ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

MARKING SCHEME

JUNE 2011

PHYSICS

9188/3

1 (a) (i) Any two with correct units B1

(ii) magnitude and unit/error of the quantity B1

(iii) units have the same meaning everywhere in the world/AW B1

(iv) There is an incorrect coefficient/missing term/extra terms /angles B1

Experimental/Practical verification /AW. B1

(v) Precision: closeness to mean value / close to each other / small deviation / small random error B1

Accuracy: closeness to true value / far from true value B1

Deviation true value is large / large systematic error.

(b) (i) Body changes direction, so there is a resultant force B1B1

(ii) Greatest: tension and weight act against each other but resultant in direction of tension/ $T - mg = \frac{mv^2}{r}$ /AW. M1

Lowest: tension and weight act in same direction/ $T + mg = \frac{mv^2}{r}$ /AW M1

Greatest: vertically below centre /AW – at bottom

Lowest: vertically above centre /AW – at top. A1

(iii) ΔE_k = work done / E_p lost = E_k gained

= F × d B1

F = $\frac{GMm}{R^2}$, (since h <<R) B1

ΔE_k = $\frac{GMmh}{R^2}$, $(d = h)$ AO

(c) (i) 1. Kinetic energy
2. potential energy Both to be correct B1

(ii) 1. $\frac{1}{2}mv^2 = 2.5$

$\therefore v = 50 ms^{-1}$ A1

2. k = ~~$w^2 m$~~ $\omega^2 m$

= $\left(\frac{50}{0.35}\right)^2 \left(2.0 \times 10^{-3}\right)$ C1

= 40.8 Nm^{-1} A1

A – with 1 more s.f.

(iii) Amplitude increases (to a maximum) as frequency approaches natural frequency /ANS B1

Amplitude decreases after resonance /ANS B1

2 (a) (i) Damped – Amplitude decreases with time (till oscillations die) B1

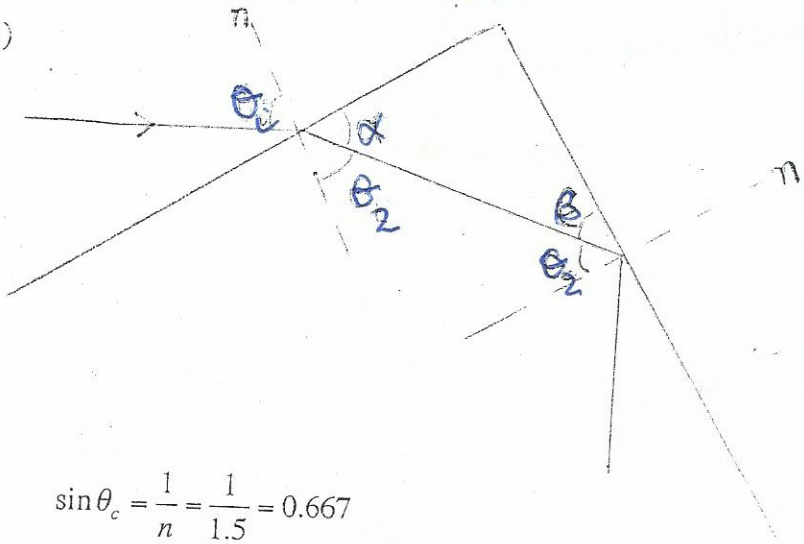
Forced: Amplitude may remain constant since lost energy is replenished with external driving force /ANS B1

If, forcing frequency = natural frequency, **resonance occurs** B1

(ii) Reduces magnitude of amplitude OR Reduces resonance frequency B1

(b) (i) $\frac{\sin i}{\sin r} = \text{constant}$ B1

(ii)



$$\sin\theta_c = \frac{1}{n} = \frac{1}{1.5} = 0.667$$

$\theta_c = 46.5°$ C1

$\beta = 90 - 46.5 = 43.5°$

$\alpha = 180 - (60 + 43.5) = 76.5°$ C1

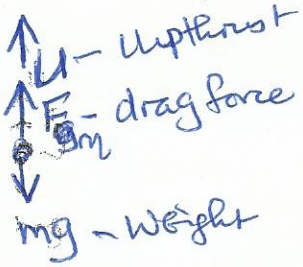
$\theta_i = 90 - 76.5 = 13.5$ C1

$\therefore \frac{\sin\theta i}{\sin\theta t} = n$ C1

$\sin\theta i = 1.5 \times \sin 13.5 = 0.316$

$\theta_i = 20.45°$ A1

3 (a) (i)



forces, directions B1

names of forces B1

(ii) Initially $W > u + F_\eta$ B1

F_η increases with velocity B1

(Until $W = u + F_\eta$)

When $W = u + F_\eta$ then terminal velocity achieved B1

$$\frac{4}{3}\pi r^2 \rho g = \frac{4}{3}\pi r^3 \sigma g + 6\pi\eta r V_t \quad \text{B1}$$

$$V_t = \frac{2r^2(\rho - \sigma)g}{9\eta} \quad \text{A1}$$

ρ – density of steel

σ – density of viscous fluid.

(b) upthrust = weight/weight of displaced fluid C1

$= \rho v g$

$= 860 \times 0.03 \times 0.1 \times 0.1 \times 9.81$ C1

$= 2.53$ N A1

4 (a) (i) *similarity*

- Both involve change of direction of wave B1

– Common point of incidence

– No change of frequency

Difference: reflection – no change of medium
Refraction – change of medium B1

Reflection – No change in energy
Refraction – change in energy

Reflection: No change of speed
Refraction: change of speed.

(ii) Longitudinal: vibrations are parallel to direction of travel of wave B1

(b) (i) Spreading of waves as they pass through an aperture or round an obstacle (of comparable to the wavelength) B1

(ii) 1. Gradient $= \frac{d}{3}$

$n\lambda = d\sin\theta$. $n = 3$

$\frac{\lambda}{\sin\theta} = \frac{d}{n}$ C1

$\frac{6.30 - 4.54}{0.576 - 0.444} = \frac{176}{1.760 \times 10^{-9}}$

$= 0.132$

Gradient calculation C1
With correct substitution

$d = 3.96 \times 10^{-6}$ m A1
OR $N = 252$ lines/mm $\left(\frac{1}{d}\right)$

5 (R) calculations
(R) – Use the graph

OR $d\sin\theta = n\lambda \Rightarrow \sin\theta = \frac{n\lambda}{d} = \frac{3 \times 556 \times 10^{-9}}{3,96 \times 10^{-6}} = \frac{1,68 \times 10^{-8}}{3,96 \times 10^{-6}}$

2. $\sin\theta = 0.521$ ✓
$\therefore \theta = 31.4°$ ✓

$= 0,142$ C1

$\theta = 24,8°$ A1

(c) Reduces the fractional uncertainty of the angle B1

$\theta \Rightarrow 24,8° - 31,4°$