

QUESTION 1

- 1.1 A ✓✓
1.2 D ✓✓
1.3 C ✓✓
1.4 B ✓✓
1.5 C ✓✓
1.6 B ✓✓
1.7 C ✓✓

[14]

QUESTION 2

- 2.1 If a net force acts on a body the body accelerates in the direction of the net force. ✓✓
The acceleration is directly proportional to the net force and inversely proportional to the mass of the body. ✓✓

2.2



- ✓ (force)
✓ (any 2 correct)
✓ (any 2 correct) ✓✓

2.3 $F_g = mg$ ✓

$$= (0,0470 \text{ kg})(9,81 \text{ m/s}^2)$$

$$= 0,461 \text{ N} \quad \checkmark$$

2.4 $F_{\text{net}} = ma$ ✓

$$T + (4,2) + (0,461) = ma$$

$$(10) - (2)(9,81 \text{ m/s}^2) = 2a$$

$$a = 0,1 \text{ m/s}^2$$

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

$$F_{\text{net}} + (4,2) + (0,461) + (0,7) = ma$$

$$25,0 - 20 - (2)(9,81 \text{ m/s}^2) - T = 4a$$

$$25,0 - T = 4a$$

$$2T - 25,0 = 24,2 - T \quad \checkmark \quad \text{(Manipulation and equating)}$$

$$T = 24,6 \text{ N} \quad \checkmark$$

(4)

[14]

QUESTION 3

- 3.1 In an isolated system the total linear momentum remains constant in both magnitude and direction. ✓✓

3.2 sum of p before = sum of p after

$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$(40)(10) + (20)(0) = (40 + 20)(4,5)$$

$$v_2 = 5,33 \text{ m/s} \quad \checkmark$$

3.3 $\Delta p = \Delta p_1$ ✓

$$\Delta p_1 = \Delta p_2 = \Delta p$$

$$= (140)(4,5) - (150)(0)$$

$$= 630 \text{ N} \cdot \text{s} \quad \checkmark$$

[10]

QUESTION 4

4.1 The work done by a conservative force is not path dependent. ✓✓

4.2 Force of gravity ✓✓

4.3 The net work done on an object is equal to its change in kinetic energy. ✓✓

The work done on an object by the net force is equal to its change in kinetic energy.

4.4 $W_{\text{net}} = \Delta K$ ✓

$$W_{\text{spring}} + W_{\text{grav}} + W_{\text{net}} = \Delta K = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2$$

$$277 \text{ J} + 0 + F_{\text{spring}} \Delta x_{\text{spring}} + F_{\text{net}} \Delta x_{\text{net}} = \frac{1}{2}(3000)(10)^2 - \frac{1}{2}(3000)(0)^2$$

$$277 \text{ J} + 0 + (2000)(1,0) + \sin(30^\circ)(\Delta x)(\cos 180^\circ) + 2545(\Delta x)(\cos 180^\circ) = 15000 \text{ J}$$

$$277 \text{ J} + 0 - 14700 \Delta x - 2545 \Delta x = 15000$$

$$\Delta x = 0,5 \text{ m} \quad \checkmark$$

4.5 $F = \frac{W}{\Delta x} = \frac{277 \text{ J}}{0,5 \text{ m}} = 554 \text{ N} \quad \checkmark$

[14]

QUESTION 5

5.1



✓ (F_g smaller in length than F_string) ✓✓

5.1.1 $a = a_0 + \Delta a$ ✓ or $\Delta a = a_0 + \frac{1}{2}at^2$ ✓ or $v^2 = v_0^2 + 2ay$ ✓

$$0,12,0 = 0 + a(2)$$

$$a = 0,6 \text{ m/s}^2 \quad \checkmark$$

5.1.2 $\Delta y = v_0 t + \frac{1}{2}at^2$ ✓

$$-0,12,0 = 0 + \frac{1}{2}(0,6)t^2$$

$$4,80t^2 - 0,12,000 - 0,12,0 = 0$$

$$\Delta t = 24,87 \text{ s} \quad \checkmark$$

$$\Delta x_{\text{max}} = 24,87 \text{ s} + 4 = 28,87 \text{ s} \quad \checkmark \quad \text{(4 - for adding 4 s)} \quad \checkmark$$

5.2



- ✓ (area labelled correctly)
✓ (all v and dt - values correctly)
✓ (shape first 4 s)
✓ (shape 4 s to 28,87 s) ✓✓

[14]

QUESTION 6

6.1 The Doppler effect ✓✓

6.2 $\Delta f = \frac{v}{\lambda}$ The observed frequency is higher than the actual frequency. ✓✓

$$\Delta f = \frac{v}{\lambda} \Delta \lambda$$

$$\Delta f = \frac{v}{\lambda} \Delta \lambda$$

$$940 \quad \checkmark = \frac{340}{\lambda} (944,3 - \lambda)$$

$$940\lambda = 340(944,3 - \lambda)$$

$$940\lambda = 321062$$

$$\lambda = 341,55 \text{ m} \quad \checkmark$$

[10]

QUESTION 7

7.1 The electrostatic force between two charges is directly proportional to the product of the charges and inversely proportional to the squared distance between the charges. ✓✓

$$F = \frac{kq_1 q_2}{r^2}$$

$$= \frac{(9 \times 10^9)(2,0 \times 10^{-6})(3,0 \times 10^{-6})}{(0,02)^2}$$

$$= 1,35 \times 10^{-1} \text{ N} \quad \checkmark$$

$$7.2.1 F = \frac{kq_1 q_2}{r^2}$$

$$F = \frac{(9 \times 10^9)(2,0 \times 10^{-6})(3,0 \times 10^{-6})}{r^2}$$

$$= 45000 \text{ N/C} \quad \checkmark$$

$$7.2.2 F = \frac{kq_1 q_2}{r^2}$$

$$= 45000 \text{ N/C} \quad \checkmark$$

$$7.2.3 F_{\text{net}} = 45000 \text{ N} + 45000 \text{ N}$$

$$F_{\text{net}} = 90000 \text{ N} \quad \checkmark$$

✓

[10]

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