Physics Upthrust DP014

1) a) $450\ g\ cm^{-3} = 450 \times 10^{-3}\ (\times 10^{-2})^{-3}$ G1

$= 450 \times 10^{3}\ kg\ m^{-3}$

@ Jul

$= 4.5 \times 10^{5}\ kg\ m^{-3}$

b) $\Sigma S_x = 145 \sin 20^\circ + 105 \cos 35^\circ = 135.6\ m$ G1

$\Sigma S_y = 145 \cos 20^\circ - 105 \sin 35^\circ = 76.1\ m$ G1

magnitude : $S_R = \sqrt{(\Sigma S_x)^2 + (\Sigma S_y)^2}$ K1

$= \sqrt{(135.6)^2 + (76.1)^2}$

$= 155.46\ m$ GJul

direction : $\theta = \tan^{-1} \frac{\Sigma S_y}{\Sigma S_x}$ K1

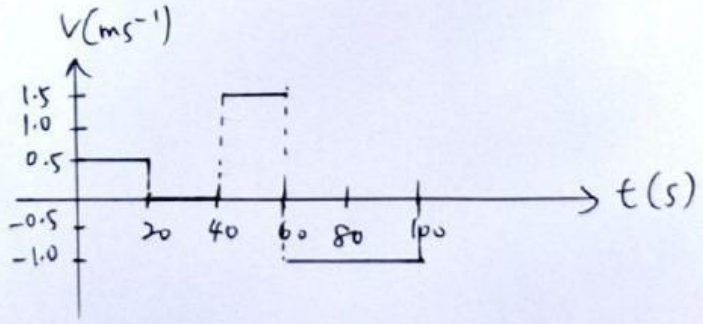
$= \tan^{-1} \frac{76.1}{135.6} = 29.30^\circ$ GJul

(above positive x-axis)

2) a) i.) $V_{avg} = \frac{\Delta s}{\Delta t} = \frac{0-10}{100-40}$ G1

$= -0.167\ ms^{-1}$ Jul

a) (ii.)



D1 correct axis & unit

D1 correct pattern / shape graph

D1 correct value time on x-axis

b) i.) $s = \frac{1}{2}(u+v)t$

$= \frac{1}{2}(0+30)t$ G1

$= 150\ m$ Jul

LIVEWORKSHEETS

2) b) (ii.) $v = u + at$

$30 = 0 + a(10)$

$a = 3\ ms^{-2}$

$v^2 = u^2 + 2as$

$15^2 = 5^2 + 2(3)s$

$s = 33.33m$ GJul

c) i.) max height, $v = 0$ K1

$v^2 = u^2 - 2gs$

$0^2 = u^2 - 2(9.81)(15)$

$u = 17.16\ ms^{-1}$ GJul

ii.) $s = 0$ K1

$s = ut - \frac{1}{2}gt^2$

$0 = 17.16t - \frac{1}{2}(9.81)t^2$

$t = 3.5s$ GJul

3) a) i.) Impulse = area under F-t graph K1

$J = \frac{1}{2}(1+5)(20)$

$= 60\ Ns$ or $kg\ ms^{-1}$ GJul

ii.) $J = \Delta p$

$J = m(v-u)$

$60 = 0.2(v-0)$ G1

$v = 300\ ms^{-1}$ Jul

LIVEWORKSHEETS

3) (b) x-axis : $\Sigma P_i = \Sigma P_f$ K1

$m_1u_1\cos 0 + 0 = m_1v_1\cos 53^\circ + m_2v_{2x}$

$0.2(2) = 0.2(1)\cos 53^\circ + 0.3v_{2x}$

$v_{2x} = 0.932$ ——— (1) G1

y-axis : $m_1u_1\sin 0 + 0 = m_1v_1\sin 53^\circ + m_2v_{2y}$

$0 = 0.2(1)\sin 53 + 0.3v_{2y}$

$v_{2y} = -0.532$ — (2) G1

$v = \sqrt{v_x^2 + v_y^2}$

$= \sqrt{(0.932)^2 + (-0.532)^2}$

$= 1.07\ ms^{-1}$ G Ju1

$\tan\theta = \frac{0.532}{0.932} = 0.571$

$\theta = 29.72^\circ$ (accept θ-ve) G Ju1

4) a) i.)



4 correct labels & directions : 3 marks

3 correct labels & directions : 2 marks

2 correct labels & directions : 1 marks

ii.) $\Sigma F_y = 0$

$N - W\cos\theta = 0$

$N = mg\cos 30^\circ$

$= (3)(9.81)\cos 30^\circ$ G1

$= 25.49\ N$

$\Sigma F_x = 0$

$W\sin\theta + f - f_s = 0$

$(3)(9.81)\sin 30^\circ + F - \mu_s N = 0.$

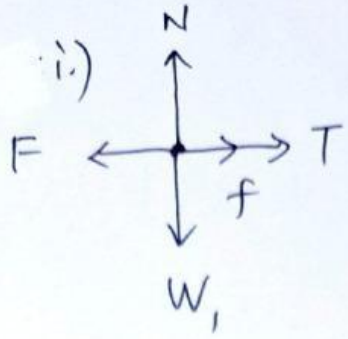
$14.715 + F - 0.8(25.49) = 0$

G1

$F = 5.67\ N$ Ju1

LIVEWORKSHEETS

4) b) i.)



mass 1

D3 (all 5 forces are correct with correct arrows & labels)

D1 (all 2 forces are correct with correct arrows & labels)



mass 2

ii.) $\Sigma F_y = ma$ K1

$T - W_2 = m_2 a$

$25 - 2(9.81) = 2a$

$a = 2.69\ ms^{-2}$ GU1

LIVEWORKSHEETS

5) a) $w = 900 \text{ rpm} = \frac{900 \times 2\pi}{60}$

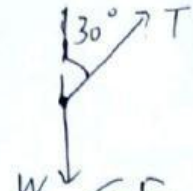
$= 30\pi \text{ rads}^{-1}$ @ 94.25 rads^{-1} G Jul

$w = 2\pi f$

$30\pi = 2\pi f$

$f = 15 \text{ Hz}$ G1 Jul

b) i.)



$\Sigma F_y = 0$ K1

$T\cos 30^\circ = mg$

$T = \frac{50 \times 10^{-3}(9.81)}{\cos 30^\circ}$ G1

$= 0.57N$ Jul

ii.) $\Sigma F_x = ma_c$ K1

$T\sin 30^\circ = \frac{mv^2}{r}$

$v = \sqrt{\frac{3 \times \sin 30^\circ (0.57) \sin 30^\circ}{50 \times 10^{-3}}}$ G1

$= 2.92 \text{ ms}^{-1}$ Jul

6) a) $w = \frac{2400 \times 2\pi}{2 \times 60} = 125.66 \text{ rads}^{-1}$ K1

$v = rw$

$= 0.03(125.66)$ G1

$= 3.77 \text{ ms}^{-1}$ Jul

b) i.) $\alpha = \frac{w - w_0}{t}$

$= \frac{90 - 60}{5}$ G1

$= 6 \text{ rads}^{-2}$ Jul

LIVEWORKSHEETS

6) b) (ii.) $\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$= 60(5) + \frac{1}{2}(6)(5)^2$ G1

$= 375$ rad Ju1

(iii.) $n = \frac{375}{2\pi} = 59.68$ revolutions GJu1

c) i.) $\tau = rF\sin\theta$

$\tau_1 = 0.5(10)\sin 90 = 5$ Nm GJu1

$\tau_2 = -0.2(30)\sin 90 = -6$ Nm GJu1

ii.) $\Sigma\tau = \tau_1 + \tau_2 + \tau_{mg}$

$= 5 + (-6) + 2(9.81)(0.1)\sin 90^\circ$ G1

$= 0.962$ Nm (anticlockwise) Ju1

7) a) $\Delta T = 30 - 120 = -90^\circ C$ K1

$\frac{Q}{t} = -kA\frac{\Delta T}{L}$

$= -(390)(4\times10^{-4})\left(\frac{-90}{0.6}\right)$ G1

$= 23.4\ Js^{-1}$ Ju1

b) i.) at 27°C, $V_{rms} = \sqrt{\frac{3RT}{M}}$

$= \sqrt{\frac{3(8.31)(27+273.15)}{4\times10^{-3}}}$ G1

$= 1367.7\ ms^{-1}$ Ju1

at 53°C, $V_{rms} = \sqrt{\frac{3(8.31)(-53+273.15)}{4\times10^{-3}}}$ G1

$= 1171.4\ ms^{-1}$ Ju1

LIVEWORKSHEETS

7) b) (ii.) $\Delta V_{rms} = V_f - V_i$

$= 1171.4 - 1367.7$

$= -196.3 \ ms^{-1}$ GJul

c) i.) isothermal occurs at constant T, $\Delta U = 0$ J1

ii.) $\Delta U = Q - W$

$0 = Q - 1500$ G1

$Q = 1500 \ J$ Jul

Q positive, heat absorb J1

d) i.)

$Q = -1500 \ J$ or $W = -8000J$ K1

$\Delta U = Q - W$

$= -1500 - (-8000)$ G1

$= 6500 \ J.$ Jul

ii.) $W_{QRP} = W_{QR} + W_{RP}$ K1

$= -8000 + 0$ G1

$W_{QRP} = -8000J$ Jul

LIVEWORKSHEETS