THE UNITED REPUBLIC OF TANZANIA

PRESIDENT'S OFFICE

REGIONAL ADMINSTRATION AND LOCAL GOVERNMENT

KASULU TOWN COUNCIL

FORM FOUR PRE-MOCK EXAMINATION

CODE: 031 **PHYSICS 1**

Time: 3:00 Hours **Friday, 23.05.2025**

INSTRUCTIONS

1. This paper consists of section A, B and C with total of eleven (11) questions.
2. Answer all questions in section A and B and two (2) questions in section C.
3. Non – programmable calculation and mathematical table may be used.
4. Cellular phones and any un authorised materials are not allowed in the examination room.
5. Write your examination number on every page of your answer booklet (s).
6. Where necessary the following constants may be used.
   (i) Acceleration due to gravity $g=10m/sec^2$
   (ii) Specific heat capacity of copper = $390JKg^0C^{-1}$
   (iii) Specific heat capacity of piece of metal = $400JKg^0C^{-1}$
   (iv) Specific heat capacity of water = 4200 $JKg\ ^0C^{-1}$
   (v) The speed of sound in air = 330m/sec
   (vi) Density of water = $1000kg/m^3$

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SECTION A (16 marks)

Answer all questions in this section.

1. For each of the items (i) – (x), choose the correct answer from the given alternatives and write its letter beside the item number in the answer booklet provide.

(i) How does studying physics contribute to our understanding of the natural world and the universe?

A. Physics is not related to the study of the natural world and the universe.
B. Physics helps us understand the behaviour of matter and energy from sub atomic particles to celestial bodies.
C. Physics only deals with artificial and human – made systems.
D. Physics is not essential for understanding the natural world and the universe.
E. Both letters (A to D) are correct answers.

(ii) The following are the uses of Relative density in everyday life except.

A. Designation of various structure such as ship and places.
B. Selections of building materials
C. Identification of germs.
D. Determination of density of unknown substances
E. Designation of swimming and diving equipment.

(iii) If a bubble of air is released at the bottom of a water pond, it will rise to the water surface of the pond. Why does this happen?

A. The weight of the bubble is greater then the up thrust
B. The density of water is the same as that of the air bubble
C. Up thrust is equal to the weight of the air bubble.
D. Up thrust is greater than the weight of the air bubble.
E. Up thrust is less than the weight of the air bubble.

(iv) Why wind mills are constructed around the coastal areas in open plains, in gaps of mountain ranges or at the top of a rounded hills?

A. Because there are cheap to harvest energy.
B. Because there are no obstructions and strong winds blow to rotate wind turbines propellers.
C. Because when the sun heats the atmosphere some particles become warmer than the other.
D. Because there are less movement of people and vehicles in those areas.
E. Because the wind turbines are noisy and can spoil the landscape.

(v) How can the rate of thermionic emission from a metal surface be increased? A. By increasing the metal ion concentration
B. By increasing the surrounding pressure
C. By decreasing the temperature of the metal to stabilize election
D. By increasing the surface area of the metal
E. Both letter A to D are correct answers.

(vi) Which statements is correct about the half – life of a Radio active source?

A. It is half the time for the Radio active source to become safe.
B. It is half the time it takes an atom to decay
C. It is half the time it takes the activity of the source to decrease to zero.
D. It is the time it takes the activity of the source to decrease by half.
E. Both letter form A to D are correct.

(vii) How much heat energy is given out by a copper block of 40g mass when it cools from 1840^0C to 40^0C?

A. 28008J
B. 2800J
C. 2808J
D. 28000J
E. 28080J

(viii) What is the milky way?
A. A planet in the solar system
B. A galaxy in which the solar system belongs.
C. One of the solar systems.
D. One of the stars in the solar system.
E. Both letter (A to D) are correct.

(ix) Lenz's law can be used to predict the
A. Magnitude of back electromotive force in a circuit.
B. Magnitude of induced current in a circuit
C. Direction of applied electromotive force across a circuit.
D. Direction of the induced electromotive force or back electromotive force in a circuit.
E. Magnitude of induced electro motive force or applied electromotive force.

(x) The layer in the atmosphere where weather phenomena are formed is the
A. Stratosphere
B. Magnetosphere
C. Troposphere
D. Thermosphere
E. Exosphere

2. Match the items in List A with responses in List B by writing the letter of the correct response beside the item number in the answer booklet provided.

LIST A	LIST B
(i) The ratio of the distance moved by effort to the distance moved by the load. (ii) A simple machine which can pull a heavy load along a slopping surface. (iii) The ratio of the work out put to the work in put x 100%. (iv) Ability of the surface of a liquid to behave like a fully stretched elastic skin. (v) Ability of liquids to rise or fall in a narrow tube. (vi) Movement of particles from high concentration to low concentration.	A. Sinking B. Osmosis C. Combination pulley D. An inclined plane E. Velocity ratio F. Single fixed pulley G. Diffusion H. Elasticity I. Efficiency J. Mechanical advantage K. Capillarity L. A simple pulley M. Surface tension

SECTION B (54 Marks)
Answer all questions in this section:-

3. (a) (i) State the condition necessary for total internal refection to occur.
(ii) Why does an object appear coloured when light falls on to it?
(b) (i) What is meant by the term complimentary colours?
(ii) Explain why the result mixing blue and yellow paints is very different from that of mixing blue and yellow lights.
(c) A screen is placed 80cm from an object. A lens is used to produce on the screen an image with magnification 3. Calculate the:-
(i) Distance between the object and the lens.
(ii) Focal length of the lens.

4. (a) (i) Explain why cathode ray tubes (CRT) are evacuated.
(ii) What happens to the CRT (Cathode ray tube) when a gas is maintained?

(b) How are hard x-rays produced?

5. (a) Describe the three types of volcanoes by giving one example in each case.
   (b) Briefly explain the two main types of ocean tides.
6. (a) Mention two practical examples in our daily life in which the principle of conservation of energy is applied.
   (b) Name a machine or an apparatus used to change the following forms of energy.
   (i) Heat energy to mechanical energy.
   (ii) Mechanical energy to electrical energy
   (iii) Electrical energy to sound energy
7. (a) (i) State Archimedes' principle.
   (ii) A block of metal of density 2700kg/m^3 has a volume of $4x10^{-2}m^3$. Calculate the mass of block.
   (b) A 5Ω resistor and a 1Ω resistor are connected in parallel to a cell of electromotive force 6V and internal resistance 0.5Ω. Calculate the current flowing round the circuit.
8. (a) Three capacitors with capacitances of 15 uf, 25 uf and x are configured in a circuit such that the equivalent capacitance is 7 uf.
   (i) Identify the type of arrangement of capacitors
   (ii) Determine the capacitance of capacitor x.

   (b)State two ways in which power is lost in a transformer.

SECTION C: - (30 marks)

Answer two (2) questions from this section.

9. (a) (i) Name three (3) basic radiations that occur naturally.
   (ii) Define mass number and atomic number as applied in Radioactivity.
   (iii) Thorium disintegrates in the following manner

$$Th^{232}_{90} \longrightarrow Ra^{228}_{88} \longrightarrow AC^{228}_{89} \longrightarrow Th^{288}_{90} \longrightarrow Ra^{224}_{88}$$

   State the particles emitted at each part of the disintegration.
   (b) A thorium 228 radio active source placed in a polythene bottle decayed into a radioactive gas thoron. The decay process was recorded by the Geiger-Muller (G-M) tube as follows:-

The in minutes	0	4	8	12	16	20
Count rate	40	30	20	14	10	7

   (i) Draw the graph of the count rate against time.
   (ii) From the graph, determine the half – life of thoron.
10. (a) (i) Name two semiconductors which are of special importance in electronics.
   (ii) Explain how P-n junction diode is formed.
   (b) Explain why semi conductor solid state diodes are fast replacing the vacuum type diodes in many applications.
   (c) (i) What do you understand by the term rectification?
   (ii) State the uses of a diode.
11. (a) (i) State the laws of electromagnetic induction.
   (ii) Mention two advantages of alternative current (a.c) generators over direct current (d.c) generators.
   (b) A transformer with 4800 turns in the primary coil is designed to work from 240V a.c mains to give a supply at 8V in order to ring a bell.
   (i) What would happen if the transformer were connected to 240V d.c mains?
   (ii) Briefly explain why the primary current increases when a bell is being rung?

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MAY 2025
PHYSICS MARKING SCHEME

SECTION A (16 marks)

1. MULTIPLE CHOICE

i	ii	iii	iv	v	vi	vii	viii	ix	x
B	C	D	B	D	B	D	B	A	C

1@Mark

2. MATCHING ITEMS

i	ii	iii	iv	v	vi
E	D	I	M	K	G

1@Mark

SECTION B (54 marks)

3. (a) (i) Condition necessary for total internal reflection
(01mark) Light must be passing from a dense medium to a less dense one.
(01marks) Incident angle should be greater than critical angle of the medium.
(ii) An object appears coloured when light falls onto it because the object reflects light of it colour falling onto it and absorbs the rest. **(01marks)**

(b) (i) Complementary colours are light which when added together, they give white light **(2 marks)**
(ii) Pigments are impure while light is pure. A yellow pigment absorbs blue light and reflects yellow, red and green and a blue pigment absorb yellow and red lights and reflects blue and green. When the two are mixed only green light will be reflected in common, thus the mixture will look green. While blue light and yellow light are complementary colours, i.e. they add to white light. Pigment colour mixing is termed subtractive colour mixing while mixing of colour lights is known as additive colour mixing. **(2 marks)**

(c) (i) Given data:
Distance between the screen and the object
U+V = 80cm
Magnification = 3
From above
U+V = 80cm _____ 01
and
$M = \frac{V}{U} = \frac{3}{1} = \frac{V}{U}$
V= 3ll _____ 02
From eq (01) and (ii) above.
U+3U = 80 cm
$\frac{4U}{4} = \frac{80}{4}$ cm
U = 20 cm
The distance between the object and the lens = 20cm. **(01mark)**

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(c) (ii) From the lens formula:
$\frac{1}{f} = \frac{1}{U} + \frac{1}{V}$
$f = \frac{UV}{} = U(3U) = 3U2 = \frac{3U}{} = 3X20$ cm

U+V U+3U 4U 4 4

F= 15cm

The focal length of the lens = 15cm **(01mark)**

4. (a) (i) Cathode ray tubes are evacuated so that electrons any travel without colliding with other particles, Thus minimizing air resistance and so electric resistance. **(03 marks)**

(ii) If gases maintained in the tube it (the tube) will behave like an open circuit. When potential difference across it is strong enough it will cause an electric spark which will ionize the air and make it conduct electricity.

(b) Hard x-rays are produced when a very light voltage is applied between electrodes, such a high voltage will accelerate electrons into electro magnetic waves and heat. **(03 marks)**

5. Three type of volcanoes are:

- Active volcanoes – Are those that either erupt constantly or have erupted in recent times. **(02 marks)**
  Example of Active volcanoes is Mount OL Doinyo Lengai in Tanzania.
- Dormant volcanoes – Are the volcanoes that have been in active for some time but are capable of erupting again. **(02 marks)**
  Example: Mount Kilimanjaro in Tanzania.
- Extinct volcanoes – Are volcanoes that erupted previously but have not erupted in the recorded history of at least 10,000 years. **(02 marks)**
  Example: Mount Elgon at Kenya.

(b) Two main types of Ocean are:-

- Spring tides **(1 ½ marks)**

This occur during the new moon and full moon phases when the sun, the Moon and the Earth are aligned. It occur twice a month. That is during full moon and new moon period.

- Neap tides

During this time, Moon and sun are perpendicular to each other and forces of the sun and moon tend to counteract one another. The result is a small difference between high and low tides.

Neap tide are weak tides. **(1 ½ marks)**

6. (a) Two application of the principle of conservation of energy:-

- Pulling a catapult to throw a stone
- Winding the main spring of a mechanical watch **(1 ½ @marks) two applications.**
- Re charging a car battery
- The swinging of a simple pendulum.

(b) (i) A steam engine converts heat energy to mechanical energy. **(02 marks)**

(ii) A dynamo converts mechanical to electrical energy. **(02 marks)**

(iii) A microphone converts sound to electrical energy. **(02 marks)**

7. (a) (i) Archimedes' principle state that " When a body is partially or totally immersed in a fluid it experiences an up thrust which equals to the weight of the displaced fluid". **(03 marks)**

(ii) Data given

Density of a metal block = 2700kg/mm^3

Volume of the metal block = 4x10^{-3} m^3

Density = $\frac{\text{Mass}}{\text{Volume}}$ = **(01 marks)**

Mass = Density x volume

= 2700 x 4x10^{-2}kg

= 108kg

Mass of the metal block = 108kg **(02 marks)**

(b) Data given.

$R_1 = 5\Omega$ $R_2 = 1\Omega$

= 6V

r = 0.5Ω

For parallel correction

$I = I_1 + I_2$

$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2}$

$\cancel{V}\left[1\right] = \cancel{X}\left[1 + 1\right.$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1+5}{5}$$

$$\frac{1}{R} = \frac{6}{5}$$

$$\frac{6R}{6} = \frac{5}{6}$$

$$R = \frac{5\Omega}{6}$$ **(01 marks)**

From

$E = V+Ir$

$E = IR + Ir$

$E = I(R+r)$

$I = \frac{E}{R+r}$

$I = \left[\frac{6}{5 + 0.5}\right]A$

6

I = 4.5A

The current flowing will be 4.5A **(02 marks)**

8. (a) Data given

Capacitance (C_1) = 15uf

Capacitance (C_2) = 25uf **($^{01}/_2$ marks)**

Capacitance (C_3) = X

Equivalent capacitance = 7ur.

(i) Series arrangement of capacitors.

(ii) Identify the value of capacitance of capacitor **X**

From $\frac{1}{c} = \frac{1}{c_1} + \frac{1}{c_2} + \frac{1}{c_3}$ **($^{01}/_2$ marks)**

$$\frac{1}{7} = \frac{1}{15} + \frac{1}{25} + \frac{1}{x}$$

$$\frac{1}{7} = \frac{40x + 375}{375x}$$

$375x = 7(40x + 375)$

$375x = 280x + 2625$

$375x = 280x + 2625$

$375x = 280x = 2625$

$$\frac{95x}{95} = \frac{2625}{95}$$

X = 27.6 UF

The value of capacitance (c_3) = x = 27.6 ur

or $\frac{138}{5}$ uf **(02 marks)**

8. (b) In a transformer, power is lost in the following ways in a transformer:-

(1.5 marks) ⟶ As heat in the resistance of the transformer's coils.

(1.5 marks) ⟶ Eddy currents tend to oppose the current in the transformer there by reducing power.

(1.5 marks) ⟶ Hysteresis losses

(1.5 marks) ⟶ Sound generated as a result of the vibrations in the transformer.

SECTION C

9. (a) (i) – Alpha particle (Ϙ particles) ($^{01}/_2$ marks)

- Beta particles (β – particles) ($^{01}/_2$ marks)
- Gamma rays (ϑ - rays) ($^{01}/_2$ marks)

(ii) – Mass number is defined as the sum of the number of protons and neutrons present in the nucleus. **(01 marks)**

- Atomic number is defined as the number of protons present in the nucleus. **(01 marks)**

(iii) From the disintegration given

$$Th^{232}_{90} \longrightarrow Ra^{228}_{88} + \alpha^{4}_{2} - (\alpha - \text{particle})$$

$$Ra^{228}_{88} \longrightarrow AC^{228}_{89} + - (\beta^{0}_{-1} - (\beta - \text{particle})$$

$$Ac^{228}_{89} \longrightarrow Th^{228}_{90} + \beta^{0}_{-1} - (\beta - \text{particle})$$

$$Th^{228}_{90} \longrightarrow Ra^{224}_{88} + \alpha^{4}_{2} - (\alpha - \text{particle})$$

$\therefore$ $Th^{232}_{90} \xrightarrow{\alpha} Ra^{228}_{88} \xrightarrow{\beta} Ac^{228}_{89} \xrightarrow{\beta} Th^{228}_{90} \xrightarrow{\alpha} Ra^{224}_{88}$ **(1 ½ marks)**

9 (b) (i) Drawing the graph from the following data.

Time in Min	0	4	8	12	16	20
Count rate	40	30	20	14	10	7

From the graph below:-

Half-life can be calculate by taking number of count rate over 2.

$$t/_2 = N/_2$$

Then, $t/_2 = 40/_2$ when N=20

$t/_2$ = 20 count rate

20 count rate on vertical axis and then intersection with horizontal axis.

Then find the required half – life in minutes:-

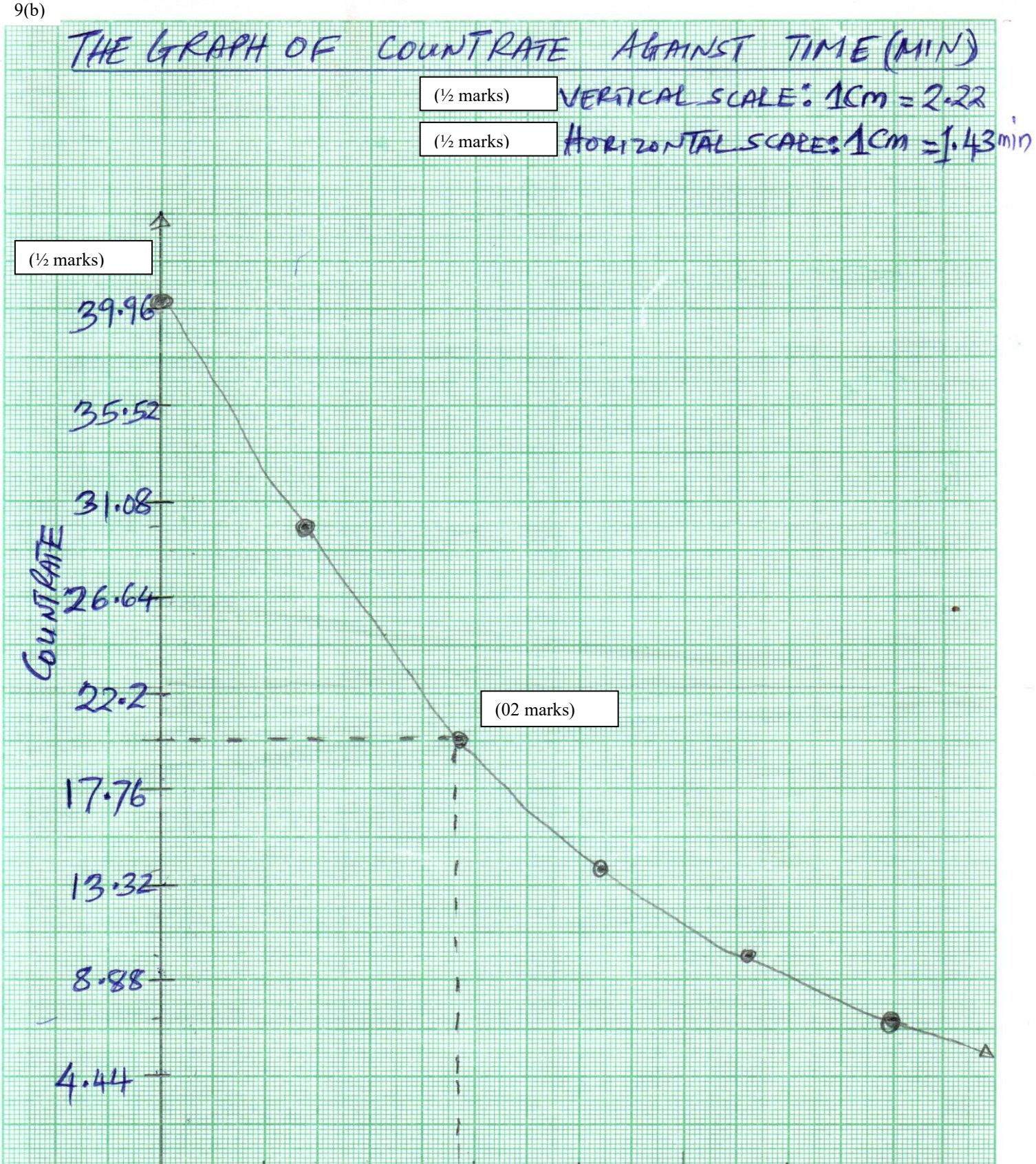
- It will reach at point 5.7 x 1.43 minutes

  = 8.7 x 151 minutes

  Half-life $\approx$ 8.151 minutes (01 marks)

  From the graph

9(b)


THE GRAPH OF COUNTRATE AGAINST TIME (MIN)
(½ marks)
VERTICAL SCALE: 1Cm = 2.22
(½ marks)
HORIZONTAL SCALE: 1Cm = 1.43 min
(½ marks)
39.96
35.52
31.08
26.64
22.2
17.76
13.32
8.88
4.44
COUNTRATE
(02 marks)

9. (b) (ii) From the graph, half life of thoron = 8.151 minutes.(02marks)

Note: The time taken for count rate to drop to a half of the original count rate.

10. (a) (i) Silicon and Germanium **($^{01}/_{2}$@ mark)**

(ii) A P-n junction diode is made by combining a p-type semi conductor and an n-type semiconductor in a single continuous crystal. **(02 marks)**

(b) -They are less expensive to make **($\frac{1}{2}$ mark)**

- They are reliable in circuits **($\frac{1}{2}$ mark)**
- They are consume less power **($\frac{1}{2}$ mark)**
- They are much easier to make. **($\frac{1}{2}$ mark)**
- They are smaller and so they occupy less space **($\frac{1}{2}$ mark)**

(c) (i) Rectification is the process off transforming or converting an alternating current to a direct current. **(02 marks)**

(ii) Uses of diode.

- Rectification of alternating current. **($^{01}/_{2}$ marks)**
- To restrict the flow of current in a circuit to one direction only. **($^{01}/_{2}$ marks)**
- Some diodes like LED (Light emitting diode) are used in special circuit arrangement to detect the flow of electricity. **($^{1}/_{2}$ marks)**

11. (a) (i) - Lenz's law states that

"The direction of induced electromotive force is such that it opposes the change producing it". **($^{01}/_{2}$ marks)**

- Faraday's law state that

"The magnitude of induced emf is proportional to the rate of change of the magnetic flux linking the conductor". **($^{01}/_{2}$ mark)**

(ii) Advantages of a.c generator over d.c generators:-

- The voltage produced can be easily stepped up.
- They produce electricity without change in composition of its part (unlike cells or batteries) **(0.6@marks)**
- They can produce e.m.f in definitely without needing to change parts.
- Easy to alter the amount of e.m.f created by simply changing the rate of cutting of flux or the number of turns of its coil.
- Their voltage can easily be stopped up or down.

(b) (i) – This, can lead to over heating and possibly damaging the transformer. **(01@ mark)**

- A large steady current may flow through the primary coil because a transformer's primary coil has low resistance.
- No voltage will be induced in the secondary coil, meaning the transformer will not function as intended.
- There will be no changing magnetic field because DC does not vary with time.

(ii) When the bell is ringing it acts as a load on the transformer. The increased load cause more current to be drawn from the secondary coil. Due to the principle of conservation of energy, an increase in secondary current results in an increase in the primary current. This is because the power supplied to the secondary coil must be drawn from the primary coil.**(02 marks)**