

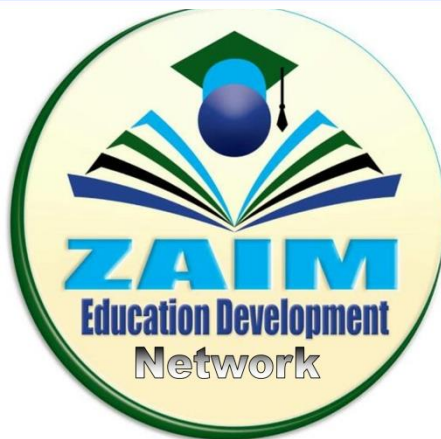
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THE NATIONAL MUSLIM COUNCIL OF TANZANIA

KINONDONI SECONDARY SECONDARY

P.O.BOX 21308, Dar es Salaam. Mob: 0713331725/0715018089



FORM FIVE

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(CORONA HOLIDAY)

EXAMINATIONS

March-April 2020

BASIC APPLIED MATHEMATICS

INSTRUCTIONS:-

- This paper consists of 10 questions.
- Attempt all questions showing clearly all the necessary steps.
- Non-programmable calculators and mathematical tables may be used.

1. By using non-programmable calculator, evaluate

(a) $\frac{(0.823)^{2/3} \times (1.754)^{1/2}}{(2.074)^{1/4}}$

(b) $5 \left(\frac{e^{0.25} - e^{-0.25}}{e^{0.25} + e^{-0.25}} \right) \left(\frac{2.946 \ln e^{1.76}}{\log 10^{1.41}} \right)$

(c) $\frac{\log(31.42) \ln 31.42}{22^{1/5}}$

(d) $\frac{12 \tan^{-1}(3.42) e^{8.22}}{(0.001182)^{1/2}}$

2. (a) Given $f(x) = \begin{cases} x^2 & \text{for } -\infty < x < 0 \\ x & \text{for } 0 < x < 1 \\ 2-x & \text{for } 1 < x < \infty \end{cases}$

- (i) sketch the graph of f .
(ii) determine the domain and range of f .

(b) (i) Solve the equation $x^4 - 5x^2 - 36 = 0$

(ii) Solve simultaneously in terms of r

$$\begin{cases} x^2 + y^2 = 25r^2 \\ 2y + x = 10r \end{cases}$$

3. (a) In an A.P the 3rd term is 8 and the 7th term is 20. Find the sum of the first 50 terms.

(b) In a G.P the sixth term is 8 times the third term, and the sum of the seventh and eighth terms is 192.

Determine the sum of the fifth to eleventh terms.

4. (a) If $y = x^2 - x$, then find $\frac{dy}{dx}$ by definition.

- (b) Find $\frac{dy}{dx}$ when $y = \frac{(x-1)^2}{x^2-1}$
- (c) Determine the turning points on the curve $y = \frac{x^3}{3} - \frac{x^2}{2} - 6x + \frac{5}{3}$ and state their nature.
5. (a) Define the following terms:
 (i) Vertical asymptote
 (ii) Horizontal asymptote
- (b) Sketch the graph of $f(x) = \frac{3x+2}{2x+4}$ and state its domain and range.
- (c) Find the inverse of $f(x) = \frac{4x-8}{x-4}$
6. (a) Evaluate $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \frac{1}{2^{n-1}} + \dots$
- (b) The third term of a convergent G.P is the arithmetic mean of the 1st and 2nd terms. Find the common ratio and, if the first term is 1, find the sum to infinity.
- (c) Use the concept of sum to infinity to change $0.\dot{4}\dot{5}$ into fraction.
7. (a) If $x:3:5 = 8:y:9$, find the value of x and y .
- (b) If z varies directly as the square root of x and inversely as the square root of y , $z = 4$ when $x = 4$ and $y = 2$. Find the value of z when $x = \frac{1}{9}$ and $y = \frac{1}{3}$
8. (a) the curve is given parametrically by the equations $x = 3t^2 - 4$ and $y = 4t + t^2$. Find the slope of this curve when $t = 1$.
- (b) Find $\frac{dy}{dx}$ given that $x^2 + y^2 - 2xy + 3y - 2x = 7$
- (c) The daily profit, p , of an oil refinery is given by $p = 8x - 0.02x^2$, where x is the number of barrels of oil refined. How many barrels will give maximum profit and what is the maximum profit?
9. (a) Divide $p(x) = x^3 + 8$ by $Q(x) = x + 2$
- (b) If $R = \{(1,4), (2,3), (1,1), (3,2), (4,1)\}$
 (i) Find R^{-1}
 (ii) Draw a pictorial representation of R^{-1} .

10. (a) Determine the turning points of the curve: $y = \frac{x^3}{3} - \frac{x^2}{2} - 6x + \frac{5}{3}$ and distinguish between them.

(b) Find the range of values of x for which the series $1 - (1-x) + (1-x)^2 - (1-x)^3 + \dots$ converges.

(c) Prove that $\sum_{k=0}^{\infty} (-1)^k x^k = \frac{1}{1+x}$ for $|x| < 1$

ADVANCE MATHEMATICS

INSTRUCTION:

- Answer All Questions

1. (a) Use non-programmable calculator to calculate

$$\sqrt[4.120]{\frac{3.1416[(9.483)^2 - (5.075)^2]}{0.0001980}} \quad \text{Correct to 5 decimal places.}$$

(03 marks)

- (b) Solve that quadric equation by inspection method; $4x^4 - 18x^3 + 23x^2 - 3x - 6 = 0$.

(04 marks)

2. (a) Simplify $(A' \cap B) \cup [A \cap (B \cup \phi)]$

(03 marks)

- (b) In a class of 34 students all taking at least one of the subjects A, B and C has $n(A \cap B' \cap C') = 2n(A' \cap C' \cap B)$, $n(A \cap B) = 7$, $n(B \cap C \cap A')$ and students taking exactly two subjects among these three are of the same number, find:-

(i) $n(A \cap B \cap C)$

(ii) $n(A)$

(iii) the number of students taking either A or B but not C.

(06 marks)

3. (a) If “Np denotes $\sim p$ ” and “Apq denotes $p \wedge q$ ” using only A and N, write $(p \leftrightarrow \sim q) \wedge r$

(03 marks)

- (b) Is this valid? $[(p \rightarrow r) \vee (q \rightarrow r)] \rightarrow r$

(03 marks)

- (c) Draw the electrical network of $[(\sim p \wedge q) \leftrightarrow p] \wedge r$

(03 marks)

4. (a) Find the sum to n terms of $\frac{1}{1 \times 2 \times 3} + \frac{3}{2 \times 3 \times 4} + \frac{5}{3 \times 4 \times 5} + \frac{7}{4 \times 5 \times 6} + \dots$

(05 marks)

- (b) Given that $\sum_{i=0}^{n-1} x^{-i}$, find

(i) the sum of the first n terms

(ii) the sum to infinity of the series.

(05 marks)

5. (a) For what values of p will the equation $\frac{x^2 - bx}{ax - c} = \frac{p-1}{p+1}$ has roots equal in magnitude but

opposite in sign.

(04 marks)

(b) Find the coefficient of x^{15} in the expansion of $\left(x^2 - \frac{3}{x}\right)^{12}$

(04 marks)

(c) The products of the first three terms of a Geometric progression is 1000. If we add 6 to its second term and 7 to the third term the resulting three terms form Arithmetic progression. Find the terms of the G.P.

(04 marks)

6. (a) A quadratic equation has positive roots α and β such that $\alpha - \beta = 2$ and $\alpha\beta = 15$. Determine its equation, and hence obtain the quadratic equation, whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$.

(05 marks)

(b) Find the value of a for the system below to be inconsistent. Then solve by using inverse matrix method

$$\begin{pmatrix} 3 & 1 & -3 \\ 1 & 2a & 1 \\ 0 & 2 & a \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} -3\frac{1}{2} \\ 5\frac{1}{2} \\ 5 \end{pmatrix} \text{ When } a = 2$$

(06 marks)

(c) Find the value of k for the system below to

(i) have no solution

(ii) have many solutions

$$\begin{cases} 3x + 4y - z = 2 \\ kx - y + 2z = 1 \\ 2x - 3y + 3z = 2 \end{cases}$$

(05 marks)

7. (a) Given $\sum_{r=1}^4 r^2 = \sum_{r=1}^4 3r$, find $\sum_{r=1}^4 (r+2)^2$

(04 marks)

(b) Prove by mathematical induction that $10^{2n-1} + 1$ is divisible by 11 for all positive integral values n.

(04 marks)

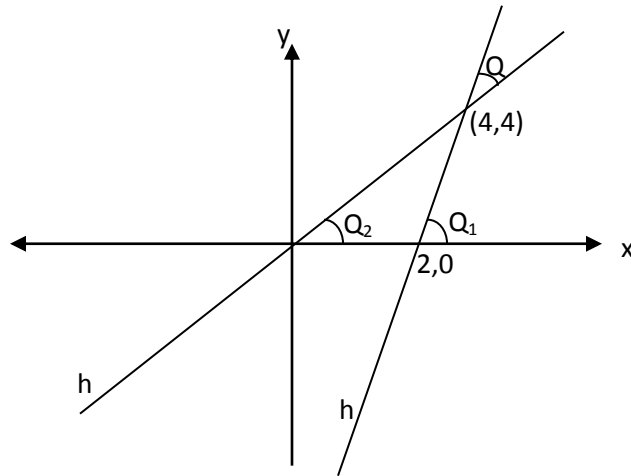
8. (a) Given $f(x) = 2 - \sqrt{3x+6}$, sketch the graph of $f(x)$ and obtain its domain and range.

(05 marks)

(b) Given $f(x) = x^2 + 6x$, find $g(x)$ such that $f \circ g = x^4 + 14x^2 + 40$

(04 marks)

9. (a) In the following diagram,



(i) Show that $Q = Q_1 - Q_2$ hence find the acute angle between the lines above.
(03 marks)

(ii) Show that $\tan Q = \frac{\tan Q_1 - \tan Q_2}{1 + \tan Q_1 \tan Q_2}$ and hence find the acute angle between the lines above.

(b) Find the equation of the circle through the intersection of the circles

$x^2 + y^2 - 8 - 2y + 7 = 0$ and $x^2 + y^2 - 4x + 10y + 8 = 0$ and having its centre on the y-axis.
(04 marks)

10. Azam company has a flour-store in Pugu district with 120 tons of flour and in Mbagala district having 40 tons of flour. Shoppers Plaza has ordered 80 tons, and Nakumatt 50 tons. Shoppers Plaza is 20 km from Pugu and 40 km from Mbagala. Nakumatt is 15 km from Pugu district and 30 km from Mbagala district. Delivery costs are proportional to the distance traveled. How should he supply his customers to minimize the total transport costs? What is the minimal transport cost?

HISTORY

INSTRUCTIONS:-

1. This paper consists of eight (08) questions in total.
 2. A candidate has to choose and answer four (05) questions ONLY.
 3. Each question carries twenty (20) marks.
 4. Be direct to the point.
 5. Good handwriting will be appreciated.
-
1. Describe how slave trade contributed to the widening gap in development between Africa and Europe. Provide six (06) points.
 2. In spite of its weaknesses pre-colonial education had several positive elements. Verify it with the support of six (06) points.
 3. Identify the six (06) differences in development of political systems between Africa and Europe in the 15th century.
 4. "Despite their differences, pre-colonial social formations in Africa were homogeneous" Justify it with six (06) supportive evidences.
 5. Explain the three (03) successes and three (03) problems of Back to Africa movement.
 6. Examine the contention that the struggles for civil right movement as advocated by Martin Luther King Junior was spearheaded by economic problems.
 7. Explain why colonialism and imperialism never intended to develop Africa. Provide six (06) points.
 8. With eight (08) points discuss the violent nature of the colonial, state as remarked by Frantz Fanon.

KISWAHILI

MAELEKEZO

1. Jibu maswali matano (5).
2. Chagua swali moja toka kila sehemu.
3. Muda: Masaa matatu.

A: NADHARIA YA FASIHI 20%

1. Jadili nadharia kuhusu uhusiano wa fani na maudhui.
2. Jadili wataalamu watano wanaoelezea neno fasihi na fafanua dhima za mwanafasihi kwa mifano halisi.

B: FASIHI SIMULIZI 20%

3. (a) Fafanua aina za sanaa.
(b) Jadili sifa za sanaa.
(c) Fafanua tofauti tatu za kifani kati ya methali na vitendawili.
4. (i) Kwa kutoa hoja tano nzit, fafanua aina za wahusika wanyama.
(ii) Fafanua makundi matatu ya wahusika wa fasihi simulizi.
5. (a) Fafanua aina za riwaya pendwa.
(b) Fafanua sifa za riwaya pendwa.
(c) Nini maana ya hadithi fupi.
6. (a) Fafanua vijenzi vya tamthiliya.
(b) Fafanua tofauti tano kati ya tamthilia na riwaya.

D: TAMTHILIA (NGUZO MAMA) 20%

7. Jadili vipengele vya matumizi ya lugha kwa kutumia “NGUZO MAMA”.
8. Uongozi mbaya, kutowajibika na usaliti umechangia matatizo mengi katika jamii. Jadili matatizo nane kutokana na “NGUZO MAMA”.

E: SARUFI

9. (a) Jadili aina tano za vitenzi vishirikishi vipungufu na matumizi yake.
(b) Fafanua kwa mifano kuhusu Kitenzi kishirikishi kikamilifu.
10. (a) Fafanua aina tano za Vivumishi vya pekee.
(b) Fafanua aina tano za Vivumishi vimilikishi.

GEOGRAPHY

INSTRUCTIONS:-

1. This paper consists of two sections A and B.
2. Attempt five (5) questions in all. Two (2) questions from section A and three (3) questions from section B.
3. Questions ONE (1) is compulsory.
4. Use of relevant sketch maps may add you more marks.

SECTION A

MAPWORK AND PRACTICAL GEOGRAPHY

Attempt two (2) questions from this section. Question one (1) is compulsory

1. Carefully study the map extract of MAFINGA sheet 232/4 and answer the following questions.
 - (a) What is the length of the all weather road with bound surface 480778 to 567870.
 - (b) From the map, outline the merits of using contours as a technique of representing relief on the topographical maps.
 - (c) Give an account on the population distribution of the area.
 - (d) Calculate the forward bearing of hospital 519819 from Race Track 532785.
 - (e) Use the precise evidences to explain the economic activities which are undertaken in the area shown in the map.
2. Carefully study the following data in table and answer the questions that follow:

PRODUCTION OF MAJOR EXPORT CROPS IN 2013

COUNTRY	COTTON	COCOA	PALM OIL	COPRA	COFFEE
TANZANIA	220	180	120	100	200
KENYA	100	120	75	80	100

- (a) Present the data by means of proportional semi-circles.
 - (b) What is the usefulness of the method you have used?
3.
 - (a) Describe the characteristics of extraterrestrial photographs?
 - (b) A swamp in a topographical map whose scale is 1:50,000 measures 80 cm². Find the area of this swamp in a photograph whose scale is 1:40,000.
 4. A research process proceeds through a logical manner in order to obtain meaningful information. Give an outline of research procedures.

SECTION B

Attempt three questions from this section

5. Plate tectonic theory is a new version of the old statement of continental drift. Justify the statement.
6. Discuss the role played by climate on weathering process.
7. Critically examine the processes behind the occurrences of sedimentary rocks. Why is this type of rock beneficial to Man?
8. Using concrete examples explain how faulting has been responsible for landscape evolution.
9. Discuss the classification of mass movements. What are the controlling factors in mass wasting?

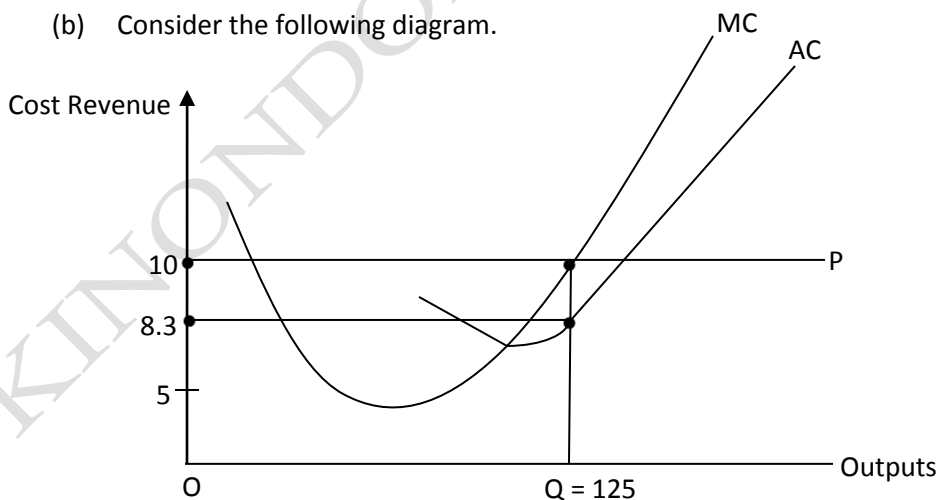
ECONOMICS

INSTRUCTIONS:-

1. This paper consists of two (2) sections.
2. Attempt five (5) questions at least two (2) questions from each section.

SECTION A

1. (a) Outline five (5) roles of the Government in the mixed Economic system.
(b) Critically analyse the assumptions of the production possibility frontier. (Give five points)
2. (a) Three local comic book collectors have expressed an interest in buying Adam's collection.
The individual demand equation for each of these three individuals is:
 $Q_{D,1} = Q_{D,2} = Q_{D,3} = 550 - 2.5 P$.
Where P is measured in Tshs. Per comic book.
(i) What is the market demand equation for Adam's comic books?
(ii) How many more comic books can Adam sell for each Tshs. reduction in price?
(iii) If Adam has 900 comic books in all, what price should he charge to sell his entire collection?
(b) With examples each, explain four (4) types of supply.
3. (a) Outline five (5) negative impacts for non-existence of specialization and division of labour.
(b) Define capital intensive technique of production. Explain four (4) disadvantages of capital intensive technique of production.
4. (a) Outline five (5) ways of minimizing costs, in the production process.
(b) Consider the following diagram.



Find:

- (i) Total cost (T)
- (ii) Total Revenue (TR)
- (iii) Average cost (AC)

- (iv) Profit or loss.
- (v) Shade the area where the firm makes profit or loss, and given reason.

SECTION B

- 5. (a) Explain four (4) ways in which the term market can be defined.
(b) Outline six (6) basis or ways in which monopoly can exist.
- 6. (a) Describe the three (3) types of elasticity of demand.
(b) When Anna's income increased by 40%. Find the income elasticity of demand and comment your answer.
(c) Briefly explain how time can affect price elastasticity of demand in the short-run.
- 7. (a) Show mathematically and graphically that MPL and APL are images of MC and AC (AVC), respectively.
(b) Distinguish between the following.
 - (i) Specific factor of production and non specific factor of production.
 - (ii) Specialization by process and specialization by craft.
 - (iii) Capital productivity and capital consumption.
- 8. In detail explain eight (08) causes of internal economies of scale; explain why the SR and LR AC are U-shaped.

BIOLOGY

INSTRUCTION:

1. Answer all questions in section A and any three questions from section B.

SECTION A

1. a) Account for the following statements:-
i) Not all genetic information is found in nucleus.
ii) A dominant role for the mitochondria is the production of ATP, but in plants not all energy are produced by mitochondria
iii) The cell will stop its functions if all ribosome are removed from it. **(3 marks)**
- b) Draw a typical eukaryotic cell and show the organelles which are responsible for the following:
i) Movement of water and dissolved mineral salts from cell to cell.
ii) Increase in internal surface area without increase in volume by a change in shape.
iii) Prevent the cell from bursting when exposed to the hypertonic solution.
iv) Stores glycoprotein and protein molecules synthesized from different organelle.
v) Associated with initiation and control of cell division. **(5marks)**
2. a) With example explain the meaning of cell differentiation. **(4marks)**
b) Explain the adaptation of that cell. **(4marks)**
3. a) Imagine that you are coordinator of biology and you have decided to eliminate the topic of classification from biology syllabus. Briefly explain what will happen to future biologist. **(3marks)**
b) Study the diagram below then answer the following questions:-



- i) Outline General characteristics of the kingdom to which the specimen belong **(2 marks)**
ii) Draw a well labeled diagram of the specimen in the diagram above. **(3 marks)**

4. a) Outline the principle sources of a wide variety of polysaccharides. **(4 marks)**
 b) Which part of lipid is responsible for its characteristic? In briefly describe the features of that part. **(3 marks)**
5. a) Give the differences between the following:-
 i. Conjugated and derived protein
 ii. Fibrous and conjugated protein
 iii. Secondary and primary protein. **(3 marks)**
 b) Using examples classify protein according to their functions. **(5 marks)**
6. a) i) Define refractory period and state its significant.
 ii) You have noticed that one of your child have trouble seeing at night and in the dark and the other child is colorblindness. What could be the problem of each child? **(4 marks)**
 b) Briefly explain the factors which affects the speed of transmission of nerve impulse. **(3 marks)**
7. a) Small invisible organisms are more dangerous and trouble makers than large organisms like lion. Justify this statement by using relevant example. **(5 marks)**
 b) i) What do you understand by the term feedback mechanism.
 ii) With example state main type of feedback mechanism. **(3 marks)**
- SECTION B**
8. a) Give an example of the most primitive plant. Why are they most primitive? **(5 marks)**
 b) Discuss the life cycle of mango plant. **(10 marks)**
9. a) Is it necessary for the eye to adjust the pupil size and to Refract light rays before the light rays are focused on retina? Give reasons for your answer. **(5 marks)**
 b) Draw a well labeled diagram of synapse and briefly describe its transmission. **(10 marks)**
10. a) i) Define nyctinasty movement.
 ii) With relevant example, explain the mechanism of nyctinasty movement.
 iii) State significances of nyctinasty movement. **(10 marks)**
 b) Each receptor has the lowest threshold for the adequate stimulus. Use this concept to classify receptors. **(5 marks)**
11. a) Describe the structural adaptation of the HIV virus. **(7 marks)**
 b) Draw a well labeled diagram of positively phototactic unicellular eukaryote and outline its adaptation. **(8 marks)**

PHYSICS

INSTRUCTIONS

- ▶ This paper consists of thirteen questions (13) questions.
- ▶ Answer any eight (8) questions.
- ▶ Each weighs 12.5 marks.

- ▶ The following constants may be used

- Radius of Earth 6400km,
- $g = 10\text{m/s}^2$
- $G = 6.67 \times 10^{-11} \text{Nm}^2\text{kg}^{-2}$,
- At STP $P = 10^5 \text{ Pa}$,
- $T = 273\text{K}$
- Linear expansivity of copper $\alpha = 20 \times 10^{-6} \text{K}^{-1}$,
- Young modulus of copper $E = 1.2 \times 10^{11} \text{ Pa}$.
- Coefficient of viscosity of water $\eta = 10^{-4} \text{ Pas}$.
- Density of water $\rho = 10^3 \text{ kg/m}^3$

1. (a) (i) Distinguish between dimensional analysis and error analysis. **[2.5 Marks]**

(ii) A liquid having small depth but large volume is forced by an applied pressure P above

it to escape with velocity v through small hole below. v is given by

$$v = CP^x \rho^y$$

where ρ is the liquid's density and C , x and y are dimensional constants.

(i)

Determine x and y (ii) If $v = 14 \text{ m/s}$ when $P = 1.0 \times 10^5 \text{ Pa}$ and $\rho = 1000 \text{ kg/m}^3$, deduce C

[05 Marks]

(b) The resistance R of a uniform conducting wire is calculated using measurement of its length l and radius r . The instrument for measuring l has a systematic error of -1% and that of r has systematic error of -1%. If there is no error in the value of the resistivity, calculate the value of R of systematic error. **[05 Marks]**

2. (a) A certain bedspring is observed to compress by 1.00 cm when a certain person is at rest atop the spring. What would be the spring's compression if the same person was dropped onto the spring from a height of 0.250 m above the top of the spring? Assume the person is dropped from rest. **[05.5 Marks]**

(b) A solid sphere of radius R is floating in a liquid of density ρ with half of its volume submerged. If sphere is slightly pushed and released, it starts

performing SHM. Find frequency of these oscillations.
[07 Marks]

3. (a) Two soap bubbles combine to form a single bubble. In this process, the change in volume and surface area are respectively V' and A' . If P is the atmospheric pressure, and γ is surface tension of the soap solution, then derive the relation $3PV + 4\gamma A = 0$
[06 Marks]

(b) A drop of water is placed between two glass plates which are then pushed together until water is squashed out into a thin circular film of radius 5 cm and thickness 0.2 mm. Calculate the force applied normal to the plates, which is required to separate them. Give underlying theory of your calculation. **[06.5 Marks]**

4. (a) A man stands on the surface of the earth at the latitude of 60° North. Calculate

- (i) its linear velocity
- (ii) its acceleration due to rotation of the earth. **[04.5 Marks]**

(b) (i) An Aeroplane in level flight makes a complete circular turn in 2 minutes at constant speed of 100 m/s. What is the centripetal force as fraction of its weight? **[04 Marks]**

(ii) A satellite is said to be in geosynchronous orbit if it rotates around the earth once every day. For the earth, all satellite in geosynchronous orbit must rotate at distance of 4.23×10^7 m from earth centre. What is the magnitude of acceleration felt by geosynchronous?
[04 Marks]

5. (a) Use kinetic theory of gases to deduce each of the following laws;

- (i) Avogadro's law
- (ii) Dalton law of partial pressure
- (iii) Graham law of diffusion

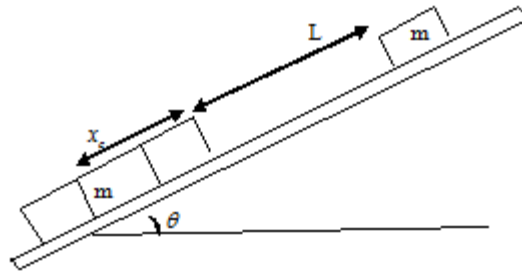
[06 Marks]

(b) State two conditions and assumptions of real gases and use them to derive Van der Waals equation given by; $\left(P + \frac{a}{V^3}\right)(b - V) = Rt$ where P is pressure and V is volume.

[06.5 Marks]

6. (a) (i) A block initially sliding on the floor of a room is eventually brought to rest by friction. Is the momentum of the box conserved? Explain. **[02.5 Marks]**

(ii) A block of mass is placed in a frictionless spring gun at the bottom of the incline so that it compresses the spring by an amount x_c . The spring has spring constant k . The incline makes an angle θ with the horizontal and the coefficient of kinetic friction between the block and the incline is μ_k . The block is released, exits the muzzle of the gun, and slides up an incline a total distance L . Find an expression for L in terms of the other quantities described plus the acceleration due to gravity.



[05 Marks]

- (b) A neutron of mass m collide elastically with nucleus of mass M . Show that, if the neutrons kinetic energy is E_o , the maximum kinetic energy it can lose during collision is given by $\frac{4mME_o}{(M-m)^2}$ [05 Marks]

7. (a) The mean free path of molecule of gas of air at 0°C and 1 atmosphere is $2 \times 10^{-7} \text{ m}$. What will be the mean free path at 1 atmosphere and temperature 227°C . [03.5 Marks]

- (b) A uniform rod of length l and mass M rests on a smooth horizontal table. A point mass $m = \frac{1}{2}M$ moving at right angles to the rod with speed v collides with one end of the rod and sticks to it.

- Describe the subsequent motion of the rod
- Derive the velocity (speed and direction) of the centre of mass (of the combined rod and mass) after the collision.
- Derive the angular speed of the combined rod and mass after the collision.
- Find the point on the rod that is stationary immediately after the collision.

[09 Marks]

8. (a) (i) Using principle of conservation of angular momentum, explain how does a person perform summersault. [02.5 Marks]

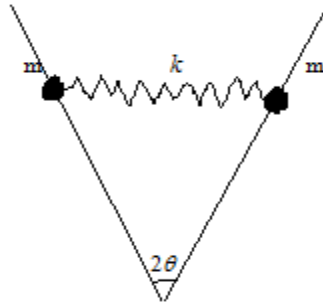
- (ii) Pendulum consists of small mass m at the end of string of length L . the pendulum is pulled aside to an angle θ with vertical. At an instant of release, using the suspension point as axis, find the torque of pendulum and its angular acceleration. [05 Marks]

- (c) What is speed of efflux? With assumptions derive the relation for speed of efflux given by $v = \sqrt{2gh}$ where h is the original height of liquid in large, open container.

[05 Marks]

9. (a) Calculate the critical velocity of water flowing in a pipe of cylindrical shape of radius 30 cm. [05 Marks]

(b) Two particles of mass m are constrained to move along two horizontal frictionless rails that make an angle 2θ with respect to each other. They are connected by a spring with spring constant k . What is the frequency of oscillations for the motion where the two masses always stay parallel to each other (ie: the distance between the meeting point of the rails and each particle is equal)?



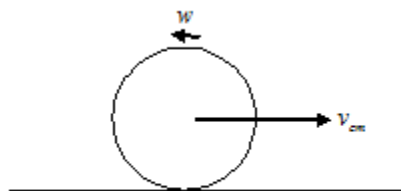
[07.5 Marks]

10. (a) A solid copper rod is of cross sectional area 15 mm^2 and length 2.0 m . Calculate (i) its change in length when its temperature rises by 30° C , (ii) the force needed to prevent it from expanding by amount in (iii). Assume that the proportional limit is not exceeded.
[06.5 Marks]

(b) Four identical hollow cylindrical column of steel, support a bit structure of mass $50,000 \text{ kg}$. The inner and outer radii of each column are 30 cm and 40 cm respectively. Assuming the load distribution to be uniform. Calculate the compression strain of each column.
[06 Marks]

11. (a) (i) List down two (2) ways of describing g as applied to gravitation. Give its appropriate units in each case. **[02 Marks]**
(ii) Calculate the work done in taking a 5.0 kg mass from the surface to a point where gravitational field strength is negligible. **[05 Marks]**

(b) A solid spherical ball of radius R is sliding along a surface and rotating the “wrong” way. There is friction between the ball and the surface. What is the minimum initial value of ω in terms of initial speed of the ball’s center of mass (v_{cm}) in order to ensure that the ball ends up moving to the left in the picture below?



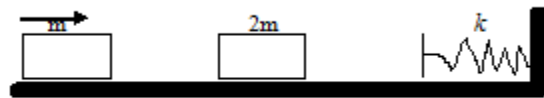
[07 Marks]

12. A 2.0 g particle moves at constant speed of 3.0 mm/s around in circle of radius 4.0mm.
 (a) Find magnitude of angular momentum of particle.

(b) If $L = \sqrt{\ell(\ell + 1)}\hbar$ where ℓ is integer, find the value of $\ell(\ell + 1)$ and approximate value of ℓ .

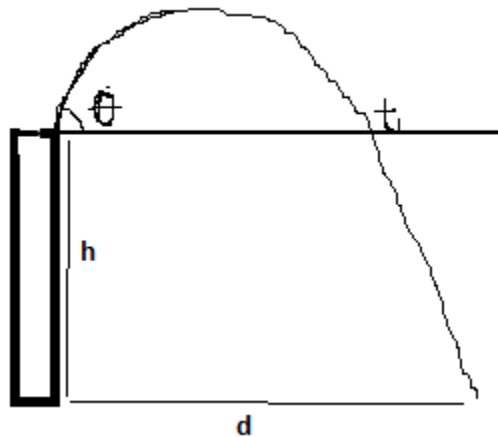
(c) By how much does the ℓ change if the particles speed increases by one-millionth of a percent, and nothing else changing? Use your result to explain why the quantization of angular momentum is not noticed in microscopic physics. **[12.5 Marks]**

13. (a) A block of mass m is moving on a smooth table when it collides elastically with a second block of mass $2m$, which then elastically strikes a mass less spring which compresses an amount d before the block comes to rest



Find the original velocity at which the first block was moving, in terms of the other variables in the problem. **[06.5 Marks]**

- (b) A projectile is launched from a cliff a height h above the ground at an angle θ above the horizontal. After a time t_1 has elapsed since the launch, the projectile passes the level of the cliff top moving downward. It eventually lands on the ground a horizontal distance d from its launch site. Find θ in terms of the other given quantities and the acceleration of gravity (g). (Ignore air resistance)



[06.5 Marks]

CHEMISTRY

INSTRUCTIONS:

- Answer any **five (5)** questions.
- In your calculation you may use the following constants
C = 12, H = 1, O = 16, Cl = 35.5, P = 31, N = 14, Zn = 65, Cu = 64, S = 32
 $h = 6.626 \times 10^{-34} \text{ J.s}$, $R_H = 1.0967 \times 10^7/\text{m}$
 $c = 3.0 \times 10^8 \text{ m/s}$ $R = 0.0821 \text{ L atm/mol.k}$, $R = 8.314 \text{ J/mol.k}$
 K_f of water = 1.86°C/m . K_b of water = 0.51°C/m , 1 mmHg = 1 torr, 1 atm = 760 mmHg.

SECTION A

- (a) Explain the meaning of the following terms:

 - (i) Ionization energy
 - (ii) Standard heat of formation
 - (iii) Electronic affinity
 - (iv) Atomization energy. [08 marks]

(b) State Hess's law of constant heat of summation. [02 marks]

(c) The enthalpy of formation of ammonia is -46 kJmol^{-1} and the bond dissociation enthalpies of nitrogen gas and hydrogen gas are $+945 \text{ kJmol}^{-1}$ and $+436 \text{ kJmol}^{-1}$ respectively. Calculate the average bond enthalpy of an N-H bond. [05 marks]

(d) Magnesium will also displace copper from copper (II) sulphate solution. If an excess of magnesium is added to 100 cm^3 of 1.0 mol dm^{-3} copper(II) sulphate, the temperature increases by 46.3°C .

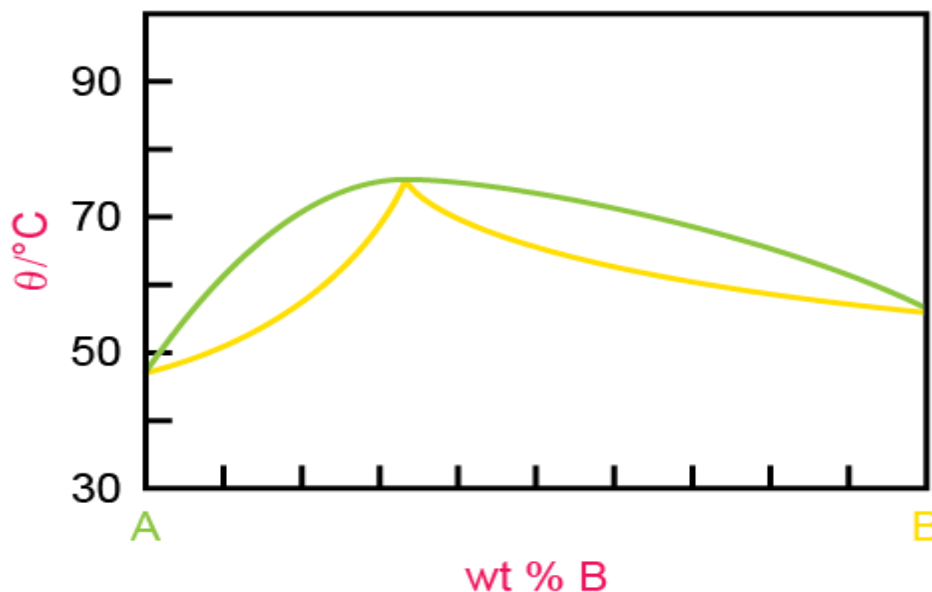
 - (i) Calculate the molar enthalpy change for the reaction
 - (ii) Calculate the minimum quantity of magnesium required to ensure it is in excess.
 - (iii) Calculate the temperature change if only 0.8 g of magnesium is added. [05 marks]
- (a) (i) State Raoult's law. [02 marks]

(ii) Under what conditions does a solution formed up on mixing two liquids A and B behaves as an ideal solution. [04 marks]

(b) A solution contains 50.0 g of heptane (C_7H_{16}) and 50.0 g of octane (C_8H_{18}) at 25°C . The vapor pressures of pure heptanes and pure octane at 25°C are 45.8 torr and 10.9 torr, respectively. Assuming ideal behavior, answer the following:

 - (i) What is the vapor pressure of each of the solution components in the mixture?
 - (ii) What is the total pressure above the solution?
 - (iii) What is the composition of the vapor in mass percent?
 - (iv) Why is the composition of the vapor different from the composition of the solution? [08 marks]

(c) Answer the following questions, using the accompanying figure.



- A liquid mixture consists of 33 g of component A and 99 g of component B. At what temperature would the mixture begin to boil?
- Under the conditions in (a), what is the composition of the vapor when boiling first occurs?
- If the distillation is continued until the boiling point is raised by 5.0 °C, what would be the composition of the liquid left in the still?
- Under the conditions in (iii), what are the composition and mass of the two components collected over the initial 5.0 °C interval? [06 marks]

3. (a) State

- Dalton's law of partial pressure.
- Charles law

[04 marks]

- Write down the main postulates of the kinetic theory of gases.
- Which postulates of the kinetic theory are not strictly true, and why?
- What does a small value for the van der Waals constant a suggest about the molecules of the gas?
- Compare the values obtained for the pressure of 3.00 mol CO_2 at 298.15 K held in a 8.25-dm³ bulb using the ideal gas, and van der Waals equations. For CO_2 the equation constants are

$$a = 0.462 \text{ Pa m}^6 \text{ mol}^{-2}, \quad b = 4.63 \times 10^{-5} \text{ m}^3 \text{ mol}^{-1} \quad [10 \text{ marks}]$$

- Two chambers are connected by a valve. One chamber has a volume of 15 L and contains N_2 gas at a pressure of 2.0 atm. The other has a volume of 1.5 L and contains O_2 gas at 3.0 atm. The valve is opened, and the two gases are allowed to mix thoroughly. The temperature is constant at 300 K throughout this process.

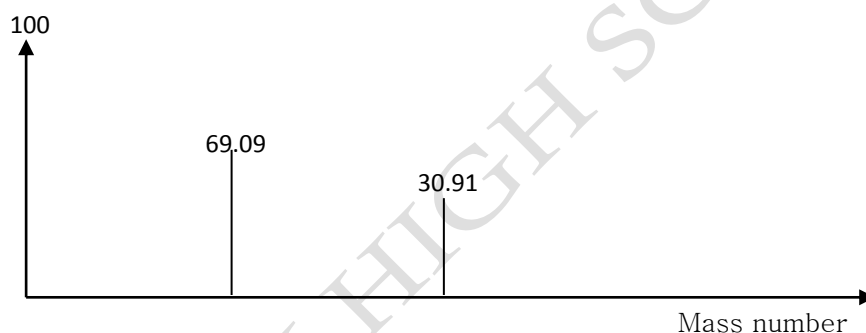
- How many moles each of N_2 and O_2 are present?
- What are the final pressures of N_2 and O_2 , and what is the total pressure?
- What fraction of the O_2 is in the smaller chamber after mixing? [06 marks]

4. (a) Define the following terms:
- (i) Colligative properties
 - (ii) Distillation.
 - (iii) Immiscible liquid [06 marks]
- (b) (i) State the law defining the equilibrium distribution of a solute between two immiscible liquids. [02 marks]
- (ii) Obtain an expression for the ratio of masses of the materials distilled in a steam distillation in terms of the molar masses and the partial pressures of the two components. [02 marks]
- (iii) The distribution coefficient of isobutric acid between ether and water is 3 at 25°C. What will be the amount of isobutric acid removed if 4 g of isobutric in 100 ml of water is extracted with 100 ml of ethoxyethane (ether) at 25°C? What would be the effect have been if two successive 50 ml portions of ether had been used to extract the aqueous layer? [05 marks]
- (c) An aqueous solution of MCl_3 is prepared by dissolving 31.15 g of the electrolyte in 725 mL of H_2O ($d = 1.00 \text{ g/mL}$). The solution freezes at 22.118°C. What is the atom represented by M^{3+} ? (Assume complete dissociation of MCl_3 to M^{3+} and Cl^- .) [05 marks]
- 5 (a) Define the term *electronegativity* and explain why the electronegativity values of the Group II elements Be–Ba decrease down the group. [03 marks]
- (b) (i) Sketch the shapes of each of the following molecules, showing any lone pairs of electrons. In each case, state the bond angle(s) present in the molecule and name the shape. [06 marks]

Molecule	Sketch of shape	Bond angle(s)	Name of shape
BF_3			
NH_3			
PCl_5			

- (ii) State the types of intermolecular force which exist, in the liquid state, between pairs of BF_3 molecules and between pairs of NH_3 molecules. [02 marks]
- (iii) Name the type of bond which you would expect to be formed between a molecule of BF_3 and a molecule of NH_3 . Explain how this bond is able to form [02 marks]
- (c) Name the type of bond which you would expect to be formed between a molecule of BF_3 and a molecule of NH_3 . Explain how this bond is able to form. [03 marks]
- (d) The time taken for effusion of equal volumes of CO_2 and a mixture of CO_2 and CO were 32 sec and 27sec respectively. Calculate the molar mass of the mixture and the proportions of each gas in the mixture. [04 marks]

6. (a) What are the four quantum numbers? Explain the physical significance of each of the four quantum numbers. [06 marks]
- (b) Write the electronic configuration of each of the following [4.5 marks]
- (i) $^{32}_{16}\text{S}^{2-}$ (ii) $^{137}_{56}\text{Ba}$ (iii) $^{52}_{24}\text{Cr}^{3+}$
- (c) Use the Rydberg equation to calculate the wavelength in nanometers of the spectral line of hydrogen for which $n_2 = 6$ and $n_1 = 3$. (Report your answer using three significant figures.) Would we be expected to see the light corresponding to this spectral line? Explain your answer.
- (d) With the idea of diagram, outline how the mass spectrometer is used to determine the masses and relative abundance of isotopes. [5.5 marks]
- (e) When a sample of natural copper is vaporised and injected in a mass spectrometer, the result are as shown.



Use the data to compute the average mass of natural copper. The relative mass of copper of ^{63}Cu and copper ^{65}Cu are 62.09 and 64.93 respectively. [04 marks]

GENERAL STUDY

INSTRUCTIONS:-

6. This paper consists of sections A and B.
7. Answer a total of FIVE questions from any of the two sections.
8. Each section carries (20) marks.

SECTION A: PHILOSOPHY AND RELIGION

1. What is the role of religion in a secular state like Tanzania. (Give any six points)
2. Discuss six (06) guiding principles of Tanzania development philosophy by Nyerere.
3. Why is religious tolerance important to a country like Tanzania? (Give any six (06) points)
4. "Philosophy is a multi - sectoral discipline". Discuss in six (06) points.

SECTION B: CONTEMPORARY/CROSS CUTTING ISSUES

5. Elucidate the six (06) impacts of environmental predicaments on the social and economic development of Tanzania.
6. Drought is said to be man oriented problem. Discuss in six points.
7. Explain the causes and effects of Radiation pollution. (Any eight (08) points four each).
8. Account for the constraints hampering the movement against subordination of women in Tanzania. (Give any six (06) points).
9. Why it difficult to discuss about HIV/AIDS with your parents? (Give any six (06) reasons).

ENGLISH LANGUAGE

INSTRUCTIONS:-

9. This paper consists of four (4) sections.
10. Attempt five (5) questions, one from each section. Question number one is compulsory.
11. Provide valid examples where necessary to elaborate your answer.
12. Each question carries 20 marks.

SECTION A: INTRODUCTION TO LANGUAGE (40 Marks)

Answer question one and any other from this section.

9. a) Give a brief explanation on each of the following language concepts.
 - i. Language is the reflection of culture,
 - ii. Language is a system,
 - iii. Language variations
 - iv. A community language
 - v. Pidgin
- b) Mention the two main dialects of English language and show their five differences.
2. What is an international language?
Analyze the status of English language in the world and assess its position in the Tanzanian context.
3. a) With examples compare and contrast the following linguistic terms.
 - i. Linguist/polyglot
 - ii. Performance/competence
 - iii. Geographical dialect/sociolect.
 - iv. Code switching/code mixing.
 - v. Second language /foreign language
- b) Explain with examples what is language learning and language acquisition.

SECTION B: WORD FORMATION (20 marks)

Answer **one (1) question** from this section

4. a) Read the following passage and answer the questions that follow.

Two Norwegian scientists have won the Nobel Prize for physiology and medicine for work published in the English language. Today, though, if a scientist is going to coin a new term, it is most likely in English. And if they are going to publish a new term, it is most likely in English.

Look no further than the Nobel Prize awarded for physiology and medicine to Norwegian couple. Their research was written and published in English.

The first major shock to the system of basically having a third of science published in English, a third in French and a third in German you may think of Latin as the most dominant language of science. And in many years it was the universal means of communication in

western Europe from the late Medieval period to the mid 17th century. Then it began to fracture. Latin became one of many languages in which science was done.

Questions

- a) From the short passage identify the morphemes mentioned in i – iii then write the word in which the morphemes appear.
- Four (4) lexical morphemes
 - Four (4) derivational morphemes.
 - Two (two) inflectional morphemes.
- b) Write new sentences by changing each of the words in capital into a noun.
- What you **DECIDE** today will automatically affect your future.
 - The names of evil doers were **BLACKLISTED**.
 - It is **POSSIBLE** to get an A in English examination
 - We expect to **PRODUCE** enough crops this year because there is enough rain.
 - They are waiting for the concert **ENTHUSIASTICALLY**.
- c) Name the word formation process involved in the formation of the underlined words
- Our government bought a sophisticated radar.
 - Traffic police use breathalyzers to identify drunk drivers.
 - You have to edit your article before sending it for printing
 - The rice farmer erected a scare crow in the farm.
 - The manager has decided to resign due to embezzlement allegations.
5. a) (i) What is borrowing in a language?
(ii) Why do you think borrowing is inevitable in any language? Briefly discuss this in relation to Kiswahili and English.
- b) With relevant examples, differentiate the following terms
- blending and clipping
 - affixation and affixes
 - transparent compounds and opaque compounds
 - major word classes and minor word classes
 - conversion and coining
- (c) Use in a sentence each of the following words as nouns.
- Legitimate
 - Expose
 - Die
 - Strategic
 - Hypothetic

SECTION C: PLAYS (20 Marks)

Answer **one (1) question** from this section

6. Wherever there is injustice, there is always a conflict caused by the forces attempting to maintain the unjust system and those struggling to destroy it. By using one play you have read

show clearly how the conflict affects the individuals and the society as a whole. What solution does the playwright suggest? Is the solution applicable in the Tanzanian society?

7. With reference to one (1) play, show the most distinctive literary technique used and how effective it is in carrying the playwright's intention.

SECTION D: NOVELS (20 Marks)

Answer **one question** from this section.

8. Malpractice seems to be the overriding issue in African political novels. In five (5) points support the statement in the light of one novel you have read.
9. Characterization is one of the major devices in literary work. Give five (5) reasons Justifying either your like or dislike to one of the characters in one novel you have read.

----- THE END -----