quad P_{\text{before}} &= P_{\text{after}} & 0 &= m_A v_A + m_B v_B \checkmark \\
 0 &= 10(25) + 5 \cdot v_B \checkmark & v_B &= -50 \text{ m} \cdot \text{s}^{-1} \quad (4) \\
 v_B &= 50 \text{ m} \cdot \text{s}^{-1} \checkmark \text{ OPPOSITE TO } 5 \text{ KG} \checkmark
 \end{aligned}$$

4.5.3 collision where both E_k and momentum are conserved ✓✓ (2)

[21]

Question 5

5.1 $(E_k + E_p)_B = (E_k + E_p)_C$ ✓

$$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv^2 + mgh$$

$$\frac{1}{2}(67)v_B^2 + 0 = 0 + 67 \times 9,8 \times 1,5$$
 ✓

$$v_B = 5,42 \text{ m.s}^{-1}$$
 ✓

fire fighter = f and camera = c

$$p_{\text{(before)}} = p_{\text{(after)}}$$

$$m_f.v_f + m_c.v_c = (m_f + m_c)v$$
 ✓

$$60 \times v_f + 0 = 67 \times 5,42$$
 ✓

$$v_f = 6,05 \text{ m.s}^{-1}$$
 (6)

5.2 In the absence of air resistance or any external forces, the mechanical energy of an object is constant. ✓✓ (2)

5.3. $(E_k + E_p)_A = (E_k + E_p)_B$ ✓

$$\frac{1}{2}mv^2 + mgh = \frac{1}{2}mv^2 + mgh$$

$$0 + (60 \times 9,8)h = \frac{1}{2}(60)(6,05)^2 + 0$$
 ✓

$$h = 1,87 \text{ m}$$
 ✓

5.4. Power ✓ ACCEPT RATE (1)

5.5. $E_p = mgh$ ✓

$$= 50 \times 9,8 \times 10$$
 ✓

$$= 4900 \text{ J}$$
 (3)

5.6. $P = \frac{W}{t}$ ✓

$$= \frac{4900}{60}$$
 ✓

$$= 81,67 \text{ W}$$
 (3)

5.7. $P = V.I \checkmark$

$$81,67 = 240.I \checkmark$$

$$I = 0,34 \text{ A } \checkmark \quad (3)$$

[21]

Question 6

6.1 Every particle with mass 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 distance between their centres. ✓ (2)

6.2. $FES = G \frac{m_E.m_S}{r^2} \checkmark$

$$= 6.7 \times 10^{-11} \frac{5,97 \times 10^{24} \times 1,99 \times 10^{30}}{(1,5 \times 10^{11})^2} \checkmark$$

$$= 3.54 \times 10^{22} \text{ N attraction. } \checkmark \text{ -1 IF NO DIRECTION} \quad (3)$$

6.3. $FEM = G \frac{m_E.m_M}{r^2}$

$$= 6.7 \times 10^{-11} \frac{5,97 \times 10^{24} \times 7,35 \times 10^{22}}{(3,844 \times 10^8)^2} \checkmark$$

$$= 1.99 \times 10^{20} \text{ N attraction}$$

$F_{net} = FES + FEM$

$$= -3.54 \times 10^{22} + 1.99 \times 10^{26} \checkmark \quad (5)$$

$$= 3,52 \times 10^{22} \text{ N } \checkmark \text{ towards the sun. } \checkmark$$

6.4. A to B✓ (1)

6.5. $Q_{new} = \frac{QA + QB}{2} \checkmark$

$$+1 \times 10^{-9} = \frac{-4 \times 10^{-9} + QB}{2} \checkmark$$

$$Q_B = +6 \times 10^{-9} \text{ C } \checkmark \quad (3)$$

6.6 Force per unit positive charge✓ (2)

6.7. $E_{net} = E_1 + E_2$

$$2500 = k \frac{Q}{r^2} + k \frac{Q}{r^2} \checkmark \text{ formula}$$

$$2500\sqrt{=} 9 \times 10^9 \frac{1 \times 10^{-9}}{0,01^2} \sqrt{+} 9 \times 10^9 \frac{Q}{0,005^2} \sqrt{}$$

$$Q_C = -2,43 \times 10^{-10} \text{ C} \sqrt{\quad} \quad (5)$$

[21]**Question 7**

7.1. Some of the energy is used to overcome internal resistance, this is called lost volt. $\sqrt{\quad}$ (1)

7.2. Current through a conductor is directly proportional to the potential difference across the conductor at (constant temperature). $\sqrt{\quad}$ (2)

7.3. $P = R \cdot I^2 \sqrt{\quad}$

$$150 = 10 \cdot I^2 \sqrt{\quad}$$

$$I = 3,87 \text{ A} \sqrt{\quad}$$

$$V_{\text{radio}} = I \cdot R$$

$$= 3,87 \times 10$$

$$= 38,7 \text{ V} \sqrt{\quad}$$

(3)

7.4. $r = \frac{V_{\text{lost}}}{I} \sqrt{\quad}$

$$= \frac{50 - 48,5}{3,87} \sqrt{\quad}$$

$$= 0,39 \Omega \sqrt{\quad}$$

$$V_{\text{parallel}} = V_{\text{total}} - V_p$$

$$= 48,5 - 38,7$$

$$= 9,8 \text{ V} \sqrt{\quad}$$

(3)

$$R_p = \frac{V}{I}$$

$$= \frac{9,8}{3,89}$$

$$= 2,53 \Omega \sqrt{\quad}$$

7.5. $\text{emf} = I (R + r) \sqrt{\text{coe}}$

$$50 = 3,87 (R + 0,39) \sqrt{\quad}$$

$$R_{\text{ext}} = 12,5298 \Omega$$

OR

$$R_t = R_s + R_p$$

$$12,5298 = 10 + R_p \sqrt{\quad}$$

$$R_p = 2,5298 \Omega$$

$$\frac{1}{R_p} = \frac{1}{R_1 + R_2} + \frac{1}{R_3} \sqrt{\quad}$$

$$\frac{1}{2,5298} = \frac{1}{2 + R} + \frac{1}{7}$$

$$R = 1,96 \Omega \sqrt{\quad} \quad (5)$$

7.6. increase✓

- the total resistance will increase. ✓
- the total current will decrease, because current is inversely proportional to resistance. ✓
- Lost volt will decrease, since emf is constant, external voltage which is the reading on the voltmeter will increase. ✓

7.7. $Q = I \cdot t$

$$= (3,87) (60 \times 60) \checkmark$$

$$= 13932 \text{ C} \checkmark \quad (3)$$

7.8. $\text{cost} = P \times t \times \text{price} \checkmark$

$$= \frac{150}{1000} \checkmark \times (3 \times 30) \times 1.30 \checkmark$$

$$= \text{R } 17.55 \checkmark \quad (4)$$

[25]

Question 8		
8.1.	Slip rings ✓	(1)
8.2	Mechanical energy ✓ to electrical energy ✓	(2)
8.3	DCBA	(2)
8.4	Stronger magnets More windings on the coil Faster rotation of the coil ✓ ✓ any 2	(2)
8.5	The emf induced is directly proportional to the rate of change in magnetic flux. ✓ ✓	(2)
8.6.1	Minimum ✓	(1)
8.6.2	Maximum ✓	(1)

8.6.3	Maximum ✓	(1)
8.7	Less time ✓ Emf is inversely proportional to time ✓ Emf more ✓	(3)
8.8	COE vanaf 8.6 8.8	(3)
8.9.1	AC in the primary coil creates a changing magnetic field ✓ around secondary coil ✓ Magnetic flux passing through secondary coil is changing ✓ Emf is induced in secondary coil ✓ Voltage is stepped up, induced emf is directly proportional to number of turns ✓	4
8.9.2	8.9.2 	2
		[18]

Question 9

9.1.1 $4.3 \times 1.6 \times 10^{-19} = 6.88 \times 10^{-19} \text{ J}$ ✓ ✓ (2)

9.1.2 $E = hc / \lambda = 6.6 \times 10^{-34} \times 3 \times 10^8 / (200 \times 10^{-9}) = 9.9 \times 10^{-19} \text{ J}$ ✓ (3)

9.1.3 Since $E > W_0$, ✓ electrons will be emitted from the surface of the zinc metal. ✓
The electroscope becomes less negative ✓ so the force of repulsion between the leaves decreases and they collapse. ✓ (4)

9.2.1 Minimum frequency of incident radiation at which electrons will be emitted from a particular metal. ✓✓ (2)

9.2.2 $E_{\text{red photon}} = hc / \lambda = 6.6 \times 10^{-34} \times 3 \times 10^8 / (658 \times 10^{-9}) = 3 \times 10^{-19} \text{ J}$ ✓

$\Delta E_A = (-1.52 - (-3.4)) \times 1.6 \times 10^{-19} = 3 \times 10^{-19} \text{ J}$ ✓ $\Delta E_B \neq 3 \times 10^{-19} \text{ J}$

∴ A results in the red photon. ✓ (5)

[16]