



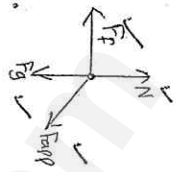
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Question 1 [20]

- 1.1 A ✓ 1.2 D ✓ 1.3 B ✓ 1.4 B ✓ 1.5 B ✓
1.6 A ✓ 1.7 D ✓ 1.8 B ✓ 1.9 A ✓ 1.10 B ✓

Question 2 [19]

2.1.1

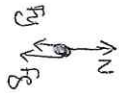


(4)

2.1.2 Yes. Constant vel means $\vec{a} = 0$. $\vec{F}_N = m\vec{a}$. $\vec{F}_{net} = 0$. (2)

2.1.3

$$F = \mu N$$



$$F_N = ma$$

$$F_x - F_f = ma$$

$$F \cos \theta - F_f = ma$$

$$40 \cos 30 - F_f = 0$$

$$N = F_g + F_g$$

$$= F_g \sin \theta + mg$$

$$= 40 \sin 30 + 2(9.8)$$

$$F = \mu N$$

$$34.64 = \mu 39.6$$

$$\mu = 0.87$$

2.2.1 $F_{grav} = mg$

$$= (80)(9.8)$$

$$= 784 \text{ N}$$

$$F_{net} = \frac{G^3 m_1 m_2}{r^2}$$

2.2.2 Equal to. (2)

$$= 12(784)$$

$$= 9408 \text{ N}$$

Question 3 [16]

- 3.1 Up ✓
3.2 Once ✓
3.3.1 $V_i = ?$
 $a = -9.8$
 $V_f = 0$
 $t = 0.78$

$$V_f = V_i + a \Delta t$$

$$0 = V_i + (-9.8)(0.78)$$

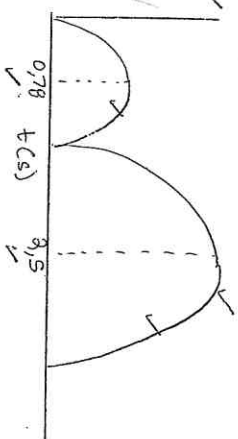
$$V_i = 7.64 \text{ m.s}^{-1}$$

$$V_f = V_i + a \Delta t$$

$$0 = V_i + (-9.8)(0.94)$$

$$t = 0.94$$

3.4 Δx (m)



axes ✓
times ✓
1st jump ✓
2nd jump ✓

Question 4 [15]

4.1.1 In an isolated system total linear momentum is conserved. (1)

$$\sum p_b = \sum p_a$$

$$m_1 V_1 + m_2 V_2 = (m_1 + m_2) V$$

$$(30)(2) + 0 = (30 + 24) V$$

$$V = 1.1 \text{ m.s}^{-1}$$

4.2.1 Independent - type of falling tool. Dependent - distance travelled (2)

4.2.2 the force which each girl imports. (or any other reasonable) (1)

4.2.3 What how does the type of falling tool affect how far a ball travels? (2)

$$F_N = m(V_f - V_i)$$

$$= 0.1(-7 - 3)$$

$$= -1 \text{ N}$$

$$= 1 \text{ N (left)}$$

Question 5 [23]

S.1.1 In an isolated system ...

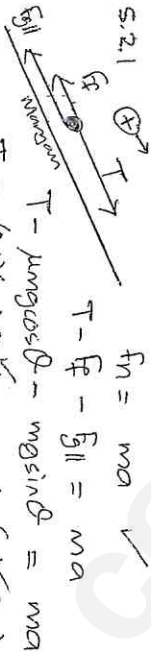
$$S.1.2 \quad M_{E \text{ top}} = F_p + F_r = mgh + \frac{1}{2}mv^2 = mgh + 0$$

$$= 3(9.8)(20) = 588 \text{ J}$$

$$M_{E \text{ bot}} = mgh + \frac{1}{2}mv^2$$

$$= (20)(9.8)(0.5) + \frac{1}{2}(20)(6)^2 = 458 \text{ J}$$

$$W_f = 588 - 458 = 130 \text{ J}$$



$$F_n = ma$$

$$T - F_g - F_{||} = ma$$

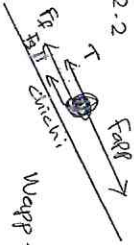
$$T - \mu mg \cos \theta - mg \sin \theta = ma$$

$$T - (0.1)(28)(9.8) \cos 30 - (28)(9.8) \sin 30 = 0$$

$$T - 23.76 - 137.2 = 0$$

$$T = 160.96 \text{ N}$$

S.2.2



$$W_n = \Delta E_k$$

$$W_{app} + W_T + W_f + W_n = \Delta E_k$$

$$W_{app} + F_f \Delta x \cos \theta + F_g \Delta x \cos \theta + F_n \Delta x \cos \theta = 0$$

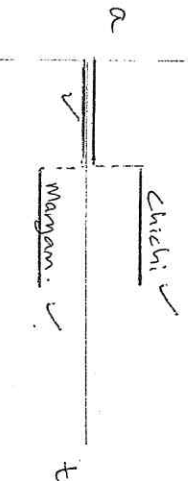
$$W_{app} + F_f \Delta x \cos \theta + (\mu mg \cos \theta) \Delta x \cos \theta + (mg \sin \theta) \Delta x \cos \theta = 0$$

$$W_{app} + (160.96)(10) \cos 180 + [(0.1)(28)(9.8) \cos 30][10 \cos 180 + (28)(9.8) \sin 30] = 0$$

$$W_{app} - 1609.6 - 220.66 - 1274 = 0$$

$$W_{app} = 3104.26 \text{ J}$$

S.2.3



(3)

Question 6 [13]

6.1.1 Charged bodies ...

$$6.1.2 \quad F = \frac{kQ^2}{r^2} \quad F^2 = kQ^2, \quad k = \frac{F^2}{Q^2}$$

$$\therefore k = \text{gradient} = \frac{1.9 - 0}{20 \times 10^{-12}} = \frac{9.5 \times 10^9 \text{ Nm}^2 \text{C}^{-2}}{20 \times 10^{-12}}$$

$$6.2 \quad E_q = \frac{kQ}{r^2} = \frac{(9 \times 10^9)(20 \times 10^{-6})}{(6)^2} = \frac{5000 \text{ N.C}^{-1} \text{m}^2}{\text{m}^2}$$

$$E_{q1} + E_{q2} = 8500$$

$$5000 + E_{q2} = 8500$$

$$E_{q2} = 3500$$

$$kQ/r^2 = 3500$$

$$\frac{9 \times 10^9 Q}{(4)^2} = 3500$$

$$Q = 6.22 \mu\text{C}$$

$$6.22 \times 10^{-6} \text{ C}$$

Question 7 [12]

7.1.1 Doppler effect is the

change in frequency of the sound detected by the listener, due to the sound source & listener relative to each other.

$$7.1.2 \quad f_L = \left(\frac{v + v_L}{v - v_S} \right) f_s$$

$$f_L = \left(\frac{v - v_L}{v + v_S} \right) f_s$$

$$f_L = \left(\frac{343 + 0}{343 - 4} \right) f_s$$

$$f_L = \left(\frac{343 - 0}{343 + 4} \right) f_s$$

$$\frac{343 f_s}{339} - \frac{343 f_s}{347} = 20$$

$$f_s = 857.38 \text{ Hz}$$

7.2.1 Moving away, wavelength $\uparrow$, frequency $\downarrow$

7.2.2 Red shift.

QUESTION 8 [20]

8.1 Power is the rate at which work is done ✓ (2)

8.2 $P = VI$ ✓

$60 = 24 I$ ✓

$I = 2,5 A$ ✓ (3)

8.3 the pd across a resistor is directly prop to current, provided temperature remains constant. ✓ (2)

~~8.4.1~~

8.4.1 $V = IR = (3,5)(7) = 17,5 V$ (3)

~~8.4.2~~

8.4.2 $V = IR, I = \frac{V}{R} =$
 $V = 24 - 17,5 = 6,5 V$ (2)

8.5 $I = \frac{V}{R} = \frac{6,5}{3} = 2,166 A$

$\therefore$ Current thro' R = $2,166 = 2,166 A$ (5)

~~8.6~~

$R = \frac{V}{I}$ ✓
 $= \frac{6,5}{0,334} = 19,46 \Omega$ (3)

Question 9 [12]

9.1 $C = f \lambda$ ✓ $3 \times 10^8 = f(260 \times 10^{-9}) = 1,15 \times 10^{15} Hz$ (3)

9.2 $E = hf = (6,6 \times 10^{-34})(1,15 \times 10^{15}) = 7,61 \times 10^{-19} J$ (3)

9.3 no of $e^- = \frac{3,044 \times 10^{-18}}{7,61 \times 10^{-19}} = 4 e^-$ ✓ (2)

~~9.4~~

$Q = It$ ✓
 $I = \frac{Q}{t} = \frac{(4)(1,6 \times 10^{-19})}{1}$
 $= 6,4 \times 10^{-19} A$ ✓ (4)