MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

MOCK EXAMINATIONS 2022

232/2 **Physics (Theory)** **Paper 2**

September, 2022 **Time: 2 Hours**

Name: MARKING SCHEME ..... Adm No: .....

Class: .....Candidate's Signature: ..... Date: 9th September, 2022

Time: 7.00AM -9.00AM

Instructions to Candidates

- *This paper consist of TWO sections; A and B. Answer ALL the questions in section A and B in the spaces provided.*
- *ALL working MUST be clearly shown. Mathematical tables, electronic calculators and slide rules may be used.*
- *Candidates should check the question paper to ensure that all the 12 pages are printed as indicated and that no questions are missing.*

Take: $c = 3.0\times10^{8}\ m/s$, $h = 6.64\times10^{-34}\ Js$

Pages
2 – REV. PETER OKOTH
3 – WILSON OBIERO / PETER ANDANGO
4 – MR. AUSTIN
5 – MR. ADONGO
6 – Mr. ASORO
7 – VICTOR ODUNDO
8 – DUNCAN OLIYA
9 – DAVID NYAKAN
10 – JESSE OPIYO.
11 – MS NYAPOLA
12 – MR. Ochieng

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SECTION	Question	Maximum Score	Candidate's Score
A	1-12	25	
B	13	14	
	14	13	
	15	14	
	16	14	
TOTAL		80	

SECTION A: 25 MARKS

Answer ALL questions in the spaces provided.

1. a) State one unique characteristic of a diode in relation to conduction of current (1 mark)

Conducts current in only one direction 1

b) Figure 1 shows a simple circuit. Use it to answer the question that follows.

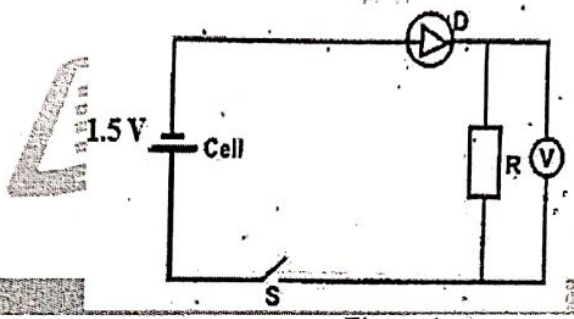


Figure 1

State and explain the voltmeter reading when switch S is closed (2 marks)

Zero ; Diode is reverse biased / Diode conducts in only one direction 2

.....

2. A sound vibrator produces sound waves inside the water. State and explain what would happen to its wavelength at the interface. (2 marks)

Wavelength increases . Sound waves move from an optically dense medium to a rarer medium / less optically dense medium. 2

3. A radioactive carbon – 14 decays to nitrogen by beta emissions as shown.

$$^{14}_{6}C \rightarrow {}^{X}_{7}N + {}^{0}_{Y}e$$

Determine the values of X and Y in the equation

X= 14 ..... (½mark)

Y = -1 ..... (½mark) 1

4. Give a reason why soft iron is used as a core of the coil of an electric bell. (1 mark)

Concentrates magnetic fields / flux 1

0

5. An X-ray tube is set to produce X-rays to penetrate human tissues, what adjustment would be made for the X-rays to penetrate a metal slab. (1 mark)

Increase the anode potential / increase the accelerating voltage. 1

6. **Figure 2** shows light travelling from more optically dense to less optically dense medium.

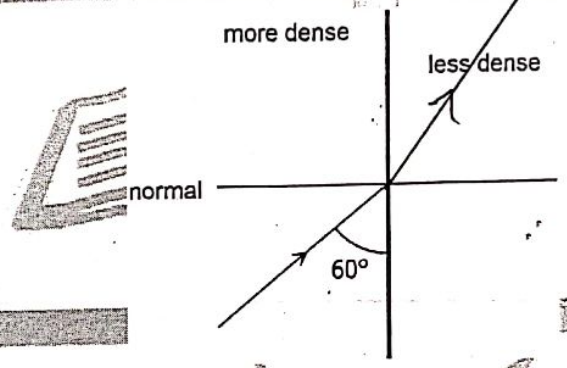


Figure 2

a) Show the direction of the refracted ray. (1 mark)

Ray and direction shown ✓1 1

b) If the refractive index of the denser medium is 1.42, calculate the angle of refraction. (2 marks)

and less dense is 1.33

$1.42 \sin 30° = 1.33 \sin r$ ✓1

$\sin r = \frac{1.42 \times 0.5}{1.33}$

$r = 32.3°$ ✓1 2

7. A building standing 200m from a pinhole camera produces on the screen of the camera an image 5.0cm ~~high~~ 2.5cm high, behind the pinhole, Determine the actual height of the building. (3 marks)

$\frac{h_o}{h_I} = \frac{u}{v}$ or $\frac{h_I}{h_o} = \frac{v}{u}$ ✓1

$h_o = 100m$ ✓

$\frac{x}{2.5cm} = \frac{200}{5.0}$ ✓1

$x = \frac{200 \times 2.5}{5.0}$ 3

7

8. **Figure 3** shows a method of magnetizing a material.

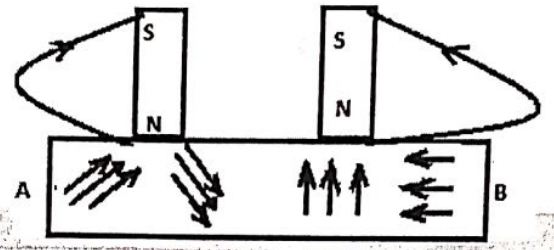


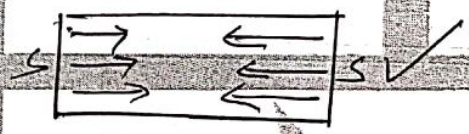
Figure 3

a) State the method of magnetization described ~~below~~ above (1 mark)

Double stroking ✓1

..... 1

b) On the space provided, draw a diagram to show how the dipoles would appear after magnetization (1 mark)



1

c) State the polarity at A and B after magnetization (1mark)

south ✓1

..... 1

9. Microwaves form part of the electromagnetic spectrum. State two uses of microwaves (2 marks)

- Cooking
- Communications
- Cancer treatment
- radio astronomy
- etc any 2 ✓✓

..... 2

10. **Figure 4** shows wave fronts approaching a concave surface.

Figure 4

Complete the diagram to show the wave fronts formed after striking the surface. Show how the focal point ofthe surface is located (2 marks)

7

11. **Figure 5** shows a hollow positively charged sphere with metal disk attached to an insulator placed inside.

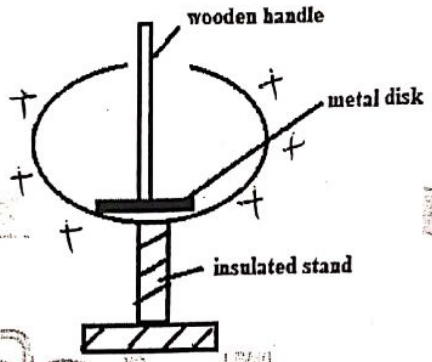


Figure 5

State and explain what would happen to the leaf of an uncharged electroscope if the metal disk were broughtnear the cap of electroscope. (2 marks)

No deflection ; charges do not reside inside a hollow sphere. 2

12. State **two** factor to be considered in constructing a paper capacitor. (2 marks)

- Area of plates
- separation distance 2

4

SECTION B: (55 MARKS)

Answer all the questions in this section in the spaces provided

13. a) Battery of e.m.f. 12V supplies a current of 10A for 5 minutes. Determine the amountof electrical energy produced. (2 marks)

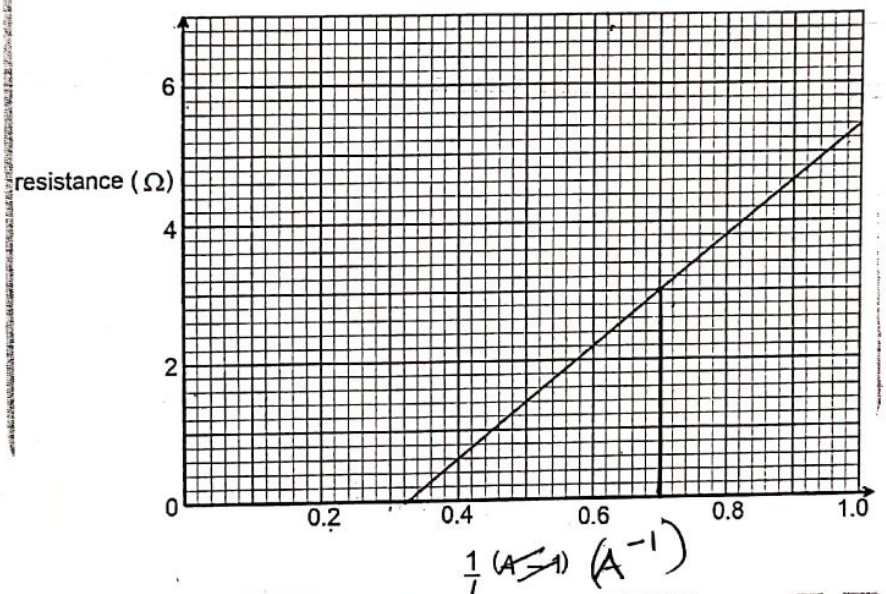
$E = pt$ or $E = VIt$ ✓

$= 12 \times 10 \times 5 \times 60$ 2

$= 36000\ J$ ✓ or $36\ kJ$.

b) **Figure 6** shows a graph of resistance against reciprocal of current. Use it to answer the questions that follow.

Figure 6



i) Find the internal resistance, r. (2 marks)

When $R = 0$, $r = e.m.f \times$ x-intercept

Then $\frac{1}{I} = \frac{r}{E}$ $= 0.1267 \times 0.32$ 2

$\Rightarrow 0.32 = \frac{r}{E}$ $= 0.0405\ \Omega$ ✓

ii) Determine the e.m.f, E of the cell. (2 marks)

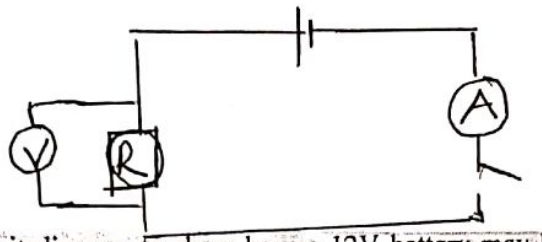
From $\frac{1}{I} = \frac{R}{E} + \frac{r}{E}$ Gradient $= \frac{3-0}{0.7-0.32}$ $= 0.1267$ V ✓

$= 7.895$ 2

$E = \frac{1}{\text{gradient}}$ ✓

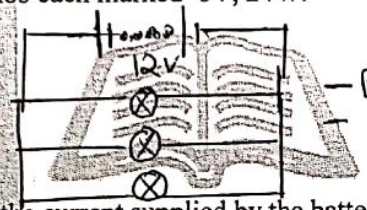
$e.m.f = \frac{1}{7.895}$

iii) Draw a circuit diagram to show the set-up used to generate the above graph (2 marks)

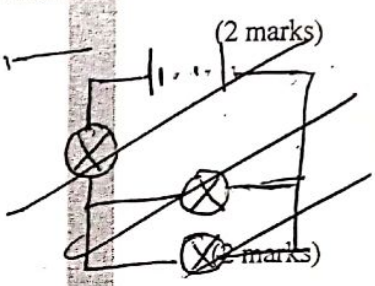


- workability with one cell ✓1
- Voltmeter across a load, and ammeter in series ✓1

iv) Draw a circuit diagram to show how a 12V battery may be used to operate efficiently 3 head lamp bulbs each marked 6V, 24W. (2 marks)



- Bulbs in parallel
- Voltage 12V.



v) Calculate the current supplied by the battery in (d) above. (2 marks)

$I = \frac{P}{V} = 2A$ ✓1

$= \frac{24W}{12}$

2

vi) Calculate the total effective resistance of the bulbs in (d) above. (2 marks)

$V = IR$

$R = \frac{12V}{0.6667}$ ✓1

$= 18\Omega$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ or $\frac{1}{R_T} = 3\left(\frac{1}{R_1}\right)$

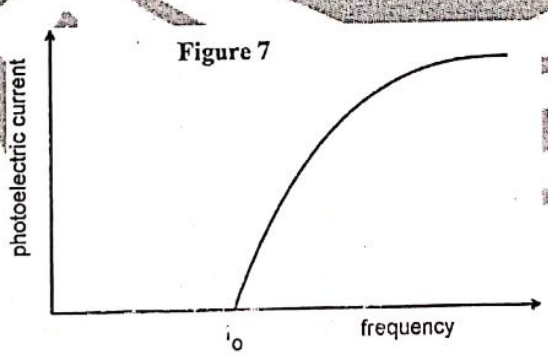
$= \frac{1}{18} + \frac{1}{18} + \frac{1}{18}$

$= \frac{3}{18}$

$R_T = 6\Omega$ 2

14. **Figure 7** shows a graph of photoelectric current against frequency. Use it to answer questions that follow.

Figure 7



a) What does the term f_o stand for in the graph above? (1 mark)

Threshold frequency / Smallest frequency required for photoemission to occur. 1

b) Explain what the graph shows in terms of photoelectric emission. (2 marks)

- Once the work function is overcome photoelectrons are produced.
The frequency has no effect on the magnitude of the photocurrent, but enables saturation current be attained

c) The work function of a metal is $6.4\times10^{-19}\ J$

(i) Explain what is meant by the term work function (1 mark)

Minimum amount of energy required to dislodge an electron(s) from a metal surface

(ii) Light with a frequency of $1.2\times10^{15}\ Hz$ is shone onto the metal surface. Find out whether or not the photons of this light will cause the photoelectric effect to take place. (3 marks)

$E = hf$

$= 6.64\times10^{-34}\times1.2\times10^{15}$

$= 7.968\times10^{-19}\ J.$

Photoelectric effect will occur since energy supplied exceeds the work function of the metal

(iii) The light source is now replaced with a light source which produces light with a frequency of $1.5\times10^{15}\ Hz$. The photons from this source contain more energy than is required to release electrons.

I. Determine the extra energy available after the electron has been released. (3 marks)

$E = hf$

$= 6.64\times10^{-34}\times1.5\times10^{15}$

$= 9.96\times10^{-19}\ J$

$hf = W_o + K.E_{max}$

$K.E_{max} = hf - W_o$

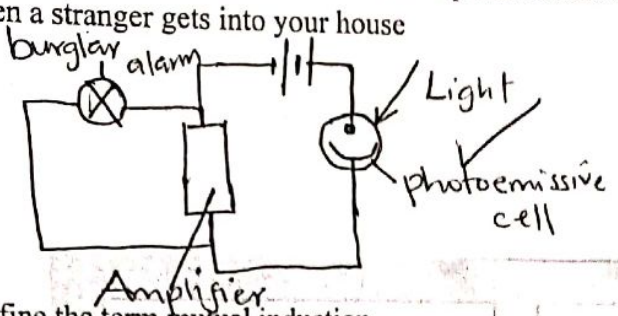
$= (9.96 - 6.4)\times10^{-19}$

$= 3.56\times10^{-19}\ J$

II. What is the extra energy calculated above converted to? (1mark)

Maximum Kinetic energy of the photoelectrons

(iv) Draw a circuit diagram to illustrate how photoelectric effect can be installed in a door to alert you when a stranger gets into your house (2 marks)



Photoemissive cell ✓1
workability ✓1
2

15. a) i) Define the term mutual induction (1 mark)

Arrangement of two coils such that a current is induced in one coil when current is changed in another. ✓1

ii) In mutual induction, the induced current is higher in the secondary coil when current in the primarycoil is switched off. Explain (2 marks)

The current takes a shorter time to die off than build up. This creates a higher rate of change of magnetic flux hence higher induced current. 2

iii) State one application of mutual induction (1 mark)

Transformer ✓ 1

b) **Figure 8** shows a small magnet attached to a spring.

Figure 8

The magnet is set oscillating up and down.

(i) State the polarity at X when the magnet is moving down. (1 mark)

North ✓ 1

(ii)Explain the cause of the deflection of the pointer of galvanometer (2 marks)

Changing magnetic flux links with the coil resulting to induced e.m.f that causes induced current to flow. 2

(iii) If the switch at S is open, the magnet will take longer to come to rest. Explain (2 marks)

There will be no induced current in the coil hence loses its magnetism. The magnet will now be under the influence of gravity. 2

c) A power station has an output of 25kW at a potential difference of 5kV. A transformer with a primary coil of 1000 turns is used to step-up the voltage to 132kV for transmission along a grid. Assuming there are no power losses in the transformer. Calculate:

(i) Current in the primary coil (2 marks)

$P = VI$ ✓

$25000 = 5000 \times I$ ✓ 2

$I = 5A$ ✓

(ii) Number of turns of the secondary coil (2 marks)

$\frac{V_s}{V_p} = \frac{N_s}{N_p}$ ✓

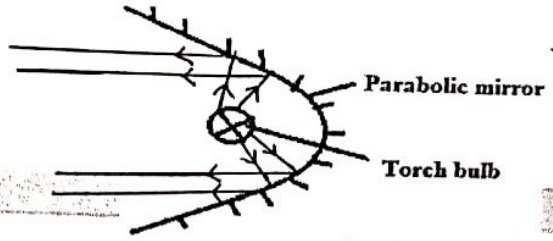
$\frac{132000}{5000} = \frac{N_s}{1000}$

$N_s = 26400$ turns ✓ 2

d) Explain why it is inefficient to use low voltage when transmitting electricity (1 mark)

It results to high current hence overheating 1

16. a) **Figure 9** shows a torch bulb placed at the principal focus of a parabolic reflector.



- Parallel rays ✓
- Direction ✓ 2

Figure 9

Using ray diagram show how the set up can be used as headlight (2 marks)

b) **Figure 10** shows a concave mirror with a wide aperture.

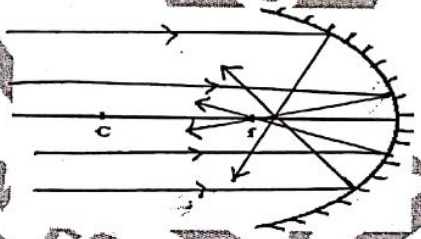


Figure 10

Rays that are far from the principal axis are reflected near but not at the principal focus.

Using a ray diagram show how spherical aberrationoccurs. (2 marks)

- Correct rays ✓ 1
- direction ✓ 1

2

c) Using the mirror formula, show that $mf = v - f$, where m is magnification, f is the focal length and v is the image distance. (3 marks)

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ ✓

multiply by v

$\frac{v}{f} = \frac{v}{u} + 1$

but $\frac{v}{u} = m$

$\frac{v}{f} = m + 1$ ✓

multiply by f

$v = mf + f$ ✓

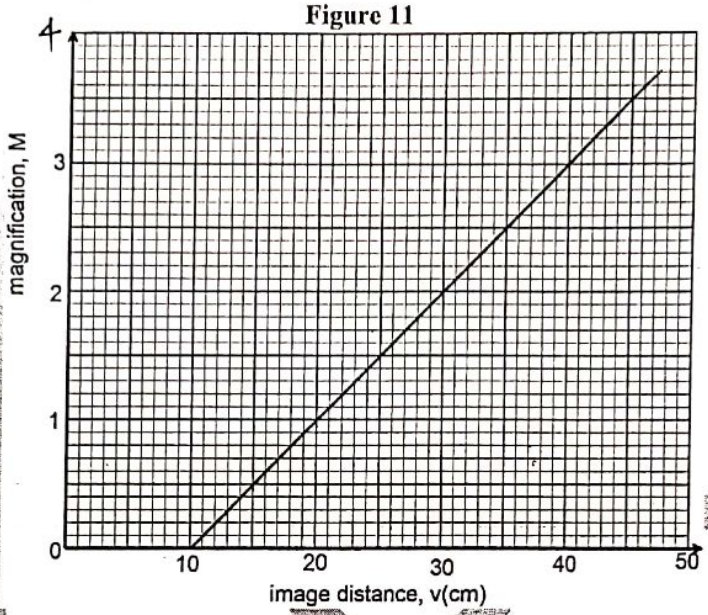
rearranging;

$mf = v - f$ as required

3

d) The graph in **figure 11** shows the variation of magnification, M with image distance, v for a concave mirror.

Figure 11



From the graph determine:

i) The object position when the image position is 45cm (2 marks)

Magnification = 3.5 ✓1 $3.5 = \frac{45}{u}$ $u = \frac{45}{3.5}$ ✓ = 12.86 cm. ✓1 2

ii) The focal length of the mirror. (2 marks)

Slope = $\frac{1}{f}$ ✓1 Slope = $\frac{1-0}{20-10}$ = 0.1 $f = \frac{1}{slope}$ ✓ = 10 cm. ✓1 2

e) A 4.0 cm tall light bulb is placed a distance of 35.5 cm from a convex mirror having a focal length of 12.0 cm. Determine the image distance (3 marks)

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ ✓ $\frac{1}{v} = \frac{1}{-12} - \frac{1}{35.5}$ ✓ $v = -8.968$ cm. ✓

$\frac{1}{-12} = \frac{1}{35.5} + \frac{1}{v}$ $v = -426/47.5$ 3

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