

URANGA PHYSICS EXAMINATION

Kenya Certificate of Secondary Education



232/3

PHYSICS

Paper 3

(Practical)

4TH EDITION (NOV. 2021) – TIME 2 1/2 Hours

MARKING SCHEME

Question 1

Part A

(a) Balance point = $49.5\text{cm} \checkmark 1\text{mk}$ (allowance of 0.5cm on the higher side and must be to 1d.p.)

(c) $X = 18.0\text{cm} \pm 1.0\text{cm} \checkmark 1\text{mk}$

$D = 40.5\text{cm} \pm 1.0\text{cm} \checkmark 1\text{mk}$ (must be to 1 d.p.)

(d) $w_1 \times 40.5\text{cm} = 1\text{N} \times 18.0\text{cm} \checkmark$ correct substitution of students values above
 $= 0.4444\text{N} \checkmark 2\text{mks}$ (student's evaluation at least to 4 s.f. or exact)

$U_w = 0.5 - 0.4395 = 0.0556\text{N} \checkmark 1\text{mk}$ (student's evaluation)

(f)

(i) $X = 18.5\text{cm} \pm 1.0 \checkmark 1\text{mk}$ (must be to 1 d.p.)

(ii) $w_1 \times 40.5 = 1 \times 18.5 = 0.4568\text{N} \checkmark 1\text{mk}$ (student evaluation at least to 4 s.f. or exact)

$U_L = 0.5 - 0.4543 = 0.0432\text{N} \checkmark 1\text{mk}$ (student's evaluation)

(g) $R.D. = \frac{U_L}{U_w} = \frac{0.4568\text{N}}{0.0556\text{N}} = 0.7770 \checkmark 1\text{mk}$ (student's evaluation at least to 4 s.f or exact)

(h) Density of L = $R.D. \times \text{density of water} \checkmark 1/2\text{mk}$
 $= 0.7770 \times 1000 \checkmark 1/2\text{mk}$

(i) $= 777.0\text{kg/m}^3 \checkmark 1\text{mk}$ (student's evaluation to at least 4s.f. must write unit)

Part B

(j)

I. Mass of the metal solid R, $M_s = 20.0\text{ g} \pm 2.0 \checkmark 1/2\text{mk}$ 1dp

II. Mass of the wrapped empty plastic beaker $M_1 = (30.0 - 45.0 \text{ g})$ ✓½mk 1dp

III. Mass of the wrapped plastic beaker+ mass of $240.\text{cm}^3$ of water, $M_2 = 250.0 - 290.0$ ✓½mk 1dp.

IV. Initial temperature of water, $T_1 = 29 \pm 5$ Degrees Celcius ✓1mk (accuracy to 1°C)

$$T_1 = 29 + 273 = 302 \pm 5 \text{ Kelvin } \checkmark \frac{1}{2} \text{mk.} \quad 1\frac{1}{2} \text{mks}$$

(k) Boiling point of water, $T = 95 + 273 = 368$ (between $85 - 99$ degrees celcius) Kelvin ✓1mk

(l) Temperature of the mixture, $T_2 = 32 + 273 = 305 \text{ Kelvin} \pm 5$ ✓1mk

(m) Heat lost by metal solid $R = (\text{heat gained by water} + \text{heat gained by plastic beaker})$

Heat lost by metal $R = \text{Heat gained by water} + \text{Heat gained by plastic beaker}$

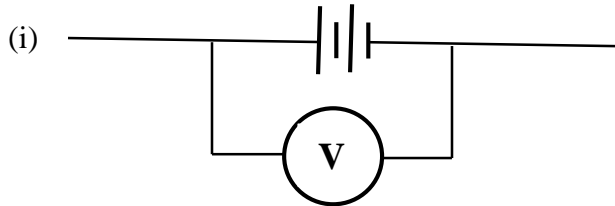
$$\frac{20.0}{1000} \times c_s \times (368 - 308) \checkmark 1 \text{mk} = \left\{ \frac{(275.5 - 33.2)}{1000} \times 4200 \times (305 - 302) \right\} + \left\{ \frac{(33.2)}{1000} \times 359 \times (305 - 300) \right\} \checkmark 1 \text{mk}$$

c_s ✓1mk (student's evaluation at least to 4s.f. or exact)

Question 2

Part A

(a)



✓½mk (circuit diagram of voltmeter across the cell)

(ii) $E_1 = 3.0 \pm 0.1$ ✓½mkVolts (½ mark)

(c) Table 2

Length L(m)	0.2	0.3	0.4	0.5	0.6	0.7	
Current , I(A)	0.42	0.36	0.30	0.26	0.22	0.20	$\pm 0.02 \text{ A}$ ½mks each up to a max. of 4 points, must be to 2d.p.
Voltage, V (V)	1.9	2.1	2.2	2.3	2.4	2.6	$\pm 0.1 \text{ V}$ ½mks each up to a max. of 4 points, must be to

							1d.p.
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(4 marks)

(e)

*A₁ ✓1mk- Labelling axes with units, if axes inverted award zero**S₁ ✓1mk- Simple, uniform and accommodate all values in the table**P₂ ✓2mks- Plotting: 5-6 pts ✓ 2mks, 4pts ✓1½mks, 3pts ✓1mk, 1-2 pts award zero**L₁ ✓1mk - a straight line graph with negative gradient passing through at least 4 correctly plotted points.*

$$(f) \text{ slope} = \frac{\Delta V}{\Delta I} = \frac{\text{student's correct } V \text{ points from graph} \checkmark \frac{1}{2} \text{mk}}{\text{student's correct } I \text{ points from graph} \checkmark \frac{1}{2} \text{mk}}$$

Student's evaluation at least to 4 s.f. with correct units (Ω or V/A) ✓1mk, award ✓½mk without units and zero for wrong units (slope must have negative sign)

$$(g) E_2 = V + Ir \checkmark \frac{1}{2} \text{mk}$$

(h)

i. *$E_2 = V\text{-intercept}(Y\text{-intercept})$ ✓1mk (extracted and read correctly from student's graph)*

ii. *$-r = \text{slope}$*

$r = \text{slope, student's value} \checkmark \frac{1}{2} \text{mk}$

Part B

$$(j) V_1 = 14.5 \pm 1.0 \text{cm} \checkmark 1 \text{mk (must be to 1 d.p.)}$$

$$(k) V_2 = 36.3 \pm 1.0 \text{cm} \checkmark 1 \text{mk (must be to 1 d.p.)}$$

$$(l) f = \frac{L^2 - (V_2 - V_1)^2}{4L}$$

$$= \frac{50^2 - (36.3 - 14.5)^2}{4 \times 50} \checkmark \text{correct substitution of student's value}$$

$$= 10.1238 \text{cm.}$$

$$f = 0.101238 \text{M} \checkmark \text{correct evaluation in metres(m) at least to 4s.f. 2mks}$$

$$(m) k = \frac{1}{0.101238} \checkmark \frac{1}{2} \text{mk correct substitution of student's value}$$

$$= 9.878 \text{D (diopetre)} \checkmark \frac{1}{2} \text{mk student's correct evaluation in diopetre(D) at least to 3d.p. 1mk}$$

(f) *k represents the power of the lens ✓1mk*