C. B. MUTER (101)

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

JUNE 2012

PHYSICS **9188/3**

1 (a) (i)

For quantity & its base unit

Quantity	Unit
Length	metre
Mass	kilogram
Time	second
Current	Ampere
Temperature	Kelvin
Amount of substance	mole
~~Luminous intensity~~	~~candela~~

6 Pairs correct ≤ 3marks
4–5 Pairs correct → 2marks
3 Pairs correct – 1Mark

3 correct – 1

1mark for base qty and its correct base unit. Max 3.

B3

(ii) *Base unit*: simplest unit of system of measurements from which other units are desired B1

Derived: one which can be expressed as multiple or quotient of base units B1

(iii) units of $\eta = \dfrac{N}{mms^{-1}} = \dfrac{kgms^{-2}}{m^2 s^{-1}}$ C1

$= kgm^{-1} s^{-1}$ A1

(b) (i) acceleration directed towards fixed point B1

acceleration ~~and~~ proportional to displacement B1

(ii) acceleration directly ~~apportioned~~ proportional to displacement from fixed point. * Choice of system

If x = displacement, ℓ = pendulum length and

Spring – mass system or differentiation of $x = x_0 \sin\omega t$ twice.

θ = angular displacement

$F = ma$

$\therefore -mg \sin\theta = ma$ B1

Reject determination from centripetal acceleration.

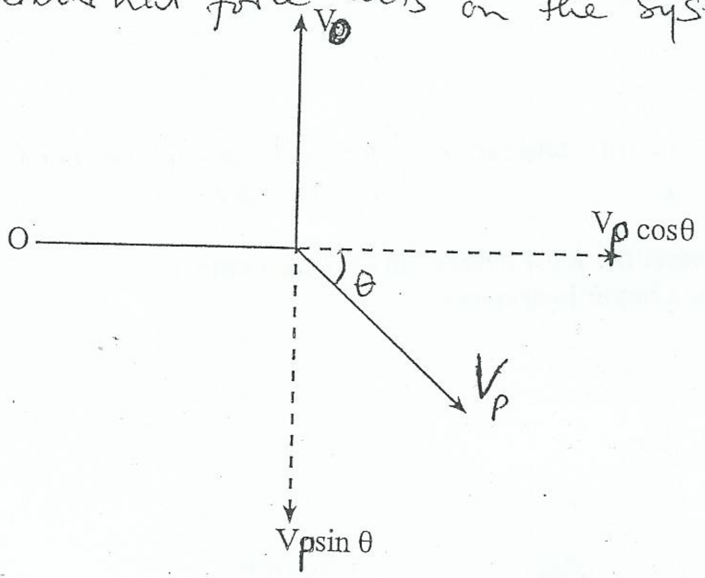
$\theta \to 0, \sin\theta \to \theta$ B1

$\theta = \dfrac{x}{\ell}$ C1

Restoring force = $-\ ma\ =\ mg\frac{x}{\ell}$ B1

a $= -\frac{s}{\ell}x = -w^2x$ ~~B1~~

(c) (i) Total momentum of a system of colliding bodies is always constant if no external force acts on the system B1



$3.0\times10^7U = 16\ U\ V_p\ \cos\theta$ C1

$3.0\times10^7 = 16\ V_p\ \cos\theta$

$V_p\ Cos\theta = 1.88\times10^6$ (i)

$U\ V_o = 16U\ V_p Sin\theta$ C1

~~$V_pSin\theta = 6.25\times10^{-2}V_p$~~ $V_p\sin\theta = \frac{V_o}{16}$ (ii) - - - - (ii)

$\frac{1}{2}U\times\left(3.0\times10^7\right)^2 = \frac{1}{2}UV_o^2 + \frac{1}{2}16U\ V_p^2$ (iii) C1

$9\times10^{14} = V_o^2 + 16V_p^2$

squaring (i) and (ii) then adding

$(V_p\sin\theta)^2 = \left(\frac{V_o}{16}\right)^2$ $\quad (1.88\times10^6)^2 = V_p^2\cos^2\theta$

$V_p^2\left(\sin^2\theta + \cos^2\theta\right) = \left(\frac{V_o}{16}\right)^2 + \left(1.88\times10^6\right)^2$

$$\left(1.88\times10^{6}\right)^2+\left(\frac{V_o}{16}\right)^2 4 = V_p^2$$

$$\cancel{V_o^2=\left(1.88\times10^{6}\right)^2+\left(6.25\times10^{-2}\right)^2V_p^2}$$ (iv) C1

$$16^2\left(1.88\times10^{6}\right)^2+V_o^2=16^2V_p^2$$

solving for V_p in (iii) and (iv)

$$16^2\left(1.88\times10^{6}\right)+9\times10^{14}-V_o^2=16V_p^2$$

$$\cancel{1.0624V_o^2=7.04\times10^{12}}$$ C1

$$16^2\left(1.88\times10^{6}\right)+9\times10^{14}=\left(16^2+16\right)V_p^2$$

$$V_o=\sqrt{\frac{7.0\cancel{4}\times10^{12}}{\cancel{1}.0624}} \qquad \sqrt{\frac{16^2\left(1.88\times10^{6}\right)^2+9\times10^{14}}{16^2+16}}$$

$= \quad = 2.57\times10^{6}ms^{-1}$ A1

(a) (i) Zero error / calibration (Accept any correct alternative.) B1

(ii) correct the error before / after measurement B1

use a better instrument B1

[Max 1]

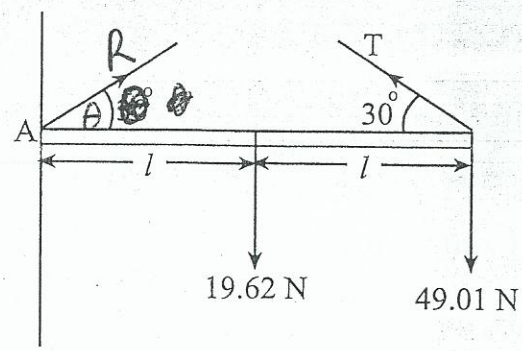
(b) $$\frac{\Delta V}{V}=\frac{\Delta Q}{Q}+\frac{\Delta r}{r}$$

$$V\times\frac{\Delta V}{V}=\left(\frac{0.1}{3.2}+\frac{0.02}{1.34}\right)\times\frac{3.2\times10^{-16}}{4\pi\times8.85\times10^{-12}\times1.34\times10^{-17}}$$ C1 ~~A1~~

ΔV = ~~$9.92+10^{9}V/m$~~ $1.03\times10^{10}V$ A1

(c) (i) Quantity defined by magnitude and detection B1

(ii)



Taking moments about A

19.62 x L+49.05 x 2L =	T x 2L Sin 30		C1
117.72 L =	TL		
T =	$\underline{\underline{117.72N}}$		A1

Resolving forces

Vertically

R Sin θ + $TSin$ 30 = 19.62 + 49.05

R Sin θ= 9.81 (i) C1

Horizontally

R Cos θ = T Cos 30

R Cos θ = 101.95 (ii)

Solving (i) and (ii)

Tan θ = 0.0962

θ = 5-5° A1

R = 102.4 N A1

3 (a) $g = \frac{GM}{r^2}$ B1

$M = \frac{4}{3}\pi r^3 \rho$ B1

$\therefore \; g = \frac{4}{3}\pi \times 6.6 \times 10^{-11} \times \rho \; r$ B1

$= 2.8 \times 10^{-10} \rho \; r$ A0

(b) $g \propto r \left(\text{Reject } g = \frac{GM}{r^2} \right)$

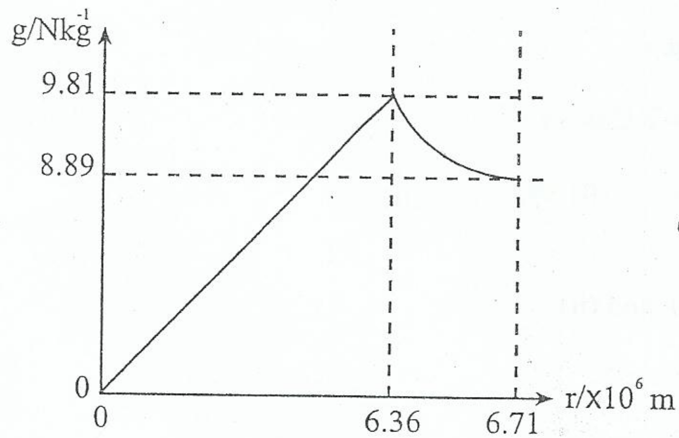
$g^1 = \frac{9.81(6.36 \times 10^6 - 250 \times 10^3)}{6.36 X 10^6}$ C1

$= 9.42 Nkg^{-1^{-1}} (\text{Reject ms}^{-2})$ A1

The earth is denser near the centre than elsewhere / AW B1

(c) g on satellite $= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24}}{(6.36 \times 10^6 + 350 \times 10^3)^2}$

$= 8.89 N Kg^{-1}$ A1



Correct shape (B1)
Correct coordinate pairs for critical values B2

Fig. 3.1

Correct shape B1

Correct coordinate pairs for critical values

$(6.3\times10^6;9.81)$ $(6.71\times10^6;8.89)$ B2

4 (a) SUM: $= 1.873 + 1.582 \pm (0.005\text{x}2)$

$= (3.46 \pm 0.01)$ mm

fractional uncertainty $= \dfrac{0.01}{3.46}$

$= 0.0029$ A1

diff. $1.873 - 1.582 = 0.291$ mm (Reject 2 sig. fig.) A1

fractional uncert. $= \dfrac{0.01}{0.291} = 0.034$ A1

(b) desired interval marked on x-axis

number of squares in interval B1
counted and B1
then multiplied by time-base setting B1

$T = \frac{5ms}{10} \times 18$

(c) (i) T = 1.8 x 5ms $= 9.0 \times 10^{-3}$ s (A) 9ms C1A1

$V_0 = \dfrac{11 \times 5}{10} = 5.5V$ A1

(ii) ~~(iii)~~ – 6 complete wave forms seen B1

– Number of complete cycles increases.