Topic Test - Waves ① — SHM — waves - basics — Refraction

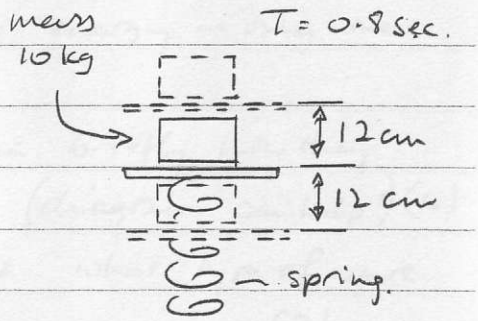
1 of 2

A Physics

1. SHM...

$g_{Earth} = 10\ m/s^2$

a.) Give the basic SHM formula + units + explain all symbols (3)



b) The diagram shows a mass bouncing on a spring. Calculate the frequency (2)

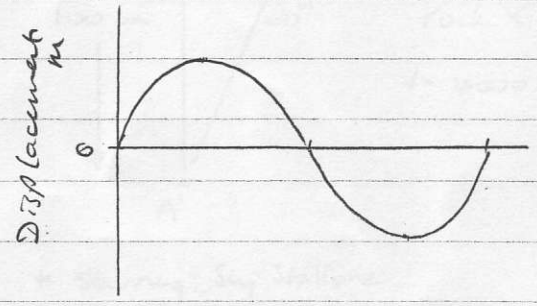
c) Calculate the maximum velocity, + say where it occurs. (3)

d) Calculate the maximum acceleration of the mass, + say where it occurs. (4)

e) Will the mass always stay in contact with the platform? Explain your answer. (2)

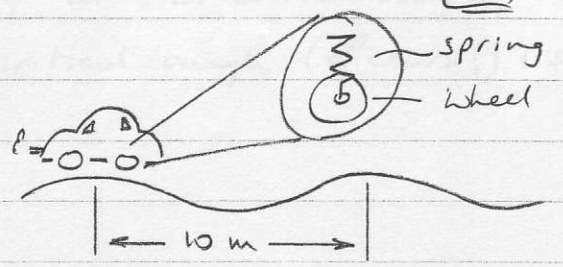
f) Calculate the maximum amplitude for the mass just to stay in contact with the platform (2)

g) The graph shows the variation of position of the platform in 1 cycle. Copy the graph, and add simple scales to the axes. Sketch the variation of velocity on the graph (4)



20

2. A car's suspension has a spring at each wheel. The natural time period of oscillation is 1 second



The car drives along an undulating (wavy) test track. The amplitude of the car's up and down bounces is monitored

a) Sketch the graph you would expect of the variation of amplitude of bounce with car speed. Explain your graph (6)

b) Real cars have damping fitted to the suspension. Explain what this does (2)

c) The car is pushed down and let go when stationary. Sketch a graph to show how the amplitude of bounce varies with time (4)

MN 11.00

Topic Test – Waves ① – SHM waves – refraction

2 of 2

A Physics

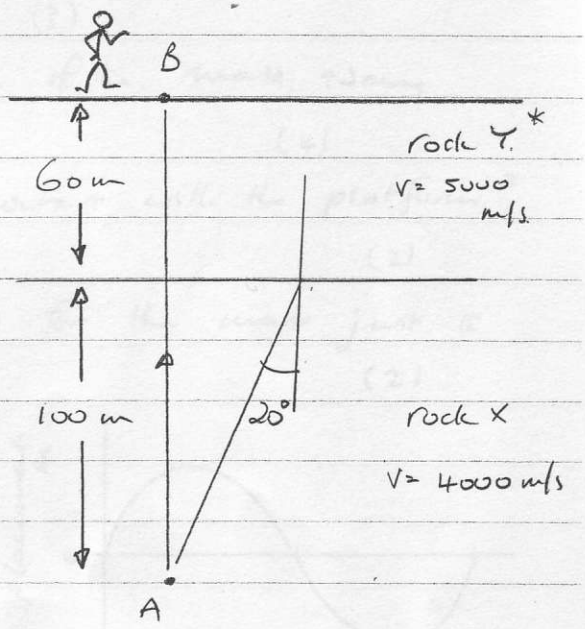
3. Waves

"There are 2 types of waves that carry energy – only one of which can be polarised."

a) Name the 2 types of wave and explain briefly how they carry energy, with 1 example of each. (diagrams can help!) (6)

b) Explain briefly what polarisation is and what type of wave can be polarised. (3)

4 There is an underground explosion at A. The sound (shock) wave travels through rock layers X and Y to the surface



a) Calculate the time taken for the sound to reach B. (3)

b) One wave hits the boundary between X and Y at 20° to the normal. Calculate the angle of refraction (3)

c) Sketch a diagram to show a sound wave hitting the boundary at its critical angle, and where it goes – Calculate the critical angle (of course!) (4)

MN 11.00

Test – Waves ① (SHM – Waves – Refraction)

Answers

A Physics

1. (a) accel. towards centre m/s² ① $a = -\omega^2 x$ — displacement m ① — $\omega = 2\pi f = 2\pi/T$ rad/sec ① ③

b) $f = 1/T$ ① $= 1/0.8 = 1.25$ ① Hz ② ①

c) max. v ... $v_{max} = \omega r$ ① $= \omega A = 2\pi f A = 2\pi \times 1.25 \times 0.12 = 0.94$ m/s

occurs at the centre of oscillation ① ③

d) $a_{max} = -\omega^2 A$ ① $= (2\pi f)^2 A$ ① $= \left(\frac{2\pi}{T}\right)^2 A = \left(\frac{2\pi}{0.8}\right)^2 \times 0.12 = 7.4$ m/s² ①

occurs at top + bottom of oscillation ① ④

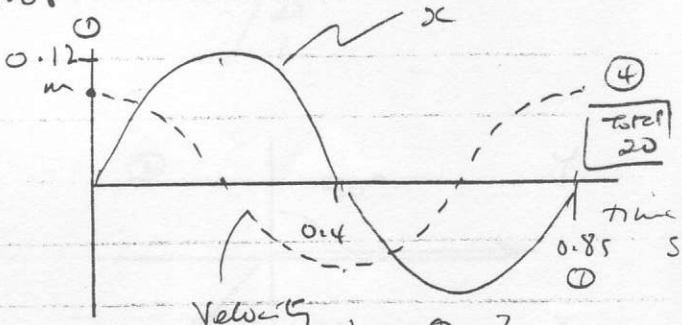
e) yes ① ... because $a_{max} = 7.4$ m/s² $< g = 10$ m/s² ① ②

f) for constant $a_{max} = g$ so $a_{max} = 10 = \left(\frac{2\pi}{T}\right)^2 A = 61.69 \times A$

so max amplitude $A = 10/61.69 = 0.16$ m $= 16$ cm ②

g) scales ①

curve ②



① ④ Total 20

2. a) graph axes ① speed scale ①

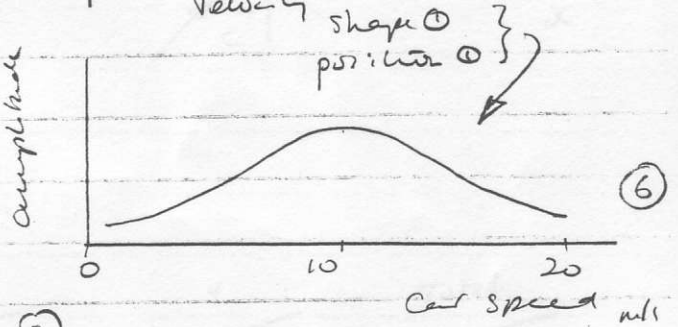
curve – shape ① peak at 10 m/s ①

max amplitude when

frequency of oscillation matches

natural frequency ① of suspension

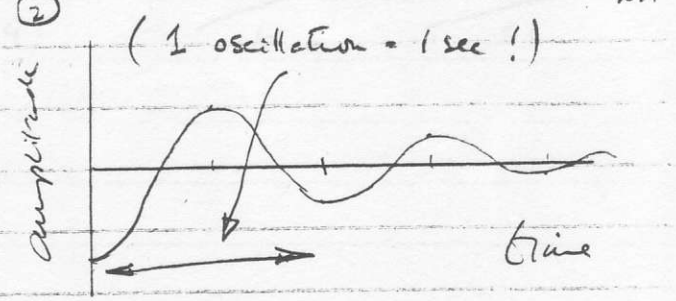
(1 Hz) – system resonates ①



⑥

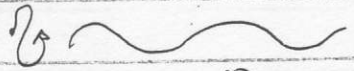
b) damping – oscillating system

loses energy ① ... by friction ① ②



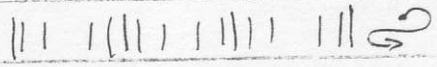
c) axes ① wavy shape ①

amplitude ↓ ① constant time period ① ④

3 a) Transverse – ① 

medium vibrates at 90° ① to energy transmission.

eg EM radiation – any. ①

Longitudinal ① 

medium vibrates along energy direction ① eg sound ⑥

b) Only a transverse wave can be polarised ①

A – unpolarised : medium vibrates in all directions ① B – polarised – 1 direction only ①

③

TJN 11.00

Test – Waves ① Answers – 2½ A Level

4 a) Time $d = vt \rightarrow t = d/v$ ①

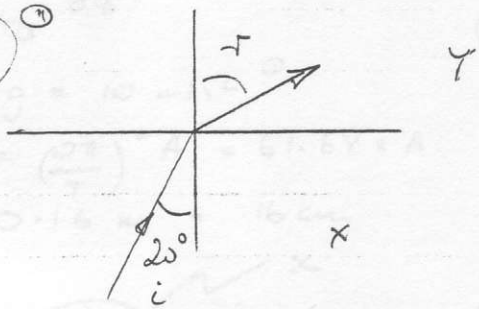
t through x = $\frac{dx}{v_x}$ = 100/4000 = 0.025 s } either ①

t through y = d_y/v_y = 60/5000 = 0.012 s

t total 0.037 s ①

b) ① $\frac{\sin r}{\sin i} = \mu_{Y \rightarrow X} = \frac{v_Y}{v_X} = \frac{5000}{4000} = 1.25$ ①

bigger angle



So $\sin r = 1.25 \times \sin i$

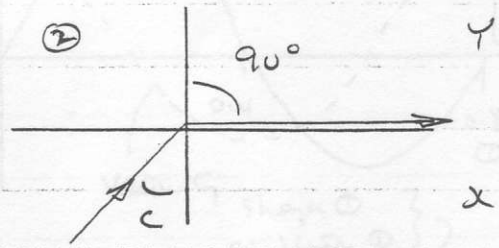
$= 0.4275$

angle $r = 25.3^\circ$ ①

c) $\frac{\sin 90}{\sin c} = \frac{v_Y}{v_X} = 1.25$

$\sin c = \frac{\sin 90}{1.25} = \frac{1}{1.25} = 0.8$ ①

angle $c = 53.1^\circ$ ①



Summary ...

Q	1	2	3	4	Total
	/20	/12	/9	/10	/51