EUNOIA JUNIOR COLLEGE
JC1 Promotional Examination 2018
General Certificate of Education Advanced Level
Higher 2

PHYSICS 9749

MARK SCHEME

Sep/Oct 2018

Paper 1
Multiple Choice

Q	*Key*	*Q*	*Key*	*Q*	*Key*	*Q*	*Key*
1	**B**	6	**C**	11	**C**	16	**D**
2	**C**	7	**C**	12	**A**	17	**C**
3	**C**	8	**C**	13	**C**	18	**A**
4	**D**	9	**A**	14	**C**	19	**D**
5	**C**	10	**C**	15	**C**	20	**A**

1 units must be homogenous

units for pressure = $\dfrac{\text{kg m s}^{-2}}{\text{m}^2} = \text{kg m}^{-1}\ \text{s}^{-2}$

units for density = $\dfrac{\text{kg}}{\text{m}^3} = \text{kg m}^{-3}$

to get units of m s^{-1} ,

has to be of form $\sqrt{\dfrac{\text{pressure}}{\text{density}}}$

2

let $\rho_s - \rho_f = Q$

then $\dfrac{\Delta Q}{Q} = \dfrac{\Delta\rho_s + \Delta\rho_f}{\rho_s - \rho_f}$

and $\mu = \dfrac{5Q}{9v_T}d^2$

$$\begin{aligned}\frac{\Delta\mu}{\mu} &= \frac{\Delta Q}{Q} + \frac{\Delta v_T}{v_T} + 2\frac{\Delta d}{d}\\ &= \frac{\Delta\rho_s + \Delta\rho_f}{\rho_s - \rho_f} + \frac{\Delta v_T}{v_T} + 2\frac{\Delta d}{d}\\ &= \frac{20+10}{1800} + \frac{0.04}{1.60} + 2\frac{0.4}{20.0}\\ &= 8.2\%\end{aligned}$$

3 car experiences forward force from t = 0 till t = C. car experiences braking force from t = D till t = D. Car max speed at C.

4 energy conserved if no air resistance so initial speed = final speed
A is untrue.

Ball 1 goes higher so spends more time in air, must have smaller horizontal speed to travel same horizontal distance

u below are vertical speeds
compare GPE:

$$\frac{\cancel{\frac{1}{2}}mu_1^2}{\cancel{\frac{1}{2}}mu_2^2} = \frac{\cancel{mg}(4y)}{\cancel{mg}\,y}$$

$$\frac{u_1}{u_2} = 2 \ \text{(prove D true)}$$

$$s = ut + \frac{1}{2}at^2$$

$$0 = t\left(u + \frac{1}{2}at\right)$$

$$t = 0 \ \text{ or } \ t = \frac{2u}{g}$$

$$\frac{t_1}{t_2} = 2 \qquad \text{(prove C wrong)}$$

5 car and trailer move with same speed (and acceleration if any)

$$F_{\text{trailer}} = 600 - 400 = 400 \text{ N}$$

$$a_{\text{system}} = \frac{F_{\text{trailer}}}{m_{\text{trailer}}} = \frac{400}{400} = 1 \text{ m s}^{-1}$$

$$= a_{\text{car}}$$

$$F_{\text{car}} = m_{\text{car}} a_{\text{car}} = 1200 \text{ N}$$

6 Consider conservation of horizontal momentum:

$$m_{\text{trolley}} v_{\text{trolley}} = m_{\text{total}} v_{\text{final}}$$

$$(5)(1.25) = (5.35) v_{\text{final}} \quad .$$

$$v_{\text{final}} = 1.17 \text{ m s}^{-1}$$

7 consider extensions separately as the weight manifests as (constant and uniform) tension through both P and Q:

$$x_{\text{P}} = \frac{3}{30}$$

$$x_{\text{Q}} = \frac{3}{10}$$

$$x_{\text{total}} = x_{\text{P}} + x_{\text{Q}}$$

$$= 0.4 \text{ m}$$

OR springs in series so

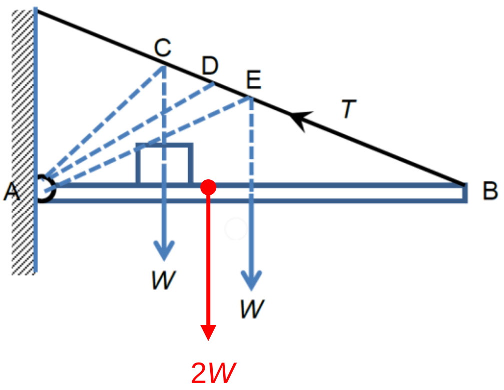
$$\frac{1}{k_{\text{eff}}} = \frac{1}{k_1} + \frac{1}{k_2}$$

$$k_{\text{eff}} = \frac{k_1 k_2}{k_1 + k_2} = \frac{300}{40}$$

$$F = k_{\text{eff}} x_{\text{total}}$$

$$x_{\text{total}} = \frac{F}{k_{\text{eff}}} = \frac{3}{\left(\frac{300}{40}\right)} = 0.4 \text{ m}$$

8 Centre of mass is:



for 3 forces in equilibrium, they pass through common point. D**9** by PCE,

$$\frac{1}{2} \cancel{m} v^2 = \cancel{m} g h$$

$$h = \frac{v^2}{2g}$$

$$\frac{h_{\text{new}}}{h_{\text{old}}} = \left(\frac{0.5v}{v}\right)^2 = 0.25$$

10 by PCE

$$s = ut + \frac{1}{2} a t^2$$

$$1 = 0 + \frac{g}{2} t^2$$

$$t = \sqrt{\frac{2}{g}}$$

$$\langle P \rangle = \frac{\Delta mgh}{t}$$

$$= \frac{5g^{1.5}}{\sqrt{2}}$$

11 less damping so:
graph generally higher than original
peak sharper and higher

12 friction provides centripetal force

13 Consider lift force F_{lift}

vertically:

$$F_{\text{lift}} \sin(60°) = mg$$

$$F_{\text{lift}} \cos(60°) = \frac{mv^2}{r}$$

$$\tan(60°) = \frac{gr}{v^2} = \frac{(9.81)(5000)}{v^2}$$

$$v = 168 \text{ m s}^{-1}$$

14 A is not always false, geostationary orbit is at a fixed height (so fixed potential ϕ but the mass of satellites themselves are different $\text{GPE} = m\phi$

B is not always false due to same reasons of different satellite masses

D is true, they must rotate once in 24h

15 consider change in GPE

$$\phi = -\frac{GM}{r}$$

$$\frac{\phi_{\text{final}}}{\phi_{\text{initial}}} = \frac{r_{\text{initial}}}{r_{\text{final}}} = \frac{1}{2}$$

$$\begin{aligned}\Delta\text{GPE} &= m(\phi_{\text{final}} - \phi_{\text{initial}}) \\ &= (0.5)((-400)-(-800)) \\ &= +200 \text{ kJ}\end{aligned}$$

logic check: mass got "higher" so GPE increases

16 consider phase difference

$$\frac{\Delta\phi}{2\pi} = \frac{\Delta s}{\lambda} = \frac{3}{2}$$

$$\Delta\phi = 3\pi \text{ (anti-phase)}$$

17 position of receiver didn't change so **not** affected by the likes of inverse square law

eg $I \propto \dfrac{1}{r^2}$

$$\begin{aligned}\frac{P_{\text{rcvd, new}}}{P_{\text{rcvd, original}}} &= \left(\frac{I_{\text{new}}}{I_{\text{original}}}\right)\left(\frac{\text{area}_{\text{new}}}{\text{area}_{\text{new}}}\right) \\ &= \left(\frac{x_{0,\text{ new}}}{x_{0,\text{ original}}}\right)^2\left(\frac{\text{area}_{\text{new}}}{\text{area}_{\text{new}}}\right) \\ &= (3^2)(0.5) = \frac{9}{2}\end{aligned}$$

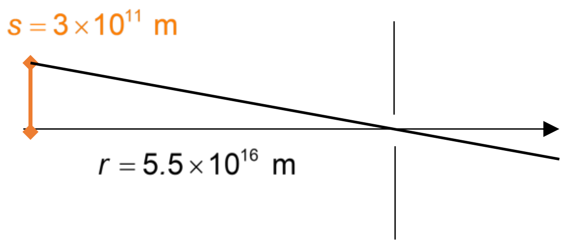
18 **(**definition)

19 double slit so

$$x = \frac{\lambda D}{a}$$

to increase x, can use longer wavelength

20 Rayleigh criteria:



$$\frac{s}{r} \simeq \theta \simeq \frac{\lambda}{b}$$

$$b \approx \frac{r\lambda}{s} = \frac{(5.5\times10^{16})(400\times100^{-9})}{3\times10^{11}}$$

$$\approx 0.1 \text{ m}$$