

Physics May 2016

1a. Density represents the mass per unit volume.

ii. Statue B:

$m = ?$

$$\rho = 2560 \text{ kg/m}^3$$

$$V = 0.027 \text{ m}^3$$

$$\rho = m/V$$

$$V \times \rho = m$$

$$m = 2560 \times 0.027$$

$$m = 69.12 \text{ kg}$$

b. $A = \pi R^2 = \pi \times 0.15^2 = 0.07 \text{ m}^2$

ii. $P = F/A$

$$27500 = F / 0.07$$

$$27500 \times 0.07 = F$$

$$1944 \text{ N} = F$$

$$P_{\text{max}} = 27500 \text{ Pa}$$

$$A = 0.07 \text{ m}^2$$

$$F = ?$$

iii. $m_{\text{of bronze}} = V \times \rho = 0.027 \times 8900 = 2403 \text{ kg}$ $\rightarrow W = 2403 \text{ N}_{\text{bronze}}$

$$W_{\text{of marble}} = 69.12 \times 10 = 691.2 \text{ N}$$

\therefore Statue B

c. $\rho = 1022 \text{ kg/m}^3$

$$P = ?$$

$$h = 1.2 \text{ m}$$

$$P = h \rho g = 1.2 \times 1022 \times 10$$

$$P = 12,264 \text{ Pa}$$

2. $W_{\text{bucket}} = 460 \text{ N}$
 $W_{\text{load}} = 700 \text{ N}$
 $h = 85 \text{ m}$

i. $\text{Work done} = F \times s = (460 + 700) \times 85 = 1160 \times 85$
 $\text{Work done} = 98600 \text{ J}$

ii. kinetic energy + potential energy [heat + sound energy losses]

b.i. $t = 4.2 \text{ sec}$

$s = 85 \text{ m}$

$u = 0$

$a = 10 \text{ m/s}^2$

v

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

$85 = 0 + \frac{1}{2} (10) (4.2)^2$

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

$v^2 = 0 + 2(10)(85)$

$v = \sqrt{1700} = 41.2 \text{ m/s}$

[to check : $s = \left(\frac{u+v}{2}\right) t$
 $85 = \left(\frac{0+v}{2}\right) 4.2$]

$\frac{85}{4.2} = \frac{v}{2}$

$20.2 \times 2 = v$

$40.4 \text{ m/s} = v$

i. $\text{av. speed} = \frac{u+v}{2}$ or $\frac{\text{total distance}}{t}$

$\text{av. speed} = \frac{85}{4.2} = 20.2 \text{ m/s}$

Which would one prefer?

I would prefer the highlighted one, since in this working I used all values he gave me, and since the time given is taking into consideration any energy losses that occurred.

Potential energy \rightarrow kinetic energy \rightarrow heat + sound energy.

3a. Milky way

b. A planet is a celestial body that has cleared the neighborhood around its orbit, while the dwarf planet has not.

Dwarf planet: Pluto

Planet: Mars.

c. Mercury - closest
Neptune - furthest

d. Each planet is orbiting around the Sun, so it depends on its position compared to that of position we are looking from

d. gravity

4a.

Wire colour	Function
Brown	Live
Yellow/green	Earth
Blue	Neutral.

b. $P = 1200 \text{ W}$

$V = 230 \text{ V}$

$I = ?$

$P = IV$

$1200 = I \times 230$

$$\frac{1200}{230} = I$$

$I = 5.2 \text{ A}$

$\therefore 7 \text{ Amp fuse}$

c. $t = 15 \text{ min.} = 15 \times 60 = 900 \text{ s}$ $P = E/t$

$E = ?$

$1200 = E / 900$

$E = 1200 \times 900 = 1,080,000 \text{ J.}$

in 1 day

$E_{\text{1 day}} = 1,080,000 \times 7 = 7,560,000 \text{ J.}$

d. Unit of electricity = kWh.

$P = 1200 \text{ W} = 1.2 \text{ kW.}$

$t = 900 \text{ s} \times 60 / 60 = 0.25 \text{ hr.}$

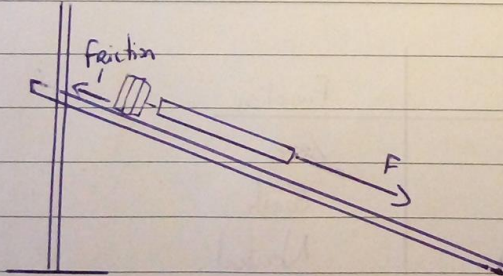
$t_{\text{1 day}} = 0.25 \times 7 = 1.75 \text{ hr.}$

$\therefore 1.2 \times 1.75 = 2.1 \text{ units}$

of electricity

e. Such appliances would have a moulded plastic outer case which insulates it. \therefore No current can flow through the person holding it.

5. a

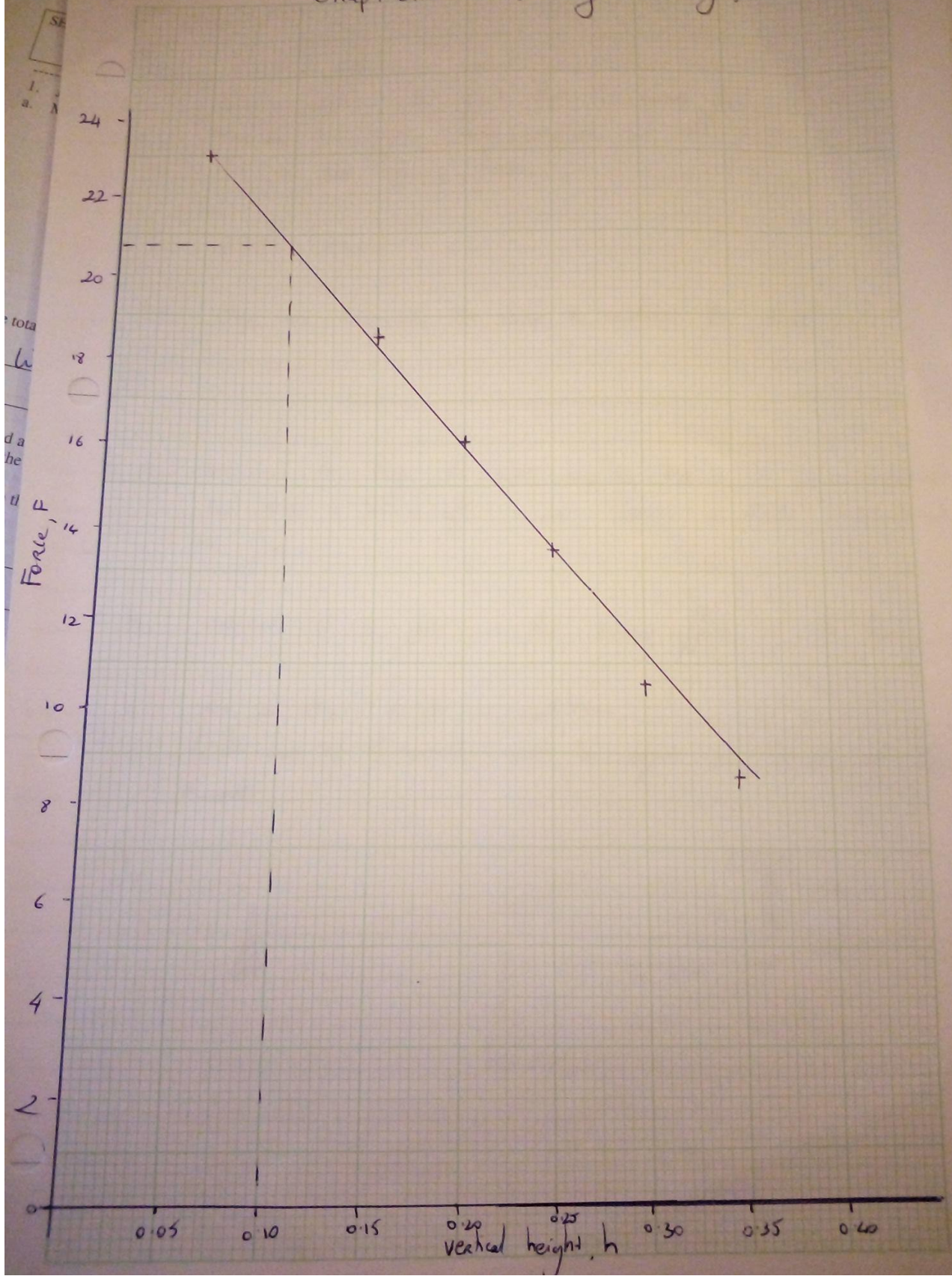


b. on graph paper

c. the force required is inversely proportional to the height.

d. Force of friction is decreasing as the height is increased. this is shown

Graph of force, F against height, h



by the increase in speed.
In other words, the fact that the masses fall in a shorter time as the height increases, implies that the friction is decreasing due to less opposing forces.

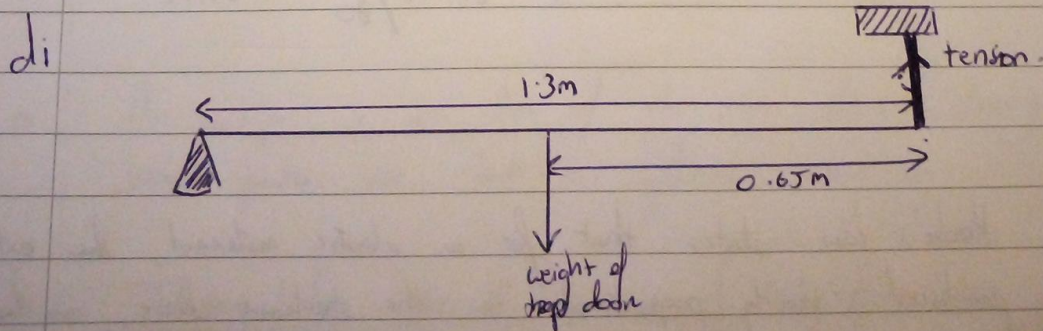
e. 23 N (around).

f. he can lubricate the ramp to reduce the friction.

6. a. because the longer the lever is, the less is the force required to create a turning effect, since distance is ~~directly~~ ^{inversely} proportional to force.

b. moment of a force is the turning effect of the force.

c. for an object to be in equilibrium:
the sum of Σ moment must be equal to the sum of Σ moments.



ii.

horizontal = balanced

∴ since balanced:

↺ moments = ↻ moments

Moment ^{weight of top bar} = Moment ^{line}

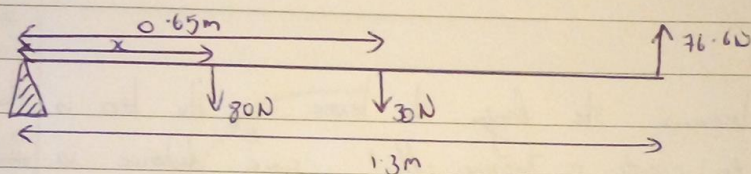
$$(F \times 5)_{\text{down}} = (F \times 5)_{\text{up}}$$

$$30 \times 0.65 = F \times 1.3$$

$$\frac{19.5}{1.3} = F$$

$$F = 15 \text{ N.}$$

iii.



Since balanced: ↺ moments = ↻ moments

Moments ^{down} + Moments ^{down} = Moments ^{line}

$$(x \times 80) + (30 \times 0.65) = (76.6 \times 1.3)$$

$$80x + 19.5 = 99.58$$

$$80x = 99.58 - 19.5$$

$$80x = 80.08$$

$$x = 80.08 / 80 = 1.001 \text{ m.}$$

7a.

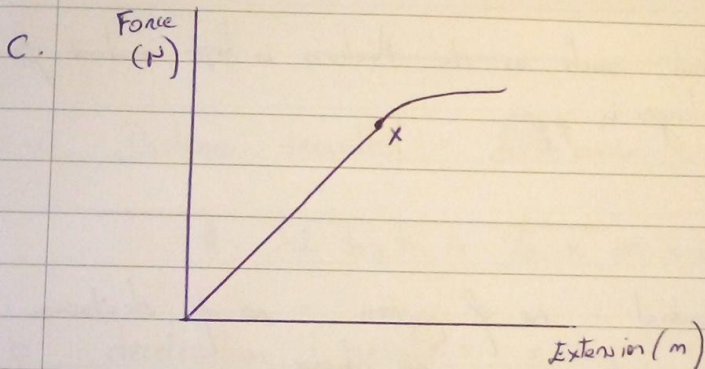
Hooke's law states that for an elastic material, the extension produced is directly proportional to the stretching force, as long as the elastic limit is not exceeded.

b. $4 \text{ cm} = 100 = 0.04 \text{ m}$

ii. $1 \text{ kg} \rightarrow 4 \text{ cm}$ $0.4 \times 3 = 1.2 \text{ cm. mark}$
 $3 \text{ kg} \rightarrow ?$

iii. $1 \text{ kg} \Rightarrow 4 \text{ cm}$ $\frac{15 \times 1}{4} = 3.75 \text{ kg.}$
 $? \rightarrow 15 \text{ cm.}$

$\therefore W = 3.75 \times 10 = 37.5 \text{ N.}$



d. when exceeded, the spring will no longer obey Hooke's law, \therefore it becomes deformed & does not return to original length.

8 a. An isotope is an atom of the same element having the same proton no. but a different mass no.

b.

Isotope	No. of protons	No. of neutrons
$^{13}_6\text{C}$	6	7
$^{14}_6\text{C}$	6	8

c. The source supplied is suspected to emit alpha particles. These are helium particles, have a positive charge and are relatively heavy. Possibly, it is also emitting Beta particles which are electrons, carry a negative charge and have a small mass.

d. Having a short half life means that the time taken for half the atoms in a given sample to decay is short.
 \therefore the radiation will decay in a short time.

e. Quality control such as the thickness is kept constant for glass. To find leakages in pipes.

9.a. electrically neutral : no of protons = no of electrons.
 \therefore no charge.

b.i. The friction between cloth and ruler causes the electrons ^{S²} to move from one object to the other, leaving the plastic ruler with one charge + the cloth with the opposite charge.

b.ii. This happens because the metal is a conductor. So when the ^{charged} plastic ruler is brought close to the metal cap, the electrons in the metal rod move in such a way because of induction. For example, if plastic ruler is positively charged, all electrons move up the metal rod, leaving the bottom part + the thin metal sheet with the same charge (in this example +ve), \therefore since like charges

the thin sheet repels and moves up.

iii. When the ruler is removed, electrons move back to the original distribution and hence the ^{thin} sheet goes back down.

c. Conductors have a no. of free electrons while insulators don't. This makes conductors able to allow electricity and heat to pass/flow through them.

10.a. Distance travelled = ~~dist~~ area under graph.

$$A = \frac{1}{2} b \times h = \frac{1}{2} \times 30 \times \frac{12}{1} = \frac{180}{1} \text{ m}$$

$$\begin{aligned} \text{b. deceleration} &= \text{gradient} = \frac{\Delta y}{\Delta x} = \frac{14^2 - 0}{200 - 230} = \frac{14^2}{-230} \\ &= \frac{196}{-230} \\ &= -0.85 \text{ m/s}^2 \end{aligned}$$

$$\text{c. average speed} = \frac{\text{t. dist.}}{\text{time}} = \frac{4210}{450} = 9.36 \text{ m/s.}$$

$$0 - 230 \rightarrow A = \left(\frac{230 + 180}{2} \right) \times 12 = 2460 \text{ m} =$$

$$230 - 300 \rightarrow 0$$

$$300 - 450 \rightarrow 1750 \text{ m}$$

$$\begin{aligned} \therefore \text{total s} &= 2460 + 1750 \\ &= 4210 \text{ m} \end{aligned}$$

$$\therefore \text{Average speed} = 9.36 \text{ m/s.}$$

d. In reality, the stopping distance is ~~more~~ greater because.
