535/2
**PHYSICS**
Paper 2
**July/Aug. 2022**
2¼ Hours

**UGANDA TEACHERS' EXAMINATIONS SCHEME**

**Uganda Certificate of Education**

**JOINT MOCK EXAMINATIONS**

PHYSICS

**Paper 2**

2 hours 15 minutes

## INSTRUCTIONS TO CANDIDATES:

*Answer any* **five** *questions.*

*Any additional question (s) answered will* **not** *be marked.*

*Mathematical tables and silent non programmable calculators may be used.*

*These values of physical quantities may be useful to you:*

| | | |
|---|---|---|
| *Acceleration due to gravity* | = | $10ms^{-2}$ |
| *Specific heat capacity of water* | = | $4200Jkg^{-1}K^{-1}$ |
| *Specific heat capacity of Ice* | = | $2100Jkg^{-1}K^{-1}$ |
| *Specific heat capacity of copper* | = | $400Jkg^{-1}K^{-1}$ |
| *Specific latent heat of fusion of Ice* | = | $336000Jkg^{-1}$ |
| *Specific latent heat of vaporization of water* | = | $2260000Jkg^{-1}$ |
| *Density of water* | = | $1000kgm^{-3}$ |
| *Density of mercury* | = | $13600kgm^{-3}$ |
| *Speed of sound in air* | = | $340ms^{-1}$ |



**Turn Over**

1. (a) Define;

   (i) Momentum. (01 mark)

   (ii) Inertia of a body. (01 mark)

(b) Explain why a passenger in a fast moving car jerks forward when brakes are applied. (04 marks)

(c) Describe a simple experiment to locate the centre of gravity of irregular piece of cardboard. (06 marks)

(d) A 5 tonne truck initially moving at a velocity of $20ms^{-1}$ accelerates to $50ms^{-1}$ in 3 seconds. Calculate the force on the truck that caused the velocity change. (04 marks)

2. (a) Define the terms strut and tie. (02 marks)

(b) What is a notch; and explain how material with a notch can be used safely. (03 marks)

(c) (i) State the law of floatation and Archimedes' principle. (02 marks)

   (ii) When a metal is completely immersed in a liquid P, its apparent weight is 20N. When it is immersed in another liquid A, the apparent weight is 16N. If the density of Q is $\frac{9}{8}$ times that of P. calculate the mass of the metal. (05 marks)

(d) (i) What is meant by the term surface tension and diffusion. (02 marks)

   (ii) State two ways by which surface tension can be reduced. (02 marks)

3. (a) Define the term specific latent heat of fusion. (01 mark)

(b)

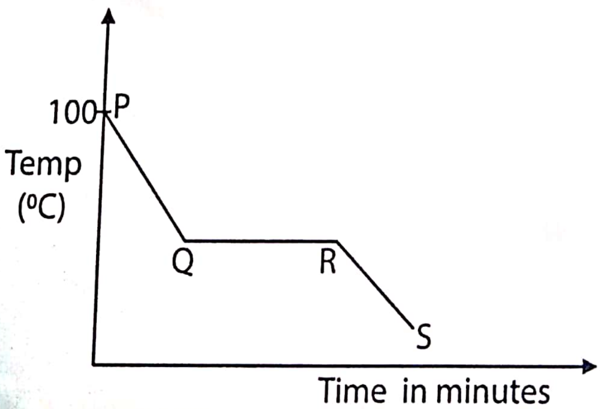



Fig. 1

Figure 1 shows a cooling curve for a substance which is in liquid form at 100°C.

(i) In what state is the substance over the regions PQ, QR and RS of the curve? (03 marks)

(ii) Use the kinetic theory of matter to explain the difference between the states of the substance over the regions PQ and RS. (03 marks)

(c) (i) What is meant by a saturated vapour and boiling point? (02 marks)

(ii) Explain why the boiling point of a liquid depends on altitude. (03 marks)

(d) A copper container of heat capacity $60JKg^{1}$ contains 0.5kg of water at 20°C. Dry steam is passed into the water until the temperature of the container and water reaches 50°C. Calculate the mass of steam condensed. (04 marks)

4. (a) (i) Describe an experiment to distinguish between soft and hard magnetic materials. (05 marks)

(ii) State one instance in which each of these materials is used. (02 marks)

(b)

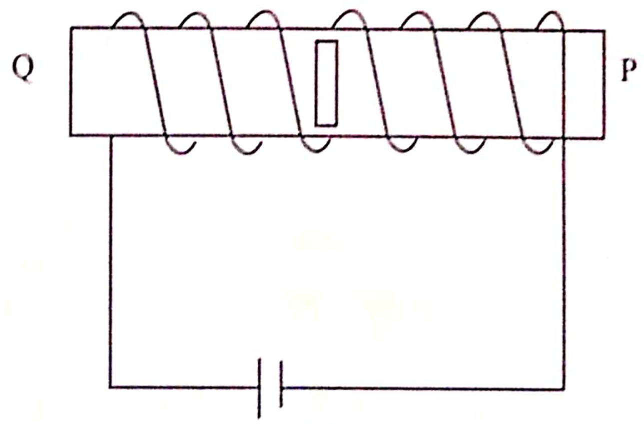



Fig. 2

Figure 2 above shows how a magnetic material can be magnetized by electrical method.

(i) Copy the diagram and indicate the direction of current in the coil. (01 mark)

(ii) Name the polarities P and Q. (02 marks)

(c) Describe how you can determine the polarity of a magnet. (03 marks)

5. (a) List **three** differences between sound waves and radio waves. (03 marks)

(b) Figure 3 below shows waves propagating towards a plane reflector.

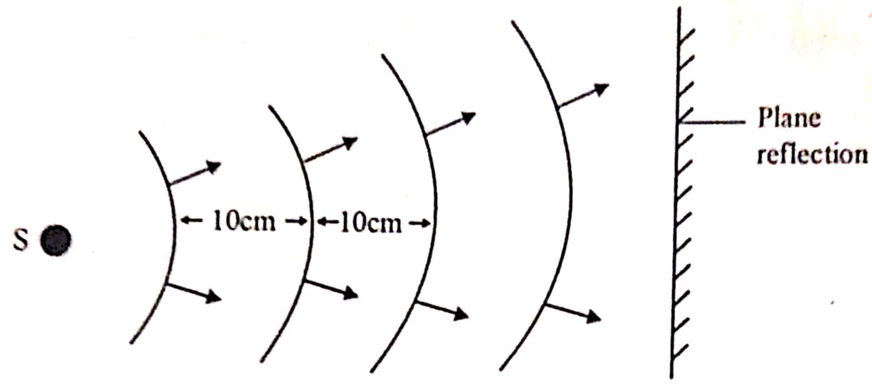



Fig. 3

(i) Draw a diagram to show how the waves are reflected. (02 marks)

(ii) Calculate the frequency of the wave if the velocity of wave is $15ms^{-1}$.

(03 marks)

(c) (i) Describe a simple echo method of determining the speed of sound in air. (06 marks)

(ii) State two ways how reverberation can be reduced in a hall.

(02 marks)

6. (a) Define the terms;

(i) A volt.(01 mark)

(ii) Electromotive force. (e.m.f) (01 mark)

(b) State one advantage of using the cells in series and for using them in parallel. (02 marks)

(c) Two cells of e.m.f. 1.5 and internal resistance of $1\Omega$, are connected to resistors of $3\Omega$, $4\Omega$ and $6\Omega$ as shown in the figure 3 below.

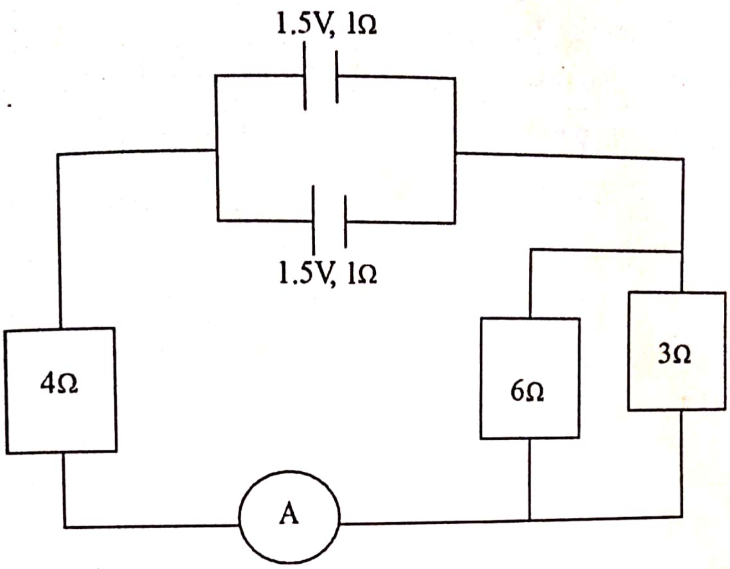



Fig. 4

Determine:

The **effective resistance** in the circuit. (04 marks)

The **ammeter** reading. (02 marks)

The power dissipated through the 4 Ω resistors. (02 marks)

(d) Give one defect of a simple cell and how it can be minimized. (02 marks)

7\. (a) (i) Define half-life of a radioactive substance. (01 mark)

(ii) A sample of wood from an ancient building gives 32 counts per minute. A similar sample of living wood gives 256 counts per minute. Given that the half-life of carbon -14 is 5600 years, estimate the age of the building. (03 marks)

(b) Describe the structure and operation of a cathode ray oscilloscope. (06 marks)

(c) A cathode ray oscilloscope connected across a supply produces a wave form shown below.

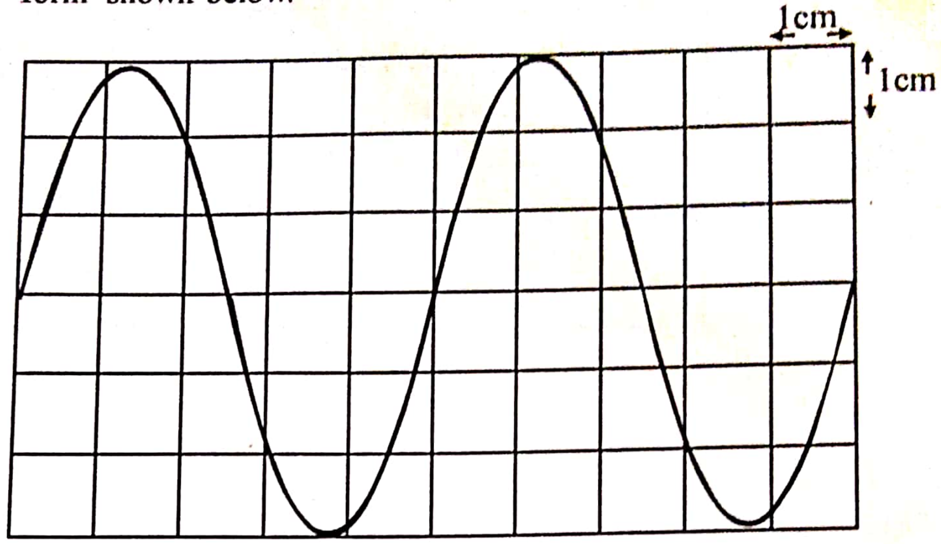



Fig. 5

(i) Identify the type of voltage generated by the power supply. (01 mark)

(ii) Find the root mean square value of the voltage generated if the voltage gain is $60Vcm^{-1}$. (03 marks)

(iii) Calculate the frequency of the power supply source if the time base setting on the CRO is $0.001scm^{-1}$. (02 marks)

8. (a) Give the difference between a pin hole camera and a lens camera. (02 marks)

(b) With aid of a diagram, explain how short sightedness be corrected. (03 marks)

(c) (i) Define the following terms in reference to the lens, linear magnification and power of a lens. (02 marks)

(ii) Explain how a convex lens can be used as a magnifying glass. (03 marks)

(d) An object 10cm is placed 15cm infront of a concave lens of focal length 10cm. By using scale diagram, find;

(i) the position of the image. (04 marks)

(ii) the nature of the image. (02 marks)

**END**

P425/2
APPLIED MATHEMATICS
PAPER 2
July/August
3hours

# WAKISSHA JOINT MOCK EXAMINATIONS

**Uganda Advanced Certificate of Education**

APPLIED MATHEMATICS

**Paper 2**

3 hours

## INSTRUCTIONS TO CANDIDATES:

- *Attempt* **all** *questions in section* A *and any* **five** *questions from section* **B**.
- *Any additional question(s) answered will* **not** *be marked.*
- **All** *working must be shown clearly.*
- *Begin each answer on a fresh sheet of paper.*
- *Silent non programmable scientific calculators and mathematical tables with a list of formulae may be used.*
- *In numerical work, take g to be* $9.8ms^{-2}$.
- *State the degree of accuracy at the end of the answer to each question attempted using a calculator or table and indicate* **Cal** *for calculator, or* **Tab** *for mathematical tables.*



Turn Over

## SECTION A (40 MARKS)

Answer **all** questions in this section.

1. Events A and B are such that; $P(A \cup B) = \frac{19}{30}$, $P(A) = \frac{5}{15}$ and $P(A/B) = \frac{5}{9}$.

   Determine the:

   Find (a) $P(A \cap B)$ (03 marks)

   (b) $P(\bar{A}/B)$ (02 marks)

2. A particle of weight 10N is suspended by two strings. If the strings make angles of $30^0$ and $40^0$ to the horizontal, find the tensions in the strings. (05 marks)

3. Given that; $f(2.09) = 1.9042$, $f(2.15) = 2.2345$, $f(2.19) = 2.4979$ and $f(2.23) = 2.8198$. Use linear interpolation or extrapolation to find;

   (a) $f(2.11)$ (03 marks)

   (b) $f^{-1}(3.0096)$ (02 marks)

4. Use the trapezium rule with 6 sub-intervals to estimate.

   $$\int_1^{1.2} x^2 \sin\left(\frac{1}{2}x\right) dx.$$

   Correct to three decimal places. (05 marks)

5. A car approaching a town does two successive half-kilometers in 16 and 20 seconds respectively. Assuming the retardation is uniform, find the further distance the car runs before stopping. (05 marks)

6. A machine manufacturing nails makes approximately 85% that are within the set tolerance limits. If a random sample of 200 nails is taken, find the probability that more than 21 nails will be outside the tolerance limits. (05 marks)

7. The following marks were scored in a mathematics test.

| Marks | 20-30 | 30-40 | 40-45 | 45-55 | 55-65 | 65-75 |
|---|---|---|---|---|---|---|
| Frequency density | 0.5 | 1.6 | 2.4 | 2.0 | 1.8 | 0.6 |

   Calculate the median. (05 marks)

8. The force, $\underset{\sim}{F}$, acting on a particle of mass 2 kg is given by $\underset{\sim}{F} = (5+4t)$N, where t is the time in seconds.

   Given that initially the particle is moving at a speed of 5 $ms^{-1}$, find the speed of the particle when t = 2 seconds. (05 marks)

## SECTION B (60 marks)

Attempt any **five** questions from this section.

9. The table below shows the marks scored by students in physics ($x$) and mathematics (y)

| Physics ($x$) | 28 | 20 | 40 | 28 | 21 | 22 | 31 | 36 | 29 | 30 | 24 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mathematics (y) | 30 | 20 | 40 | 28 | 22 | 25 | 45 | 35 | 27 | 31 | 22 | 33 |

(a) Draw a scatter diagram to represent the data above. Hence draw the line of best fit. (05 marks)

(b) Use your diagram in (a) to estimate the score in Physics when the score in Mathematics is 24. (01 mark)

(c) Calculate the rank correction coefficient for the data and comment on your result at 5% level significance. (06 marks)

10. A rectangle ABCD (3m x 4m) has forces of magnitudes 5N, 10N, 15N, 20N and 15N acting along the lines BA, CB, DC, AD and CA respectively. If $\overline{AB} = 3$m is the positive $x$-axis and $\overline{AD} = 4$m is the positive y-axis; find the;

(a) magnitude of the resultant force and its direction. (08 marks)

(b) line of action of the resultant and where it cuts the $x$-axis. (04 marks)

11. A random variable $x$ has a probability density function given by;

$$f(x) \begin{cases} \lambda x & ; 0 \leq x \leq 1 \\ \frac{\lambda}{2}(3-x); & 1 \leq x \leq 3 \\ 0 & ; \text{otherwise} \end{cases}$$

Where $\lambda$ is a constant.

Determine the;

(a) value of $\lambda$. (03 marks)

(b) expected value of $x$. (02 marks)

(c) variance of $x$. (02 marks)

(d) cumulative distribution function, f($x$) and hence $P(0.5 \leq x \leq 2.5)$ (05 marks)

12. Two cyclists P and Q are 11 km apart with Q on a bearing of $110^0$ from P. Cyclist P is riding at 5 $kmh^{-1}$ due North-East and Q is riding due $N15^0W$ at 8 $kmh^{-1}$. Find the;

(a) closest distance between them in the subsequent motion. (09 marks)

(b) time that elapses before they are closest to each other. (03 marks)

13. (a) The numbers $x = 3.7$ and $y = 70$ are each rounded off with percentage error of 0.2 and 0.05 respectively. While the number $z = 26.23$ is calculated with relative error of 0.04. Find the interval within which the exact value of $\frac{x}{y-z}$ lies; correct to 4 significant figures. (06 marks)

**Turn Over**

(b) The height and radius of a cylindrical water tank are given as $H = 3.5 \pm 0.2$ and $R = 1.4 \pm 0.1$ respectively. Determine in $m^3$, the least and greatest amount of water the tank can contain. Hence, calculate the maximum possible error in your calculation. (06 marks)

14. Given the equation $xe^{-x} - 3x + 4 = 0$

(a) (i) Show that the equation has a root between $x = 1$ and $x = 3$. (03 marks)

(ii) Use linear interpolation to obtain an approximation of the root to two decimal places. (02 marks)

(b) Use the Newton Raphson formula to find the root of the equation by performing two interactions correct to three decimal places. (07 marks)

15. A car of mass 1,200 kg pulls a trailer of mass 300 kg up a slope of 1 in 100 against a constant resistance of 0.2N per kg. Given that the car moved at a constant speed of 1.5 $ms^{-1}$ for 5 minutes, calculate the;

(a) tension in the tow bar. (05 marks)

(b) work done by the engine of the car during this time. (04 marks)

(c) total resistance if the engine developed power of 15 kW at a maximum speed of 120 $kmh^{-1}$ on a level road. (03 marks)

16. The speeds of cars passing a certain point on a motor way can be taken to be normally distributed. Observations along the motor way at a certain point show that 95% of the cars are travelling at less than 85 $kmh^{-1}$while 10% of the cars are travelling at less than 55 $kmh^{-1}$.

(a) Determine the average and standard deviation of the speeds of the cars passing that point along the motor way. (06 marks)

(b) If a random sample of 25 cars is selected, find the;

(i) Probability that their average speed is not more than 70 $kmh^{-1}$. (03 marks)

(ii) 95% confidence interval for the average speed. (03 marks)

**END**

P425/1
PURE MATHEMATICS
Paper 1
July/August
3 hours

# WAKISSHA JOINT MOCK EXAMINATIONS

## Uganda Advanced Certificate of Education

PURE MATHEMATICS

**Paper 1**

3 hours

**INSTRUCTIONS TO CANDIDATES:**

- *Answer* **all** *the eight questions in section* **A** *and any* **five** *questions from section* **B.**
- *Any additional question(s) answered will* **not** *be marked.*
- *Show* **all** *necessary working clearly.*
- *Begin each answer on a fresh page of paper.*
- *Silent, non programmable scientific calculators and mathematical tables with a list of formulae may be used.*

## SECTION A (40 MARKS)

Answer all questions in this section.

1. If the equation $x^2 + mx + n = 0$ and $x^2 + px + r = 0$ have common factors, prove that $(n-r)^2 = (m-p)(pn-mr)$. (5 marks)

2. From a class of 14 boys and 10 girls, 10 students are to be elected for a competition in which 5 boys and 5 girls or 2 girls and 8 boys are to go for it. In how many ways can they be selected? (5 marks)

3. Solve $10\sin^2 3x + 10\sin 3x\cos 3x - \cos^2 3x = 2$ for $0^\circ \leq x \leq 120^\circ$. (5 marks)

4. The area bounded by the curve $x^2 = 4ay$ and the y-axis and lines $y = 0$ and $y = 4b$ is rotated about y-axis through $2\pi$ to form a solid. Find the volume of the solid formed. (5 marks)

5. Given the points P(5,4,1) and Q($^-1$, $^-2$, 1). Find the position vector of the point R such that PR: PQ = 2:3. (5 marks)

6. Evaluate $\int x\sin^2 x\cos^2 x\, dx$. (5 marks)

7. Find the equation of the normal to curve $(x-1)^2 + (y+2) = 8$, at the point (3, $^-4$). (5 marks)

8. Q is a variable point given by the parametric equations; $x = \tan\theta - \sin\theta$ and $y = \sin\theta + \tan\theta$. Show that the locus of Q is $(y^2 - x^2)^2 = 16xy$. (5 marks)

## SECTION B (60 marks)

Answer any **five** questions from his section.

9. The tangent to the parabola $y^2 = 4ax$ at T $(at^2, 2at)$ meets the $x$-axis at P. The straight line through T parallel to the axis of the parabola meets the directrix at Q. If S is the focus of the parabola. Prove that TPQS is a rhombus. (12 marks)

10. (a) Mary operates an account with a bank which offers a compound interest of 5% per annum. She opened the account at beginning of 2019 with Shs. 800,000 and continue to deposit the same amount at beginning of every year. How much will she receive at end of 2022 if she made no withdrawal within this period? (6 marks)

(b) Expand $\left(\frac{1+x}{1+3x}\right)^{\frac{1}{3}}$ in ascending powers of $x$ up to the third term, hence by putting $x = \frac{1}{125}$ evaluate cube root of 63 correct to 4 decimal places.

(6 marks)

11. Express $f(x) = \frac{3+2x+x^2}{x^3(x+2)}$ into partial fractions. Hence evaluate $\int_2^5 f(x)dx$.

(12 marks)

12. (a) A, B and C are non-collinear points with position vectors **a**, **b** and **c** respectively. Point P and Q are on BC and CA such that BP: PC = 3:1 and CQ: QA = 2:3. If point R is on BA produced such that P, Q and R are collinear points. Find in terms of **a**, **b** and **c**, the position vectors of P, Q and R. (8 marks)

(b) Write down the equation of a line which passes through $(1, 0, {}^-2)$ in the direction of the vector $\begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$ and find the coordinates of the point where the line intersects the plane $4x+3y+2z=25$. (4 marks)

13. (a) Given; $y = be^{-2t}\sin 3t$. Prove that, $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 13y = 0$. (6 marks)

(b) A right circular cone is held with it's vertex down beneath a tap leaking at the rate of 2 $cm^3s^{-1}$. Find the rate of rise of water level when it's depth is 5 cm given that the height and radius of the cone are 15 cm and 5 cm respectively. (6 marks)

14. (a) Prove that $\frac{3\sin\theta+\sin2\theta}{1+3\cos\theta+\cos2\theta} = \tan\theta$, hence solve the equation;

$\frac{3\sin\theta + \sin2\theta}{1+3\cos\theta+\cos2\theta} = \frac{1}{\cos^2\theta} = 2$ for $0^\circ \leq \theta \leq 360^\circ$. (6 marks)

(b) Express $7\cos A + 24\sin A$ in the form $R\sin(A + \beta)$ where $\beta$ is an acute angle and R is a constant. Find the range in which $\frac{2}{7\cos A + 24\sin A + 10}$ lies. (6 marks)

15. (a) Solve the equation; $2\log_4 x + \log_2(x+6) = 6\log_8(x+2)$. (5 marks)

**Turn Over**

(b) If $z = \frac{(3-i)(5+12i)}{(1+3i)^2}$

Find the; (i) modulus of Z. (4 marks)

(ii) Argument of Z. (2 marks)

(iii) Polar form of Z. (1 marks)

16. In Focus High School Akiro of 1405 students, all students voted for the head prefect such that the rate of those who had voted is proportional to product of those who had voted and those had not yet voted. 20 students are to supervise the election and they voted before 7.00am, while the other students started to vote at 7:00am. If after 3 hours, 600 students had voted.

Find the;

(i) number of students who had voted after 8:00am. (10 marks)

(ii) time when 800 students had voted. (02 marks)

**END**

**P510/3**
**PRACTICAL**
**PHYSICS**
Paper 3
**July/Aug. 2022**
3¼ hrs

# UGANDA TEACHERS' EXAMINATIONS SCHEME

**Uganda Advanced Certificate of Education**

**JOINT MOCK EXAMINATIONS**

**PHYSICS PRACTICAL**

Paper 3

3 hours 15 minutes

## INSTRUCTIONS TO CANDIDATES:

*Answer question* **1** *and* **one** *other question.*

*Any additional question(s) answered will* **not** *be marked.*

*Candidates are* **not** *allowed to use the apparatus or write for the first fifteen minutes.*

*Graph papers are provided.*

*Mathematical tables and non – programmable scientific electronic calculators may be used.*

*Candidates are expected to record all their observations as they are made and to plan the presentation of the records so that it is* **not** *necessary to make a fair copy of them. The working of the answers is to be handed in.*

*Details on the question paper should* **not** *be repeated in the answer, nor is the theory of the experiment required unless specifically asked for. However, candidates should record any special precautions they have taken and any particular features of their methods of going about the experiment.*

*Marks are given mainly for a clear record of the observations actually made, for their suitability, accuracy, and for the use made of them.*



**Turn Over**

## Part II

(a) Suspend a mass, $m$, = $0.100kg$ from the spring, in part 1.

(b) Pull the mass vertically downwards through a small displacement and release it.

(c) Measure the time, $t$ for 20 oscillations of the mass. Hence obtain the period of oscillations, $T$.

(d) Repeat the procedure (a) to (c) for values of $m$ = $0.200, 0.300, 0.400, 0.500$ and $0.600kg$.

(e) Tabulate your results including values of $T^2$.

(f) Plot a graph of $T^2$ against $m$.

(g) Determine the slopes, $S$, of the graph.

(h) Calculate the value of $g$ from the expression $= \frac{4\pi^2\delta}{S}$.

(i) Read and record the intercept, $M$, on the $T^2$ – axis.

(j) Calculate the effective mass, $Mo$, of the spring from $Mo = \frac{C}{S}$.

2. In this experiment you will determine the refractive index, $n$ of a glass prism. (33 marks)

## Part 1

(a) Fix a plain sheet of paper on a soft board using pins.

(b) Place the glass prism on the paper and trace its outline.

(c) Remove the prism and label its outline $PQR$ as shown in the figure 2 below.

(d) Mark point, $V$ midway between $P$ and $Q$ along $PQ$.

Turn Over

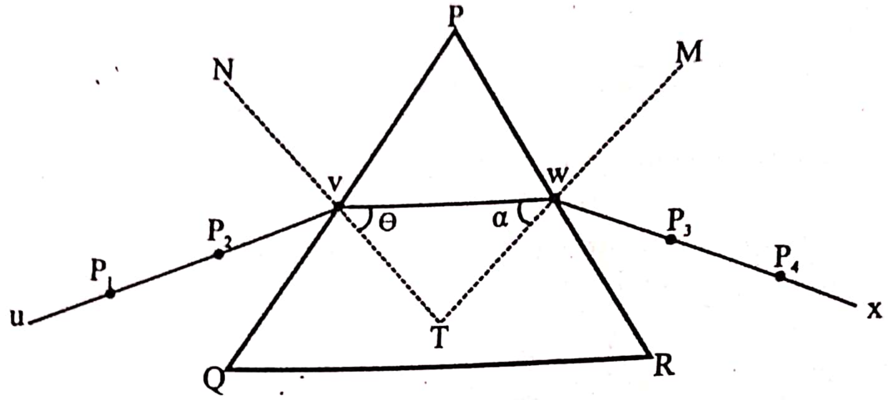



*Fig. 2*

(e) Draw a normal to side ***PQ*** through point ***V***.

(f) Draw line ***UV*** making an angle of 30 ° with the normal.

(g) Fix pins $P_1$ and $P_2$ vertically upright on line ***UV***.

(h) Replace the prism on its outline.

(i) While viewing through face ***PR***, fix pins $P_3$ and $P_4$ such that they appear t[o] be in line with pins $P_1$ and $P_2$.

(j) Remove the prism.

(k) Draw a line ***XW*** through the marks of $P_3$ and $P_4$.

(l) Join ***V*** to ***W***.

(m) Draw a normal ***MW*** at ***W*** and extending it until it meets the normal ***NV***.

(n) Measure and record angles θ and ∝.

(o) Calculate the constant ***A*** from $A = (\theta + \propto)$.

## Part II

(a) Fix the second sheet of paper provided on the soft board using drawing pins.

(b) Place the glass prism on the sheet of paper and trace its outline ***ABC*** as shown in fig 3 below.

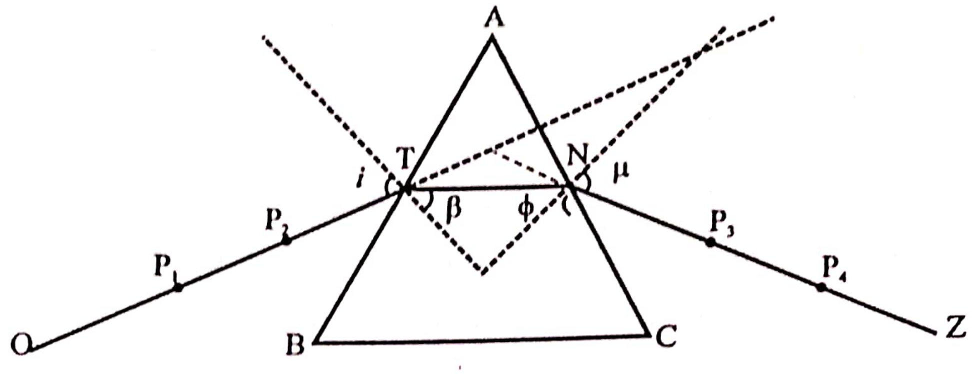



*Fig. 3*

(c) Remove the prism and draw a normal to ***AB*** at a point ***T***, a distance of about 1.5$cm$ from point ***A***.

(d) Draw line ***OT*** making an angle $l = 30^o$ with the normal.

(e) Place the optical pins $P_1$ and $P_2$ vertically on the line ***OP*** such that the angle ***i*** is equal to $30^o$.

(f) Replace the prism on its outline.

(g) While observing pins, $P_1$ and $P_2$ through face ***AC***, fix pins $P_3$ and $P_4$ such that they appear to be in line with pins $P_1$ and $P_2$.

(h) Remove the prism and pins and join ***Z*** to ***N*** through $P_4$ and $P_3$ and join also ***N*** to ***T***.

(i) Measure and record the angles; μ, $\beta$ and $\phi$.

(j) Repeat procedure (d) to (g) for $i = 35^o, 40^o, 45^o, 50^o, 55^o, 60^o, 70^o$ and $75^o$.

(k) Tabulate you results including values of; $a = (i - \beta)$, $b = (\mu - \phi)$ and $D = (a + b)$.

(l) Plot a graph of $D$ against $i$.

**Turn Over**

(m) Determine from your graph, the value $Dm$ for which $D$ has the lowest value.

(n) Calculate the refractive index, $n$, of glass from the expression;

$$Sin\ \frac{A}{2} = \frac{1}{n}\left(Sin\ \frac{Dm+A}{2}\right).$$

HAND IN THE PLAIN SHEETS OF PAPER WITH THE TRACINGS TOGETHER WITH THE REST OF THE WORK.

3. In this experiment, you will determine;

(i) the pd per $cm$, $K_o$ the slide wire potentiometer.

(ii) the calibration of a voltmeter using a slide wire potentiometer.

(33 marks)

**PART 1**

(a) Connect the voltmeter provided across the terminals of the cell labelled ***C***.

(b) Read and record the reading $E_o$ of the voltmeter.

(c) Connect the circuit shown in figure 4 below.

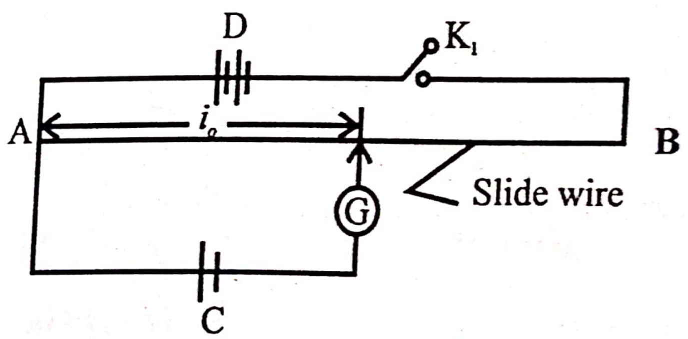



***Fig. 4***

(d) Close switch $K_1$.

(e) Move the sliding contact along the slide wire to locate a point on ***AB*** for which the galvanometer ***G*** shows no deflection.

(f) Measure and record the balance length $l_o$.

(g) Open switch $K_1$.

(h) Calculate the value of $K_o$ from the expression $K_o = \frac{E_o}{l_o}$.

## PART II

(a) Connect the circuit shown in figure 5 below.

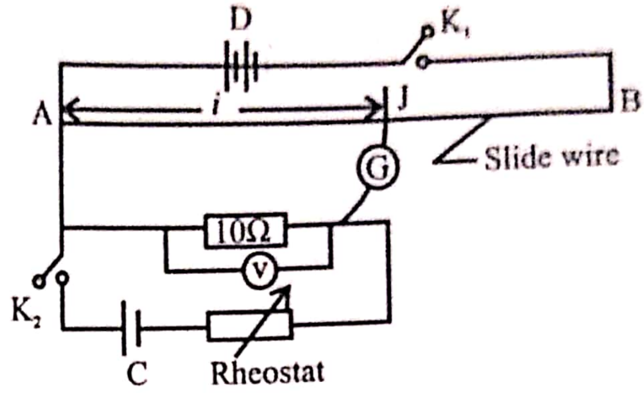



*Fig. 5*

(b) Close switches $K_1$ and $K_2$.

(c) Adjust the rheostat until the voltmeter reading $V_o = 0.35V$.

(d) Move the sliding contact along $AB$ to locate the balance point when $G$ shows no deflection.

(e) Read and record the balance length $l$.

(f) Open switches $K_1$ and $K_2$.

(g) Repeat procedures (b) to (f) for voltmeter readings, $V_o = -0.40$, 0.45, 0.50, 0.55, 0.60 and $0.65V$.

(h) Tabulate your results, including values of $Vm = E_o\left(\frac{l}{l_o}\right)$.

(i) Plot a graph of $Vm$ against $V_o$.

(j) Determine the slope $S_2$ of the graph.

(k) Comment on the value of the slope.

**END**

**456/2**
**MATHEMATICS**
Paper 2
**July/Aug. 2022**
2½ hrs

# UGANDA TEACHERS' EXAMINATIONS SCHEME

**Uganda Certificate of Education**

**JOINT MOCK EXAMINATIONS**

MATHEMATICS

**Paper 2**

2 hours 30 minutes

## INSTRUCTIONS TO CANDIDATES:

*Answer* **all** *questions in section* **A** *and any* **five** *questions from section* **B**.

*Any additional question(s) answered will* **not** *be marked.*

**All** *necessary calculations* **must** *be done in the answer booklet(s) provided. Therefore, no paper should be given for rough work.*

*Graph papers are provided.*

*Silent non – programmable scientific calculators and Mathematical tables with a list of formulae may be used.*



**Turn Over**

## SECTION A: (40 MARKS)

*Answer **all** questions in this section.*

9.

1. Express $2.0\overline{21}$ as a simplified mixed fraction. (04 marks)

10

2. Given two sets T = {first six triangle numbers} and C = {first six composite numbers}. Find $n(T \cap C)'$. (04 marks)

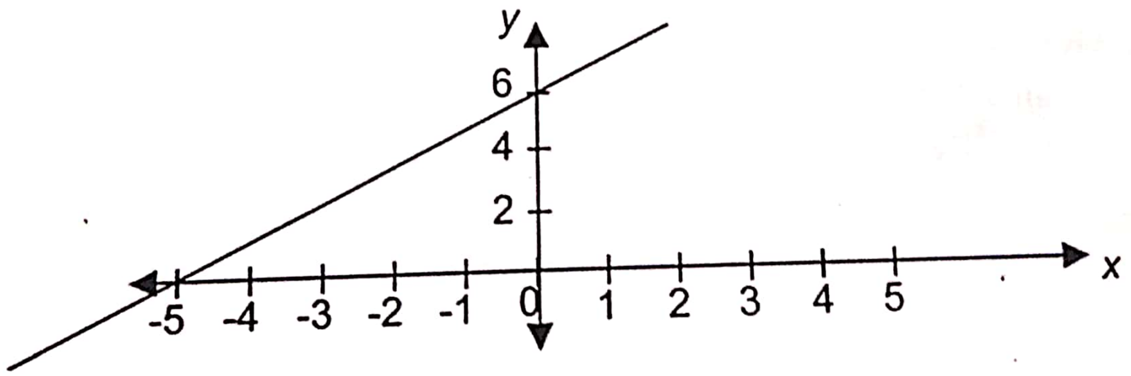
3. Without using mathematical tables of logarithm or a calculator, evaluate. (04 marks)
$$\frac{62.8^2 - 62.8 \times 52.8}{0.314}$$

4. Determine the volume of a sphere of diameter 21cm. (04 marks)

5. Given a mapping $g(x) = 3x^2 + 4$. Find the range whose domain is {-1, 0, 1,2}. (04 marks)

6. A car valued shs 21.5 millions depreciates at 18% per year. Find its depreciation after two years. (04 marks)

7. Find the equation of line below. (04 marks)




8. Given the vectors $AB = \begin{pmatrix} 9 \\ -1 \end{pmatrix}$, $CB = \begin{pmatrix} 1 \\ -7 \end{pmatrix}$. Find
   (a) the vector of $AC$
   (b) $|AC|$ (04 marks)

9. Two tanks are similar with capacities 48 litres and 6 litres respectively. If the surface area of the big tank is $40cm^2$, find the surface area of the small tank.

(04 marks)

10. A and B are two points such that A(-2,7) and B(-8,-1). Find the

(a) midpoint of AB.

(b) Length of line AB. (04 marks)

## SECTION B (60 MARKS)

*Answer any five questions from this section. All questions carry **equal** marks.*

11. A group of students in senior four sat and passed the subjects Physics (P), Chemistry (C) and Mathematics (M). Each student passed atleast one of the subjects above.

$n(P) = 18$, $n(C) = 25$, $n(M) = 21$, $n(P \cap C) = 11$, $n(P \cap M) = 10$, $n(M \cap C) = 13$, $n(P \cap M^1 \cap C^1) = 6$.

(a) Represent the above information on a Venn diagram. (06 marks)

(b) How many students passed all of the three subjects? (02 marks)

(c) Determine the probability of picking a student who passed exactly two subjects. (04 marks)

12. (a) Two towns A and B are 80km apart. A bus left town A at 9:50am for town B with speed of $90kmh^{-1}$. At the same time ,a lorry left town B for town A at $30kmh^{-1}$. By calculation, find the

(i) Time at which the bus met the lorry. (06 marks)

(ii) Distance covered by the bus to meet the lorry. (02 marks)

(b) Mary left her home at 10:32am for the market which is 24km away from her home. She reached market at 11:20am. Find he average speed.

(04 marks)

16.

13. (a) A set Q = {1, 2, 3, 4, 9, 16}, draw a papygram for the relation **"is a square of"** (04 marks)

(b) A function $h(x) = ax^2 + 7, h(-2) = 27$. find

(i) the value of $a$. (02 marks)

(ii) $h^{-1}(x)$ (03 marks)

(iii) $h^{-1}(52)$ (03 marks)

14. The cost (C) of hiring a band is partly constant and varies as the square of number of hours (n) for which the band plays.
The cost of hiring a band for six hours is shs 402,000. The cost of hiring the band for 7 hours is shs 493,000.

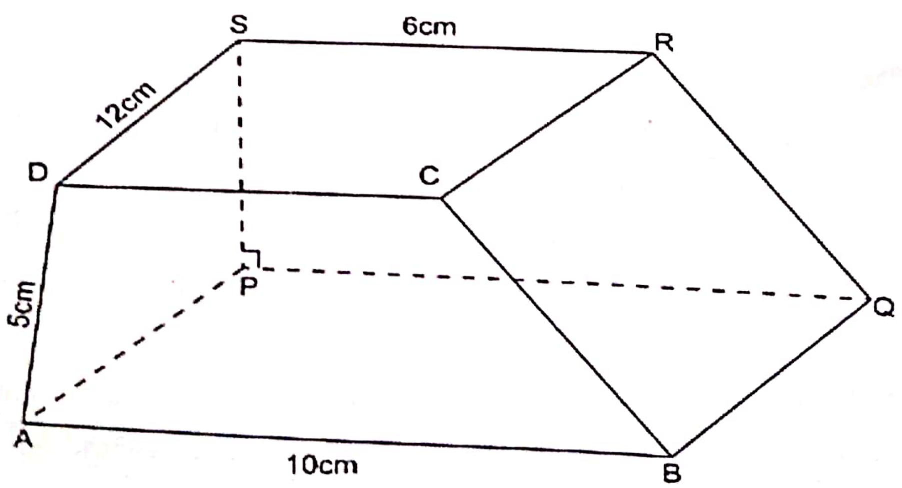
(a) Form an equation connecting C and n. (07 marks)

(b) Find the;

(i) Cost of hiring the band for 12 hours. (02 marks)

(ii) Number of hours played by the band if hired at shs850,000. (03 marks)

15. ABQPSRCD is a prism with AB = 10cm, AD = 5cm, DS = 12 cm, SR = 6cm. ABCD is a trapezium.




Calculate its

(a) length BC. (02 marks)

(b) (i) Volume. (04 marks)

(ii) Surface area. (06 marks)

16. An employee is paid gross monthly income of shs 960,000 which includes the following tax free allowances.

- Medical shs 50,000
- Housing shs 100,000 per month.
- Transport 10% of the gross monthly income.
- Airtime shs 240,000 per year.

The tax structure below is used.

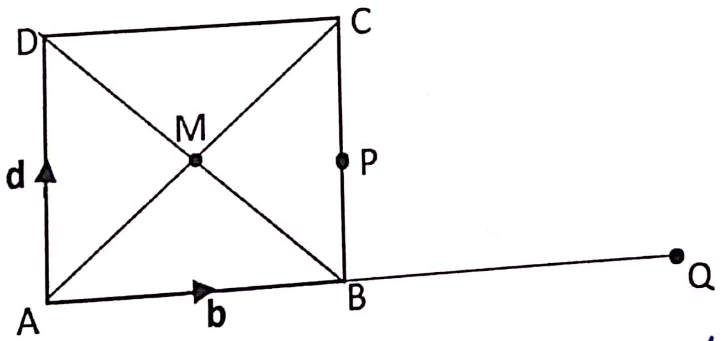
| Monthly taxable income | Tax rate (%) |
|---|---|
| First shs 100,000 | Free |
| 100,001 - 300,000 | 10.0 |
| Next shs 100,000 | 11.4 |
| Next shs 250,000 | 16.0 |
| Next shs 200,000 | 20.0 |
| Any excess | 25.0 |

Calculate the employee's monthly

(a) taxable income, (04 marks)

(b) net income. (08 marks)

17. ABCD is a square with vectors **AB** = **b**, **AD** = **d**, AC and BD meet at M and $2BC = 3PC$, $AQ = 2AB$.




(a) Express the following vectors in terms of **b** and **a**.

(i) **AC**

(ii) **BP**

(iii) **AP** (06 marks)

(b) Show that the points M, P and Q are collinear. (06 marks)

**END**

P425/1
PURE MATHEMATICS
Paper 1
July/Aug. 2022
3 hours

# UGANDA TEACHERS' EXAMINATIONS SCHEME

## Uganda Advanced Certificate of Education

## JOINT MOCK EXAMINATIONS

PURE MATHEMATICS

**Paper 1**

**3 hours**

## INSTRUCTIONS TO CANDIDATES:

*Answer **all** the eight questions in section A and any **five** questions from section B.*

*Any additional question(s) answered will **not** be marked.*

*All necessary working must be shown clearly.*

*Begin each answer on a fresh sheet of paper.*

*Graph paper is provided.*

*Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*



**Turn Over**

## SECTION A: (40 MARKS)

*Answer all the questions in this section.*

1. Solve the simultaneous equations. (05 marks)

$$3x - 2y + 5z = 11$$
$$2x + 7y - 6z = -2$$
$$5x - 9y + 2z = 12$$

2. Find the square root of a complex number $12i + 5$. (05 marks)

3. Determine the Cartesian equation of a line passing through the midpoint of AB with $A(-2,1,9)$ and $B(8,5,-1)$ which is perpendicular to the plane $3x - 5y + 8z - 11 = 0$. (05 marks)

4. Evaluate $\int_0^{\frac{4\pi}{3}} \sin^3 \frac{x}{4} dx$. (05 marks)

5. Solve the equation $\sin 5x = \sin 7x + \sin x$, for $0^o \leq x \leq 180^o$. (05 marks)

6. Differentiate $\ln\left(\frac{3+4x}{\sqrt{(9x+1)^5}}\right)$ with respect to $x$. (05 marks)

7. Determine the length of tangent drawn from the point $(2,-5)$ to the cir $x^2 + y^2 + 2x - 6y - 15 = 0$. (05 marks)

8. The first three terms of an Arithmetic progression (AP) are $6, p$ and $14$. T first three terms of a geometric progression (GP) are $p, q$ and $40$ respectiv Five the positive values of $p$ and $q$. (05 marks)

## SECTION B: (60 MARKS)

*Answer any **five** questions from this section. All questions carry equal marks.*

**9.** (a) Expand $\frac{2x+1}{\sqrt{1-3x+x^2}}$ upto the third term. (06 marks)

(b) If $(1+ax)^n = 1 - \frac{3}{5}x - \frac{27}{100}x^2 + \cdots$ Find $a$ and $n$. (06 marks)

**10.** (a) Determine the point of intersection of the line

$$\boldsymbol{r} = \begin{pmatrix} 3 \\ -1 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ -2 \\ 1 \end{pmatrix}$$ and the plane $3x - 4y + 7z = 74$.

(06 marks)

(b) Given three points $A(3,-1,2)$ $B(4,0,-1)$ and $C(7,-2,1)$ where $ABC$ is a triangle, using vectors, find the angle $BCA$ of the triangle.

(06 marks)

**11.** (a) Determine the equation of normal to the parabola $y^2 = 4ax$ at the point $P(ap^2, 2ap)$.

(04 marks)

(b) The normal in (a) above meets the $x-axis$ at point $G$. line $PG$ is produced to get point $H$ such that $PG = GH$

(i) Find the coordinates of $G$ and $H$. (05 marks)

(ii) Show that $H$ lies on the parabola $y^2 = 4a(x-4a)$ . (03 marks)

**12.** Sketch a graph of $y = x^3 + x^2 - 6x$ and hence find the area enclosed between the curve and the $x - axis$.

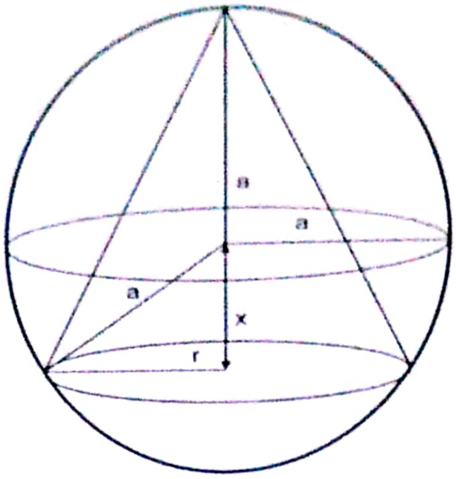
(12 marks)

**13.** Given that $x = \frac{2}{t}$ and $y = \frac{1+t}{1-t}$, find $\frac{d^2y}{dx^2}$ in terms of $t$ and hence deduce $\frac{d^2y}{dx^2}$ at the point $\left(\frac{1}{2}, \frac{-5}{3}\right)$.

(12 marks)

**Turn Over**

14. A cone of radius $r$ and whose base is a distance $x$ from the centre of the sphere is inscribed in a sphere of radius $a$ and volume $V$.




(a) Express the volume of the cone in terms of $x$and $a$. (03 marks)

(b) Show that the maximum volume of the cone that can be inscribed in the sphere is $V_{max}= \frac{8}{27}V$ where V is the volume of the sphere. (09 marks)

15. Express $3\cos\theta + \sqrt{3}\sin\theta$ in the form $R\cos(\theta - \alpha)$where $\alpha$ is cute and hence;

(a) Find the minimum value of $3\cos\theta + \sqrt{3}\sin\theta$ and the smallest positive value of $\theta$ from which $3\cos\theta + \sqrt{3}\sin\theta$ is minimum. (09 marks)

(b) Solve $3\cos\theta + \sqrt{3}\sin\theta + 1 = 0$for $0^o \leq \theta \leq 360^o$. (03 marks)

16. (a) Solve the different equation $\frac{dy}{dx} = \frac{3x^2-2x+1}{4y-3}$ given that $y = 2$at $x = 1$.

(05 marks)

(b) The rate of decrease of a variable $m$ is proportional to $m$. where$t = 0, m = 16$ and when $t = 5, m = 8$. Find $m$ when $t = 12$.

(07 marks)

**END**

P425/2
APPLIED MATHEMATICS
Paper 2
July/Aug. 2022
3 hours

# UGANDA TEACHERS' EXAMINATIONS SCHEME

## Uganda Advanced Certificate of Education

## JOINT MOCK EXAMINATIONS

APPLIED MATHEMATICS

**Paper 2**

**3 hours**

**INSTRUCTIONS TO CANDIDATES:**

*Answer **all** the eight questions in section A and any **five** questions from section B.*

*Any additional question(s) answered will not be marked.*

*In numerical work, take g to be $9.8ms^{-2}$*

*All necessary working must be shown clearly.*

*Begin each answer on a fresh sheet of paper.*

*Graph paper is provided.*

*Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.*



**Turn Over**

## SECTION A: (40 MARKS)

*Answer all the questions in this section.*

1. A family plans to have three children.

   (a) Write down the possible sample space, and construct its probability distribution table. (03 marks)

   (b) Given that X is the number of boys in the family, find the expected number of boys. (02 marks)

2. A body at point P is moving at a velocity of $24ms^{-1}$ by a constant retardation of $0.8ms^{-2}$. Using a velocity – time graph, find the distance travelled by the body in 40 seconds. (05 marks)

3. The table below shows the values of $lnx$ for given values of $x$.

| $x$ | 1.4 | 1.5 | 1.6 | 1.7 |
|---|---|---|---|---|
| $lnx$ | 0.3365 | 0.4055 | 0.4700 | 0.5306 |

Use linear interpolation, find the value of;

(a) $ln(1.66)$, correct to 3 decimal places. (03 marks)

(b) $x$ corresponding to $ln(x) = 0.400$. (02 marks)

4. ABCDEF is a regular hexagon. Forces of $2N, 4\sqrt{3}N, 10N$ and $6N$ act along AB, AC, DA and AF respectively, in the directions indicated by the order of the letters. Show that the forces are in equilibrium. (05 marks)

5. Two balls are randomly drawn without replacement from a bag containing 10 white and 6 red balls. Find the probability that the second ball drawn is;

(a) red given that the first one was white.

(b) White. (05 marks)

6. A mass of 12kg is pulled up a smooth plane inclined at $sin^{-1}\left(\frac{2}{3}\right)$ by a force P parallel to the plane. If the massaccelerates at $\frac{g}{2}ms^{-2}$,determine the force P.

(05 marks)

7. Estimate the value of $\int_0^1 \frac{dx}{1+x^2}$, by the trapezium rule using five sub-intervals, correct to three decimal places. (05 marks)

8. On a certain farm 20% of the cows are infected by a tick disease. If a random sample of 50 cows is selected from the farm, find the probability that not more than 10% of the cows are infected. (05 marks)

## SECTION B

*Answer any **five** questions for this section. **All** questions carry equal marks.*

9. An object is projected from a building of height 12metres with velocity of $24ms^{-1}$. It is projected at an angle of $40^0$ above the horizontal. Find the

(i) time taken by this object to reach the maximum height. (02 marks)

(ii) maximum height above the ground reached by the object. (04 marks)

(iii) Distance from the building upto the point where it struck the ground.

(06 marks)

**Turn Over**

10. (a) A random variable X takes on the values of the interval $0 < x < 2$ and has a probability density function, given by:

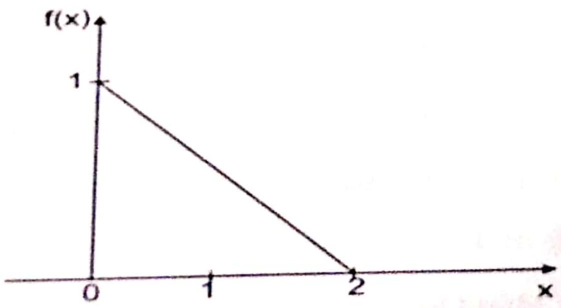
$$f(x) = \begin{cases} a; & 0 < x \leq \frac{3}{2} \\ \frac{a}{2}(2-x); & \frac{3}{2} < x \leq 2 \\ 0; & else\ where \end{cases}$$

Find:

(i) The value of $a$.

(ii) $P(X < 1.6)$. (06 marks)

(b) The probability density function $f(x)$ of the random variable X takes on the form shown below.




Determine the expression for $f(x)$ and for the cumulative probability density function of X. (06 marks)

11. (a) Show that the iterative formula for approximating the root of $f(x) = 0$, by the Newton – Raphson process for the equation $xe^x + 5x - 10 = 0$ is;

$$x_{n+1} = \frac{x_n^2 e^{x_n} + 10}{e^{x_n}(x_n + 5)}.$$

(b) Show that the root of the equation in (i) above lies between 1 and 2. Hence, with $x_o = 1.3$, find the root of the equation, correct to two decimal places.

(12 marks)

12. A force of $(8\boldsymbol{i} + 12t\boldsymbol{j} - 12\boldsymbol{k})$N act on a mass of 2kg. The body is initially at a point (2,-1,3) with velocity of $(5\boldsymbol{j} + \boldsymbol{k})ms^{-1}$

(a) Determine the speed of this body after 2seconds (08 marks)

(b) Find an expression for the displacement of the body after any time t.

(04 marks)

13. A sugar factory sells sugar in bags of mean weight 50kg and standard deviation 2.5kg. given that the weights of bags are normally distributed, find the;

(a) Probability that the weight of any bag of sugar randomly selected lies between 51.5kg and 53kg. (04 marks)

(b) Percentage of bags whose weights exceed 54kg. (04 marks)

(c) Number of bags that will be rejected out of 1000 bags purchased, for weighing below 450kg. (04 marks)

**Turn Over**

14. (a) Abdu, Betty and Charles applied for the same job in a certain company. The probability that Abdu will take the job is $\frac{3}{4}$. The probability that Betty will make it is ½, while the probability that Charles will not take it is $\frac{1}{3}$. What is the probability that:

(i) None of them will take the job?

(ii) One of them will take the job. (06 marks)

(b) Two events A and B are independent. Given that $P(A \cap B') = \frac{1}{4}$, and $P\left({A'}/{B}\right) = \frac{1}{6}$; use a venn diagram to find the probabilities:

(i) P(A)

(ii) P(B)

(iii) $P(A \cap B)$

(iv) $P(A \cup B)^1$ (06 marks)

15. Given the numbers $x = 2.678$ and $y = 0.8765$ measured to the nearest number of decimal places indicated.

(a) State the maximum possible errors in $x$ and $y$.

(b) Determine the absolute error in $xy$.

(c) Find the limits within which the product $xy$ lies, correct to 4 decimal places.

(12 marks)

16. Two points A and B are 531 metres apart. A truck X leaves point A with speed of $14ms^{-1}$ for point B with uniform acceleration of $4ms^{-2}$. At the same time, another truck Y leaves point B with speed of $18ms^{-1}$ for point A with uniform acceleration of $2ms^{-2}$.

(a) Determine the distance covered by truck X to meet truck Y (08 marks)

(b) Find the velocity of each truck at the point they met (04 marks)

**END**

**P510/2**
**PHYSICS**
Paper 2
**July/Aug. 2022**
2½ hrs

# UGANDA TEACHERS' EXAMINATIONS SCHEME

## Uganda Advanced Certificate of Education

## JOINT MOCK EXAMINATIONS

## PHYSICS

## Paper 2

**Time: 2 hours 30 minutes**

## INSTRUCTIONS TO CANDIDATES:

*Answer* **five** *questions, taking at least* **one** *from each of the sections* **A, B, C** *and* **D** *but* **not** *more than* **one** *question should be chosen from* **either** *section* **A** *or* **B.**

*Any additional question(s) answered will not be marked.*

*Mathematical tables and squared papers are provided.*

*Non – programmable scientific calculators may be used.*

*Assume where necessary:*

| | | |
|---|---|---|
| *Acceleration due to gravity, g* | = | $9.81\ ms^{-2}$. |
| *Speed of light in a vacuum, c* | = | $3.0 \times 10^{8}\ ms^{-1}$. |
| *Electron charge, e* | = | $1.6 \times 10^{-19}C$. |
| *Electron mass* | = | $9.11 \times 10^{-31}kg$. |
| *Plank's constant, h* | = | $6.6 \times 10^{-34}Js$. |
| *Permeability of free space,* | = | $4.0\pi \times 10^{-7}Hm^{-1}$. |
| *Permittivity of free space* | = | $8.85 \times 10^{-12}Fm^{-1}$. |
| *The constant* $\frac{1}{4\pi\varepsilon_0}$ | = | $9.0 \times 10^{9}F^{-1}m$. |
| *One electron volt (eV)* | = | $1.6 \times 10^{-19}J$. |
| *Avogadro's number* $N_A$ | = | $6.02 \times 10^{23}mol^{-1}$. |
| *Resistivity of Nichrome wire at 25°C* | = | $1.2 \times 10^{6}\Omega m$. |
| *Specific heat capacity of water* | = | $4.2 \times 10^{3}Jkg^{-1}K^{-1}$. |



**Turn Over**

## SECTION A

1. (a) (i) Distinguish between **real** and **virtual images**. (02 marks)

(ii) Describe how the position of an image in a plane mirror can be located. (03 marks)

(b) (i) What is meant by **radius of curvature** of a convex mirror? (01 mark)

(ii) Describe an experiment to determine the focal length of a convex mirror using a plane mirror. (05 marks)

(c) (i) Define the term **linear magnification**. (01 mark)

(ii) Sketch a ray diagram showing the formation of a real image by an object in a concave mirror and use it to show that, $M = \frac{v}{f} - 1$ where $M$ is the linear magnification, produced, $V$ is the image distance from the mirror and $f$ is the focal length of the mirror. (04 marks)

(d)

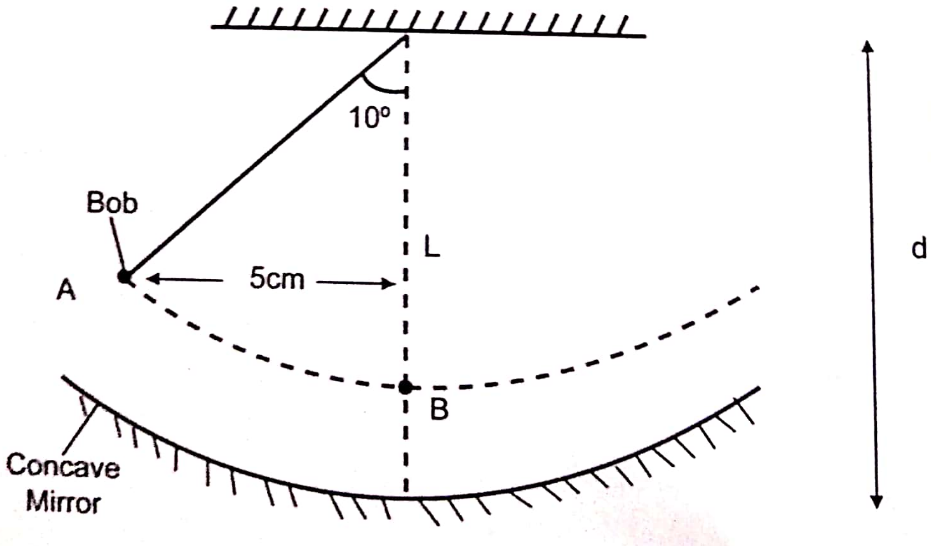



Figure 1, shows a swinging pendulum above a concave mirror of radius of curvature 20cm. $B$ is along the principle axis of the mirror. A real image of the bob at $B$ is 30cm, from the mirror. Find the height $d$. (04 marks)

2. (a) Define the term **refractive index**. (01 mark)

(b) (i) Describe how you would measure the angle of the prism using a spectrometer. (05 marks)

(ii) A ray of light is incident on the face of the glass prism of refractive index 1.50 at an acute angle of incidence from a liquid of refractive index 1.34. Find the deviation of the ray such that the ray just emerges from the opposite face in air. (04 marks)

(c) Draw a ray diagram showing a refracting telescope in normal adjustment and derive an expression for the magnifying power. (05 marks)

(d) (i) State **one** advantage and one disadvantage of a Galilean telescope. (02 marks)

(ii) Explain the effect of reducing the aperture of an objective lens in an astronomical telescope on the magnifying power and on the brightness of the image. (03 marks)

## SECTION B

3. (a) (i) What is meant by the term **diffraction** in reference to waves? (01 mark)

(ii) Explain the formation of fringes by a transmission grating. (04 marks)

(b) When monochromatic light of wave length $6.0 \times 10^{-7} m$ is incident normally on a transmission grating, the second order diffraction image is observed at an angle of $30^o$. Determine the number of lines per centimeter on the grating. (04 marks)

(c) (i) State **Huygen's principle.** (01 mark)

(ii) Monochromatic light propagating in air is incident obliquely on a plane boundary with a material of refractive index, $n$. Use Huygen's principle to show that the speed of light $v$, in the material is given by $V = \frac{u}{n}$ where $u$ is the speed of light in air. (06 marks)

(d) (i) What is meant by **interference of waves**? (01 mark)

(ii) Explain the term path difference with reference to interference of two wave motions. (03 marks)

4. (a) (i) Define **wave length**. (01 mark)

(ii) The displacement y in metres of a progressive wave is given by:

$y = 0.2\sin 2\pi(12t - 5x)$.

A progressive wave is reflected back along the same path. Show that the resultant is a stationary wave. (03 marks)

(iii) Find the frequency and the wave velocity of the wave train. (04 marks)

(b) A wire under tension of 20N produces a note of frequency of 100HZ when plucked in the middle. The wire has a length of 100cm and density of $0.6gcm^{-3}$. Calculate;

(i) the cross-sectional area of the wire. (03 marks)

(ii) the third overtone. (02 marks)

(c) A source that produces sound is receding from stationary observer towards a vertical wall with a speed, $Us$. The observer hears beats of frequency $f$. If the velocity of sound is $c$, derive an expression for the frequency $f_s$ of the source of sound. (03 marks)

(d) (i) State **three** factors which affect the speed of sound in air. (01 mark)

(ii) Explain using relative equation how the stated factors in (d) (i) above affect the velocity of sound in air. (03 marks)

## SECTION C

5. (a) (i) Define **one Henry**. (01 mark

(ii) Distinguish between **self-induction** and **mutual induction.** (02 marks)

(b) A coil of self-induction, $L$, and negligible resistance is connected to a battery in a circuit. Derive an expression for the energy stored in the inductor on switching on. (04 marks)

(c) (i) Describe an absolute method of determining resistance. (04 marks)

(ii) Explain why the method in (c) (i) above is called an absolute. (02 marks)

(d) A sheet of Aluminium is placed between the poles of an electromagnet such that the magnetic field links the sheet normally. When the sheet is pulled out, a considerable force whose magnitude increases with speed is required. Explain this observation. (03 marks)

(e) A coil of 20 turns, resistance $3\Omega$ and cross-sectional area $3.0 \times 10^{-2} m^2$ is placed with its plane perpendicular to a uniform magnetic field. The coil is connected in series with a ballistic galvanometer of resistance $2\Omega$. When the coil is rotated through $180^o$, the galvanometer makes a maximum throw of 10 divisions. When the capacitor of capacitance $1000\mu F$, charged fully to 20V, is discharged through the galvanometer, the galvanometer gives a maximum throw of 15 divisions. Calculate the flux density of the magnetic field. (03 marks)

6. (a) (i) Define magnetic moment. (01 mark)

(ii) Explain how the design of the moving coil galvanometer can be modified to produce a ballistic galvanometer. (03 marks)

(b) A horizontal wire of length 6cm and mass $1.5 \times 10^{-2} g$ carrying a current of 3A is placed in the middle of a circular coil of diameter 10cm at right angle to its axis. The coil has 100 turns. If the force on the wire is vertically upwards, calculate the current flowing in the coil that maintains the wire in equilibrium. (04 marks)

(c) Explain what is meant by eddy currents and state any **four** of their applications. (03 marks)

(d) Using diagrams explain the fields and the forces on like and unlike currents. (04 marks)

(e) (i) Show that the force per meter of a given length of the conductor is equal and opposite. (03 marks)

(ii) Find the force per metre between 2 long parallel wires 5cm apart and carrying currents of 2A and 4A in opposite direction in a vacuum. (03 marks)

**Turn Over**

7. (a) (i) Define the terms amplitude and root mean square value of an alternating voltage. (02 marks)

(ii) Show that the r.m.s. value of alternating voltage of amplitude $V_0$ is given by $V_{rms} = 0.7071V_0$. (03 marks)

(b) A sinnsoidal voltage of r.m.s value 10V is applied across a $50\mu F$ capacitor.

(i) Find the maximum value of charge on the capacitor. (02 marks)

(ii) Draw a sketch graph of charge on the capacitor against time and explain the features of the graph. (03 marks)

(c) An air cored inductor is connected in series with a switch and a $d.c$ source. The switch is left closed for some time.

(i) Explain why a spark is observed across the switch contact when the switch is reopened. (03 marks)

(ii) Explain how sparking in (c) (i) can be avoided. (02 marks)

(d) (i) Explain why capacitors are referred to wattles in an $a.c$ circuit. (03 marks)

(ii) A 240V supply of 50HZ, causes a current of 3.0A to flow through an inductor, calculate the reactance of the inductor? (02 marks)

## SECTION D

8. (a) (i) Define the terms **internal resistance** and **emf.** (02 marks)

(ii) Explain why the $p.d$ cross the terminals of a cell is great when no current is flowing in the external circuit. (03 marks)

(b) Describe an experiment to determine resistivity of a wire. (05 marks)

(c) Two wires **A** and **B** of equal length and same cross section area have resistivities $\varrho_A$ and $\varrho_B$ respectively. The wires are connected in series and a cell of e.m.f, E, is connected across the wires. Show that the across the wire A is given by; $V_A = \frac{\rho_A E}{\rho_A + \rho_B}$. (03 marks)

(d)

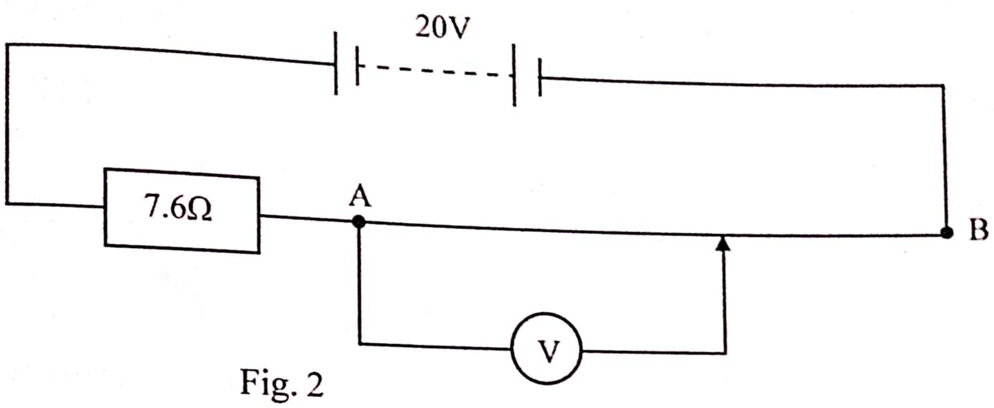



Fig. 2

Figure 2 shows a battery of emf 20V connected across a 7.6Ω resistor and a uniform resistance, R wire AB of Ω1 and 100cm long. A voltmeter of resistance connected across 40cm from A gives a reading of 3.0V. Find;

(i) The value of R. (04 marks)

(ii) The voltmeter reading when connected across 60cm from A. (03 marks)

9. (a) (i) Distinguish between **electric field intensity** and **electric field potential** at a point in an electric field. (02 marks)

(ii) Explain why a charged body attracts a neutral body. (02 marks)

(b) (i) Explain briefly what happens to the potential energy as two point charges of the same sign are brought closer. (02 marks)

(ii) Explain how charging by rubbing results into equal opposite charges. (03 marks)

(c) Describe an experiment to show that no net charge exists inside a hollow conductor. (04 marks)

(d) Charges $Q_1$, $Q_2$ and $Q_3$, of, $2\mu C$, $-3\mu C$, and $5\mu C$ respectively are situated at the corners of the triangle shown in figure 3 below.

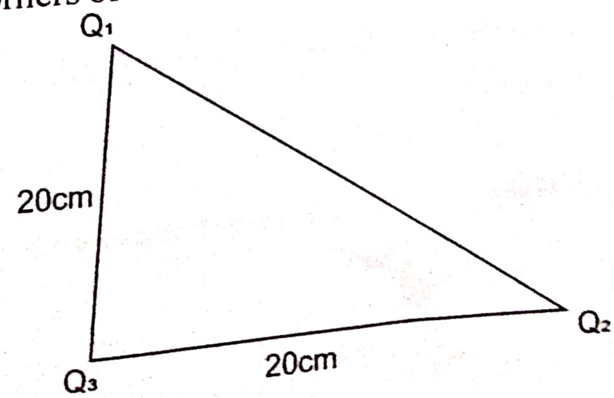



Fig. 3

**Turn Over**

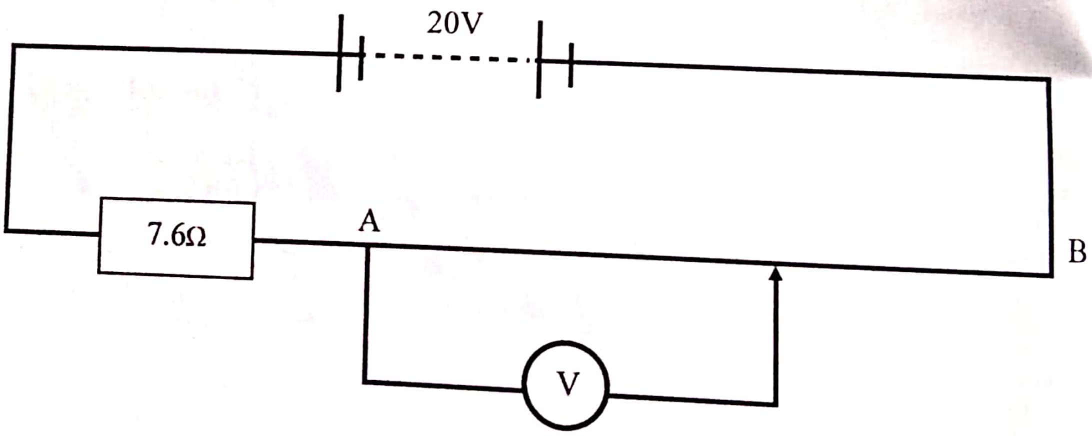
Find the amount of work done to move $Q_3$ to the point midway between $Q_1$ and $Q_2$. (05 marks)

(e) Explain why the electric field intensity close to the surface of a charged conductor is always at right angles to the surface of the conductor. (02 marks)

10. (a) (i) Define the terms **dielectric constant** and **dielectric strength** of a capacitor. (02 marks)

(ii) Briefly describe how reducing area of overlap of capacitor plates affects the capacitance of a capacitor. (03 marks)

(b) The figure below shows a network of three identical capacitors $C_1$, $C_2$ and $C_3$ each of capacitance, C, connected to a battery of emf $\varepsilon$. A dielectric material of dielectric constant is inserted between the places of $C_2$.




(i) Show that the energy E stored by a capacitor $C_2$ with dielectric is given by, $E = \frac{C\varepsilon_r \varepsilon^2}{2(\varepsilon_r + 2)^2}$ (04 marks)

(ii) Determine the total charge stored by the network if. $C = 2.0\mu F, \varepsilon_r = 2.0$ and $\varepsilon = 12v$ (03 marks)

(c) Describe an experiment to determine the capacitance of a capacitor using a ballistic galvanometer. (04 marks)

(d) Why does a dielectric material increase the energy stored by a charged capacitor? (04 marks)

**END**

Name: ............................................................. Index No. ......................

Signature: ..................................................

535/3
PHYSICS
PRACTICAL
Paper 3
July/Aug. 2022
2¼ hrs

**UGANDA TEACHERS' EXAMINATIONS SCHEME**

**Uganda Certificate of Education**

**JOINT MOCK EXAMINATIONS**

PHYSICS PRACTICAL

**Paper 3**

**2 hours 15 minutes**

## INSTRUCTIONS TO CANDIDATES:

*This paper consists of* **three** *questions.*

*Answer question* **1** *and* **one** *other question. You will* **not** *be allowed to start working with the apparatus for the first quarter of an hour.*

*Marks are given mainly for a clear record of the observation actually made for their suitability, accuracy and use made of them.*

*Candidates are reminded to record their observations and calculations in a suitable table drawn in advance.*

*Graph papers are provided.*

*Mathematical tables, slide rules and silent non-programmable scientific electronic calculators may be used.*



**Turn Over**

1. In this experiment, you will determine the relative density of the solid $X$ provided.

(a) Read and record the mass m of the solid $X$ provided.

(b) Suspend a metre rule from a clamp using a piece of thread.

(c) Adjust the metre rule until it balances horizontally.

(d) Read and record the distance of the balance point $P$ from end $A$.

(e) Suspend the solid $X$ at a distance $d = 10cm$ from end $A$ of the metre rule.

(f) Immerse the solid $X$ completely in water in a beaker as shown in figure 1.

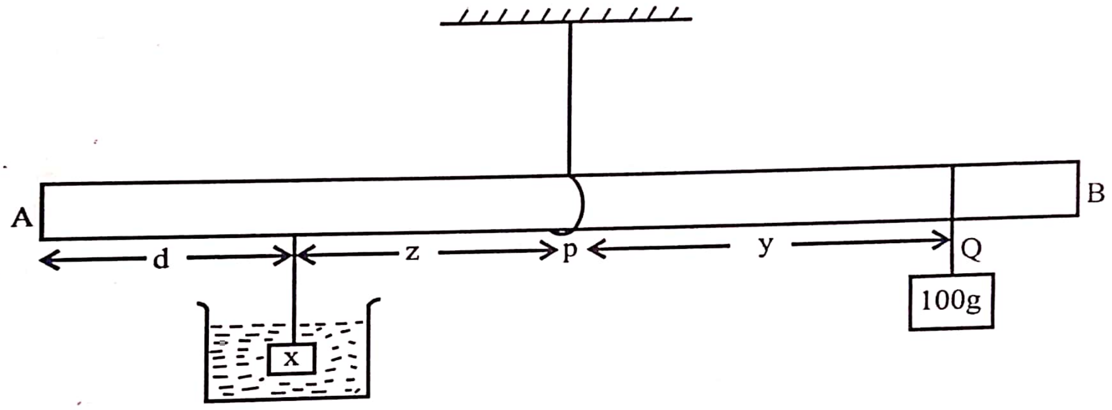



*fig. 1*

(g) Suspend a $100g$ mass from a point $Q$ between $P$ and $B$.

(h) Adjust the position of $Q$ until the metre rule balances horizontally with $X$ completely immersed in water but not touching the bottom of the beaker.

(i) Measure and record distanced $Z$ and $Y$.

(j) Repeat procedures (e) to (i) for values of $d = 15, 20, 25, 30, 35$ and $40cm$.

(k) Record your results in a suitable table.

(l) Plot a graph of $Y$ against $Z$.

(m) Find the slope, $S$ of the graph.

(n) Calculate the relative density of the solid $X$ from $R.D = \frac{m}{m-100S}$.

2. In this experiment, you will determine the refractive index, $n$ of the glass block provided.

(a) Fix a white sheet of paper on a soft board using drawing pins.

(b) Place the glass block on the paper and carefully draw its outline.

(c) Remove the glass block.

(d) Mark six points $A, B, C, D, E$ and $F$ $PQ$ such that they are $1cm$ from one another but $A$ is $2cm$ from $P$ as shown in figure 2 below.

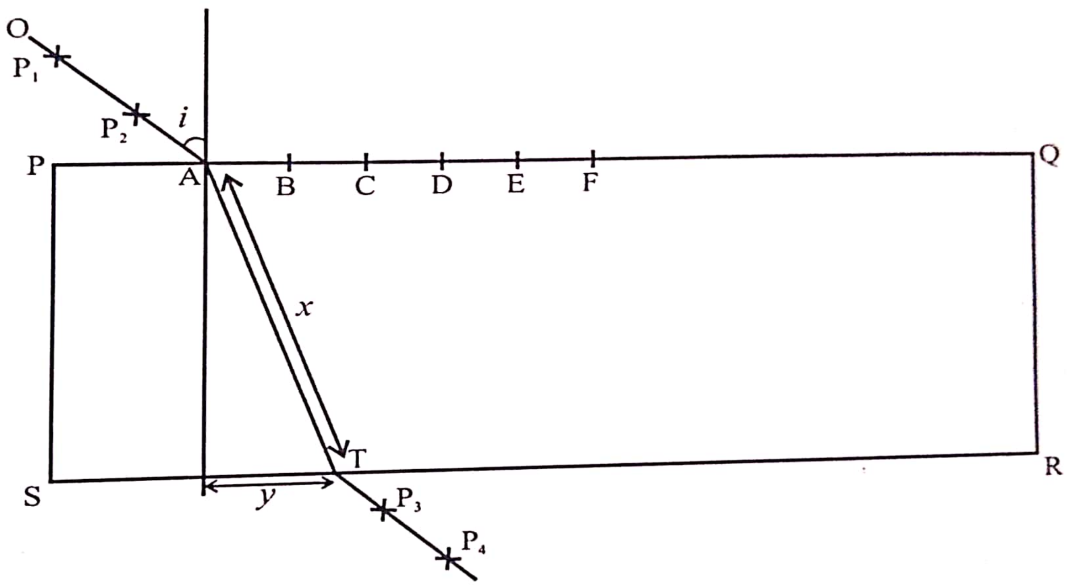



*fig. 2*

(e) Draw a normal at $A$ and a ray $OA$ such that angle $i = 60^o$.

(f) Stick two pins $P_1$ and $P_2$ on $OA$.

(g) Replace the glass block on its outline $PQRS$.

(h) Looking through side $SR$, stick two other pins $P_3$ and $P_4$ such that they are in line with the images of $P_1$ and $P_2$ seen through the glass block.

(i) Remove the glass block.

(j) Draw a line through $P_3$ and $P_4$ to cut the side $SR$ at $T$.

(k) Join $A$ to $T$.

(l) Measure the distances $x$ and $y$.

(m) Repeat procedures (e) to ($i$) for values of $i = 50^o, 40^o, 30^o, 20^o$ and $10^o$ respectively at $B$, $C$, $D$, $E$ and $F$, each time drawing a normal at the respective point.



**Turn Over**

(n) Tabulate your results including values of sin $i$ and $\frac{y}{x}$.

(o) Plot a graph of sin $i$ against $\frac{y}{x}$.

(p) Find the slope ∩ of the graph.

**HAND IN YOUR TRACING PAPER**

3. In this experiment, you will determine the constant Φ of the wire, $W$, provided.

(a) Connect a dry cell, ammeter and switch $K$ across the wire, $W$ as shown in figure 3 below

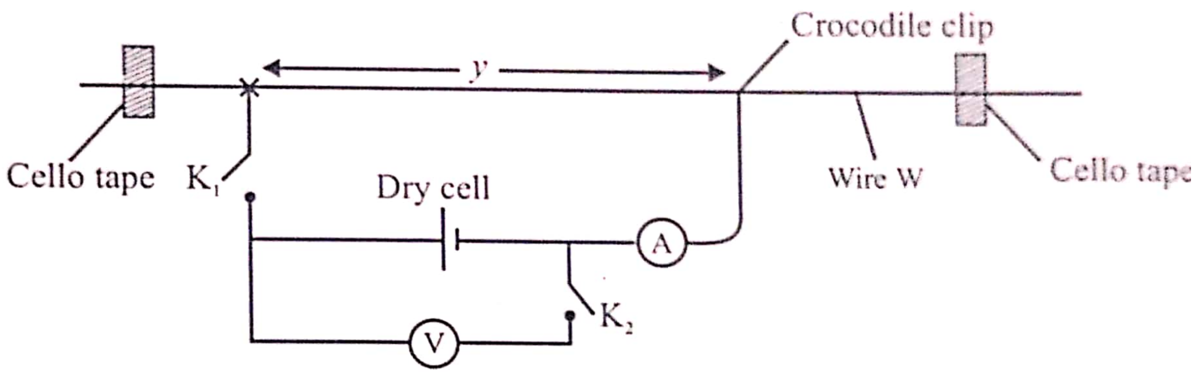



*Fig. 3*

(b) Connect a voltmeter and switch $K_2$ across the dry cell.

(c) Close $K_2$ and record the voltmeter reading $V_o$.

(d) Open switch $K_2$.

(e) Starting with a length $y = 0.30$, close $K_1$. Read and record the ammeter reading I.

(f) Open switch $K_1$.

(g) Repeat procedures (e) to (f) for values of $y = 0.40, 0.50, 0.60, 0.70$ and $0.80m$.

(h) Tabulate your results including values of $y^2$ and $\frac{y}{I}$

(i) Plot a graph of $\frac{y}{I}$ against $y^2$.

(j) Determine the slope, $S$ of the graph.

(k) Calculate Φ from the expression $\Phi = \frac{V_0 S}{9.3 \times 10^4}$.

**END**

456/1
**MATHEMATICS**
Paper 1
**July/August 2022**
2½ hrs

**UGANDA TEACHERS EXAMINATION SCHEME**
**Uganda Certificate of Education**
**JOINT MOCK EXAMINATIONS**
MATHEMATICS
**Paper 1**
2 hours 30 minutes

## INSTRUCTIONS TO CANDIDATES:

*Answer* **all** *questions in section* **A** *and any* **five** *questions from section* **B**.
*Any additional question(s) answered will* **not** *be marked.*
**All** *necessary calculations* **must** *be done in the answer booklet (s) provided. Therefore, no paper should be given for rough work.*

*Graph papers are provided.*

*Silent non – programmable scientific calculators and Mathematical tables with a list of formulae may be used.*



**Turn Over**

Name: ...........................................................

S: .

## SECTION A: (40 marks)

*Answer* **all** *questions in this section.*

1. Given that $a*b=2a^2-b$ find $-3*(-1*4)$. (04 marks)

2. The table below shows the ages of students in S.4.

| Age (years) | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|
| Number of students | 2 | 1 | 1 | 0 | 4 | 0 | 2 |

Find the,

(a) Mean age.

(b) Median age. (04 marks)

3. Solve the quadratic equation $4x^2-11x-3=0$. (04 marks)

4. Given that $\tan\theta=\frac{8}{15}$ and $\theta$ is reflex, find $\sin\theta$. (04 marks)

5. A father is 40 years older than his son. Ten years ago, the father was thrice as old as the son was. How old is the son? (04 marks)

6. Solve by matrix method. (04 marks)

$7y-x=23$

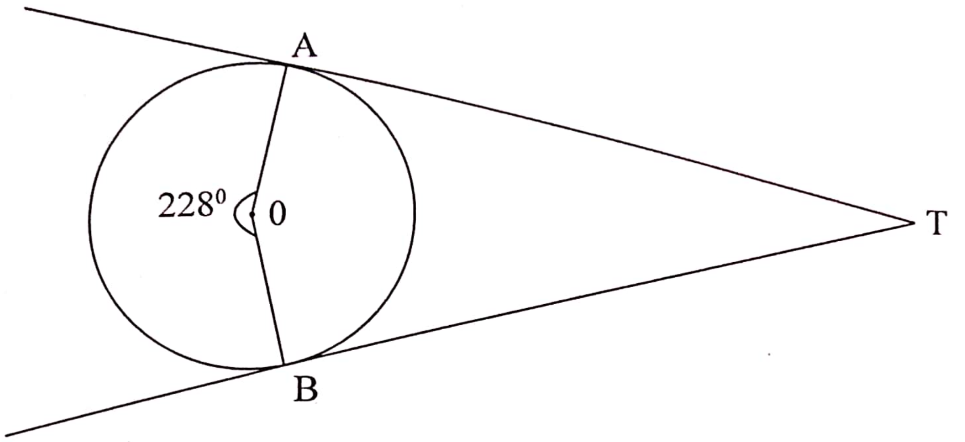
$2y+9x=-12$

7. The Sum of three consecutive counting numbers is 60. Find the numbers. (04 marks)

8. A transformation $\begin{pmatrix}4 & -1\\ 1 & 1\end{pmatrix}$ transforms a polygon of area $6cm^2$ to get the image. Determine the area of the image. (04 marks)

9. A box contains 4 green, 6 red and some yellow pencils. The probability of picking a yellow pencil is $\frac{1}{6}$. Find the number of yellow pencils in the box. (04 marks)

10. The diagram below shows a circle of centre 0, angle $AOB = 228^{o}$. $AT$ and $BT$ are tangents to the circle.




Determine the angle $ATB$. (04 marks)

## SECTION B

*Answer any **five** questions from this section. **All** questions carry **equal** marks.*

11. (a) Copy and complete the table below for the curve $y=(3-x)(\overset{2}{\cancel{3}}x+5)$

| $x$ | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| $3-x$ | 6 | | | 3 | | | 0 | -1 |
| $2x+5$ | -1 | | | 5 | | | | 13 |
| $y$ | -6 | | | 15 | | | | -13 |

(03 marks)

(b) Using a scale of 2cm to represent 1 unit in -axis and 2cm to representing 5units in y-axis, plot a graph of $y=(3-x)(\overset{2}{\cancel{3}}x+5)$ (05 marks)

(c) Use your graph in (b) above to solve the equation . (04 marks)

12. The distance and bearing of town $M$ from town $K$ are 240km and 240°
respectively. The distance and bearing of town $S$ from town $K$ are 180km and 330° respectively. Town $G$ is half way between $M$ and $S$. Using a scale of 1cm to represent 20km,

(a) Represent the information on a scale drawing. (07 marks)

(b) Determine the distance and bearing of S from $M$. (03 marks)

(c) Find the distance of $K$ from Town $G$. (02 marks)

13. Three girls Annet, Betty and Cissy started business in buying and selling of books and pens.
They all bought items from the same shop on the same day. They agreed to sell the items in the same market.
Annet bought 50 books and 80 pens. Betty bought 70 book and 60 pens. Cissy bought 40 books and 120 pens.
Each book is bought at shs4000 and a pen at shs500.
The books are sold at shs4500 each while a pen at shs700 each.

(a) Write down a;

(i) 3 x 2 matrix for items bought by the three girls.

(ii) 2 x 2 matrix for cost prices and selling prices. (04 marks)

(b) Use the matrices in (a) above to determine the girl who got more profit than others. (08 marks)

14. The table below shows the marks scored by students in an examination.

| Marks | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 |
|---|---|---|---|---|---|---|
| Number of students | 6 | 9 | 13 | 7 | 10 | 5 |

(a) Calculate the mean mark. (06 marks)

(b) Draw an Ogive (Cumulative frequency curve) and use it to estimate the median mark. (06 marks)

15. A line MN has coordinates $M(-2,1)$ and $N(6,3)$ . The images of $MN$ are and $M'(0,3)$ and $N'(8,1)$ after a rotation.

(a) Determine the centre and angle of rotation. (08 marks)

(b) Find the coordinates of $M''N''$ the images of $M'N'$ after enlargement of linear scale factor -1 about the centre in (a) above. (04 marks)

16. (a) Given that, $\sqrt[3]{\dfrac{mx^2 - n}{nx^2 + m}}$ make $x$ the subject. (06 marks)

(b) Factorise completely.

(i) $8x^3 + 1$ (03 marks)

(ii) $3x^4 - 48$ (03 marks)

17. Birungi has a maximum of shs 8000 to spend on bracelets. She will make two types of bracelets. Type A bracelets which costs shs 1000 each and type B bracelets which cost shs 800 each. Birungi plans to make more bracelets of type B than type A. Also, she wants atleast 2 bracelets of type A and over 6 bracelets of both types. Assuming she makes bracelets of type A and bracelets of type B;

(a) Write down **four** inequalities from the above information. (04 marks)

(b) Represent the inequalities on a graph taking 2cm to represent 1unit on both axes. (05 marks)

(c) If Birungi gets a profit of shs 300 from each bracelet of type A and shs 200 from each bracelets of type B, find how many bracelets of each type she should make in order to realize maximum profit and state the maximum profit realized by Birungi. (03 marks)

**END**