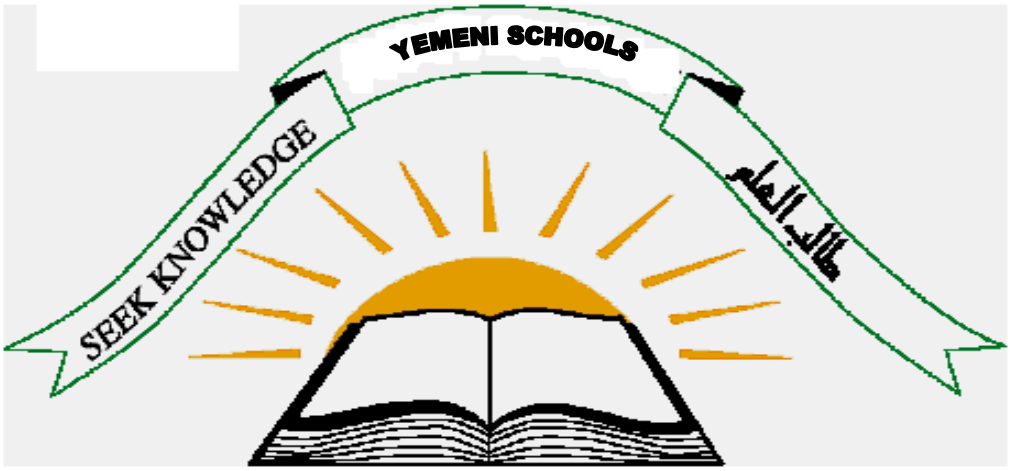
2020

YEMEN SECONDARY SCHOOL

PACKAGE 2



[FORM SIX COVID-19 HOLIDAY PACKAGE 2 APRIL]

This package consists of paper 2 subjects.The students must answer ALL questions based on your combination.The works should be at your exercise book

ADVANCE MATHEMATICS PAPER 2

(1) (a) If ω is a complex cube root of a unit and if $x = a + b$, $y = a\omega + b\omega^2$ and $z = a\omega^2 + b\omega^4$ show that $x^2 + y^2 + z^2 = 6ab$

(b) Solve the polynomial equation $x^4 + 2x^3 - x^2 + 2x + 1 = 0$

(c)(i) If $w = \frac{z+2}{2}$ and $|z| = 4$ find the locus of the w and sketch it on Argand Diagram

(ii)If $z = \cos\theta + i\sin\theta$, show that $\frac{z+1}{z-1} = -i\cot\frac{1}{2}\theta$

(2) (a) Define the following terms as used in logic.

(i) Duality

(ii) Truth values

(iii) Compound statement.

(b) Determine whether the following arguments are valid or not

(i) Mathematicians are genius. No genius people are lazy. Therefore no Mathematicians are lazy

(ii) Either the bank is closed or is not after 3 O'clock. It is not after 3 O'clock. Therefore the bank is not closed

(c) (i) Write in words the inverse and contrapositive of the following statement

"If my body is cold, then I've got no Malaria"

(ii) Test the validity of this argument using truth table.

"If it rains on Sunday, Juma will plant maize. If he plant maize, then it is not that he refused to plant beans. He refused to plant beans. Therefore, the rain did not rain on Sunday''

3. (a) (i) Find a unit vector perpendicular to the plane containing the vectors

$$\underline{a} = 2i + j - 2k \text{ and } \underline{b} = i + 2j + k$$

(ii)By using vectors, prove that angle in semicircle is a right angle.

(b) Given that $|\underline{a}| = |\underline{b}| = k\ (k \neq 0)$and angle between vectors a and b is $60°$.

If $\underline{c} = 3\underline{a} - \underline{b}$ and $\underline{d} = 2\underline{a} - 10\underline{b}$ show that $\underline{c}$ and $\underline{d}$are perpendicular

(c) The radius vector of a moving point is at any instant of time defined by the equation.

$$\underline{r} = i - 4t^2 j + 3t^2 k$$

(i) Determine the magnitude and direction of the velocity at time, $t = 1s$

(ii) Show that the acceleration of the point is constant.

4. (a) Expand $\frac{5}{(1+3x)(1-2x)}$ as a series of ascending powers of x giving the first four terms, and give the range of values for which the expansion is valid.

(b) (i) State the principle of mathematical induction

(ii) Use the principle stated above prove that $n^3 - n$ is divisible by 3 whenever n is positive integer.

(c)If p, q, r are the roots of the equation $x^3 - x^2 + 4x + 7 = 0$ form the equation whoseroots are $(p+q),\ (q+r) and\ (p+r)$

(d) Use synthetic division to find the remainder and quotient when $2x^3 + 3x^2 - 5$ is divided by $x + 3$

5.(a)(i) If $\sin\theta + \sin\emptyset = a$ and $\cos\theta + \cos\emptyset = b$, show that $cos^2\frac{1}{2}(\theta - \emptyset) = \frac{1}{4}(a^2 + b^2)$

(ii) Find the maximum and minimum values of $\frac{1}{2+3\cos x}$ and give the smallest non-negative values of x for which they occur

(b) Prove that if $t = \tan\frac{1}{2}\theta$ then $\sin\theta = \frac{2t}{1+t^2}$ and $\cos\theta = \frac{1-t^2}{1+t^2}$, hence by expressing $\frac{3+\cos\theta}{\sin\theta}$ in terms of t, show that this expression cannot have any value between $-2\sqrt{2}$ and $2\sqrt{2}$

(c) (i) Find the general solution of the equation $6sin^2\theta + 4cos^2\theta = 5\tan\theta$

(ii) Find an approximate value of $\frac{1-\cos 2\theta}{\theta\tan\theta}$ when θ is very small

(d)) In triangle ABC, prove that (i) $sin^2\frac{A}{2} + sin^2\frac{B}{2} + sin^2\frac{C}{2} = 1 - 2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$

(ii) $\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2} = \cot\frac{A}{2}\cot\frac{B}{2}\cot C\frac{C}{2}$

6.(a) With examples, define the following terms as applied to Probability

(i) Probability density function

(ii) Continuous random variable

(iii) Discrete random variable.

(b) (i) Suppose that A and B are events such that $P(A/B) = P(B/A)$ and $P(A \cup B) = 1$ and $P(A \cap B) > 0$. Prove that $P(A) > \frac{1}{2}$

(ii) A die is tossed twice and the sum of the numbers appearing is observed to be 8. What is the conditional probability that the number 5 has appeared at least once?

(c)An –aircraft gun can take a maximum of three shots at an enemy plane moving away from it. The probability of hitting the plane at the first, second and third shot are $\frac{2}{3}, \frac{2}{5} and \frac{3}{8}$ respectively. What is the probability that the plane is hit?

(d) The monthly consumption of diesel (in thousands of litres) at a certain filling station in Nzega has a normal distribution with a mean of 3 and a standard deviation of 0.25 What is the chance that the next month's diesel consumption as the filling station will be greater than 2.5 thousand litres

7. (a)(i) solve the following IVP $\cos(x)y' + \sin(x)y = 2cos^3(x)\sin x - 1$ given that $y\left(\frac{\pi}{4}\right) = 3\sqrt{2}$ and $0 \leq x < \frac{\pi}{2}$

(ii) Find the general solution of the following differential equation $y'' - 4y' - 12y = e^{6t}$

(b) State the order and degree of the following differential equations

(i)$\frac{d^3y}{dx^3} + \left(\frac{d^2y}{dx^2}\right)^2 + 5 = 0$

(ii)$\left(\frac{d^2y}{dx^2}\right)^3 + 4\frac{dy}{dx} + 4y = 0$

(c) Form the differential equations from the following general solutions

(i) $y = (Ax + B)e^x$

(ii) $x = \tan Ay$

(d) Given the following electrical components Resistor R, Inductor L, Capacitor C and electromotive force E with values$R = 10,\ L = 1, C = 0{,}04,$ and $E(t) = 5\cos t$ and are connected in series in an electric circuit. Find the equations for the charge Q and current Iin terms of t.

8. (a)(i) An ellipse has its foci at the points $(-1,0)$ and $(7,0)$ and its eccentricity is $\frac{1}{2}$Find its Cartesian equation.

(ii) Convert the Cartesian equation above (i) into polar form. Simplify the result.

(b) State the type of conic section in principle of designing.

(i) Orbit of the earth.

(ii) Satellite dishes.

(iii) Reflectors in the headlamps of cars.

(c) Show that the equation to the chord joining two points $(x_1, y_1), (x_2, y_2)$ on the rectangular hyperbola $xy = c^2$is

$$\frac{x}{x_1 + x_2} + \frac{y}{y_1 + y_2} = 1$$

(d)Sketch the polar curve $r = 2 + 3\cos\theta$

PHYSICS

The following constants may be useful

a) Specific gravity of petrol = 0.8
b) Density of air = 1.293 kg/m3
c) The coefficient of water is 10-3Pa.s.
d) Surface tension of soap = 0.08N/m
e) Tensile strength of steel = 0.48 x 108N/m2
f) Young's modulus of steel = 200 x 109N/m2
g) Rydberg constant, RH=10967700 m-1
h) Mass of neutron = 1.008665 unit
i) Mass of proton = 1.007825 unit
j) Acceleration due to gravity, g = 9.8m/s2

1. (a) (i) Give the meaning of the terms; viscosity, terminal velocity, Reynold's Number and critical velocity as used in fluid dynamics.

(ii) How is the knowledge of viscosity important to our lives?

(iii) Write down Poiseulle's formula/equation defining clearly the meaning of all symbols used.

(b) (i) A large bottle is filled with a siphon made of capillary glass tubing. Compare the coefficients of viscosity of water and petrol if the time taken to empty the bottle in the two cases is in the ratio

(ii) Why do air bubbles in water rise up?

(iii) With what terminal velocity will an air bubble 0.8mm in diameter rise in a liquid of viscosity 0.15Nsm^{-2} and specific gravity 0.9?

(c) (i) The flow rate of water from a tap of diameter 1.25cm is 3 litres per minute. Characterise the flow.

(ii) Write down Bernoulli's equation when the fluid is at rest and define all the symbols used.

(iii) The accumulation of snow on an aeroplane wing may reduce the lift. Explain.

2. (a) (i) Distinguish between transverse waves and longitudinal waves.

(ii) Define the term "reverberation''.

(iii) Mention four ways of reducing reverberation time.

(b) What is the effect of:

(i) Loading the prongs of a tuning fork.

(ii) Filing the prongs of a tuning fork?

(c) (i) Give two cases in which there is no Doppler's Effect in sound.

(ii) Why does sound travel faster in iron than in air?

(iii) The equation of a progressive wave travelling in the + x direction is given by; $y = a\sin(wt - kx)$. Show that the acceleration amplitude, $A_{max} = \frac{4x^2a}{T^2}$.

(d) A displacement wave is represented by;
$y = 0.25x10^{-3}\sin(500t - 0.025x)$ Where y, t, and x are in cm, s and cm respectively; determine

(i) Amplitude and period
(ii) Angular frequency and wavelength
(iii) Amplitudes of particle velocity and acceleration

3. (a) (i) Give the meaning of the terms: first harmonic, progressive wave, Doppler Effect and beats.

(ii) A closed pipe is suddenly opened and it is observed that the second overtone of the closed pipe differs by 200 vibrations per second from the first overtone of the open pipe. What is the fundamental frequency of the closed pipe?

(b) (i) A train approaches a stationary observer, the velocity of train being $\frac{1}{20}$ of the velocity of sound. A sharp blast is blown with the whistle of the engine at equal intervals of a second. Find the time interval between successive blasts as heard by the observer.

(ii) Explain briefly why two astronauts cannot talk on moon as they can do on the earth?

(iii) Give four examples of diffraction of light in our daily life.

(c) (i) Why are bells made of metal and not of wood?

(ii) What is meant by diffraction grating?

(iv) A parallel beam of sodium light is incident normally on a diffraction grating. The angle between the two first order spectra on either side of the normal is $27^0 42'$. Assuming that wavelength of light is 5.893×10^{-7}m, find the number of rulings per mm on the grating and the greatest number of bright images obtained.

4. (a) Define the following terms;

(i) Angle of contact
(ii) Free surface energy
(iii) Critical temperature of surface tension
(iv) Capillary action

(b) (i) A circular ring of thin wire of radius 2cm is suspended horizontally by a thread passing through the 5cm mark of the metre rule pivoted at its centre and the ring is balanced by a 5gm mass suspended at the 70cm mark. A beaker of liquid is raised until the ring just touches the surface of the liquid. If the 5gm mass is moved to the 86 cm mark, the ring just departs from the liquid surface. Find the surface tension of the liquid.

(ii) The surface tension of water is 7.5×10^{-5}N.m^{-1} and the angle of contact is zero. Explain what these two statements mean.

(c) (i) When two matchsticks immersed in water fly apart when a hot needle touches the water surface between them. Why?

(ii) A soap bubble of radius 2 x 10^{-4}m is in an air cylinder, which is originally at a pressure of 10^5Nm^{-2}. The air in the cylinder is now compressed isothermally until the radius of the bubble is halved. Calculate now the pressure of air on the cylinder.

(iii) Explain qualitatively why the power of the air inside a soap bubble must be greater than the pressure outside.

5. (a)Define the following terms;
   (i) Poisson's ratio
   (ii) Compressibility
   (iii) Fatigue
   (iv) Ultimate tensile strength

(b) In a large lecture hall, a pendulum is to be made by suspending a 40kg ball from the end of a steel wire 15m long.

(i) What cross-sectional area should the wire have if the applied stress in it is to be only 10% of its breaking stress?

(ii) How far will the ball stretch the wire?

(c) (i) The elastic limit of Earth's material is 3 x 10^8N/m^2 and the density of rock material is 3 x 10^3 kg/m^3. What is the maximum height a mountain on Earth can possess?

(ii) Why is work done in stretching a wire?

(iii) Why is the stretching a coil spring determined by its shear modulus and not Young's modulus?

6. (a) (i) State Coulomb's law.
   (ii) Compare and contrast gravitational forces and electrostatic forces.
   (iii) Two spheres are mounted on identical metal springs and rest on frictionless table. When spheres are uncharged the spacing between them is 0.05m and the springs are unstrained. When each sphere has a charge of +1.6μC the spacing doubles. Assuming that spheres have a negligible diameter, determine the spring constant of the springs.

(b) (i) Mention four properties of electric field lines.

(ii) Sketch a graph to show variation of Electric field $\boldsymbol{E}$ with the distance $\boldsymbol{r}$ from the centre of the hollow sphere.

(iii) What is meant by 'equipotential surface' and state its three properties.

(c) (i) What are the uses of a capacitor in daily life?

(ii) An isolated conducting spherical shell of radius 10cm in vacuum carries a positive charge of 1 x 10^{-7}C. Calculate the electric field intensity and potential at a point on the surface of the conductor.

(iii) Explain why is it safer to stay inside a car during lightning than outside the car?

7. (a) (i) What are the main differences between Rutherford's model and Bohr's model of an atom?

(ii) Calculate the wavelength, energy and momentum of a photon emitted by a hydrogen atom making a transition from n = 10 state to ground state.

(b) (i) What would happen if the electrons in atom were stationary?

(ii) An electron orbiting in Hydrogen atom has energy level of -3.4eV. What will be its angular momentum?

(iii) The ionization energy of Hydrogen is 13.6eV. What does it mean?

8. (a) Define;

(i) Nuclear mass (ii) isotones

(iii) Mass defect (iv) nuclear binding energy

(b) (i) Sketch the binding energy curve. From it, give a brief facts revealed by it and its importance.

(ii) Name two factors which stability of the nucleus depends.

(iii) Calculate the binding energy per nucleon of $^{40}_{20}Ca$ nucleus.

(c) (i) Define: half life and decay constant.

(ii) Show how half life is related to wavelength.

(iii) The half life of radium is 1600 years. After how much time will $\frac{1}{16}^{th}$ part of radium remain undisintegrated in the sample?

(d) (i) What is a nuclear reactor?

(ii) Name the essential parts of a typical nuclear reactor.

(iii) Distinguish between nuclear fission and nuclear fusion

9. (a) A wire carrying a current of 10A and 2m in length is placed in a field of flux density 0.15T. What is the force on the wire if it is placed

(i) At right angles to the field.

(ii) At 45^0 to the field.

(iii) Along the field?

(b) (i) Define the term "torque" as used in electromagnetism.

(ii) A vertical rectangular coil of sides 5cm by 2cm has 10 turns and carries a current of 2A. Calculate the torque on the coil when it is placed in a uniform horizontal magnetic field of 0.1T with its plane parallel to the field and 60^0 to the field.

(c) (i) What is sensitivity of a voltmeter and how can it be increased?

(ii) a Moving coil meter X has a coil of 20 turns and a resistance 10Ω. Another moving coil meter Y has a coil of 10 turns and a resistance of 4Ω. If the area of each coil, the strength of the springs and the field B are the same in each meter, which has

- The greater current sensitivity and
- The greater voltage sensitivity?

ENGLISH LANGUAGE 2

1. (a) Briefly explain the five stylistic levels of language formality

   (b) For a language style to be known there are the so called markers of style. Explain them

   briefly with vivid examples.

2. Explain all the features of the following language styles as per markers of style

   (a) Language of conversation

   (b) Language of Advertisement

3. (a) Draft an advertisement whereby a car is sold. Use all the features of language of advertisement

   (c) Define the following terms

   (i) Jargon (ii) Stylistics (iii) Slang (iv) Idiom (v) Ambiguity

   4. Compare and contrast four characters, two from each reading you have done.

   5. Language use is very important in any literary work for the intended message to reach the readers. How

   far is this statement true in reference to two plays you have read?

   6. African writers write on common themes. Use three novels you have read to justify this quotation.

   7. Writers use titles for their books that cover much information found in their works. How far is this statement true in reference to two novels read?

   8. Perform a literary analysis to any two poems you have read under this section by following all the

   steps used in analyzing a poem.

   9. Poets have strong messages to convey to the audience via their poems. Use four poems you have read to justify this statement.

GEOGRAPHY

Answer all questions

1. Describe the following terms as used in the population study
    a) Fecundity
    b) Sterility
    c) Crude Birth Rate
    d) Optimal Population
    e) General Fertility Rate
2. Give six (6) reasons on why death rates in many parts of the world have decreased.
3. Explain four (4) causes and four (4) impacts of population dynamism.
4. Explain five (5) negative effects of manufacturing Industries on the environment.
5. Analyse six strategies for fish conservation measures practiced in the world.
6. Describe four (4) Geographical requirements and four (4) human factors influencing maize production in USA Corn Belt.
7. To what extent phosphate mining is the base for the development of Morocco economy.
8. Describe six (6) circumstances which promoted Tourism Industry in Tanzania

ECONOMICS

1. (a) What is equilibrium National income? If C=2 +0.8Y AND injection (J)=100Y at all levels of income what will be the equilibrium income.?
   (b) If investment increase by Tshs 2mn calculate.
   i) Multiplier
   ii) Change in income
   iii) New level of income
   iv) New level of consumption.

2. (a) Is there any distinction between floating and fixed exchange rate?
   (b) What is meant by the term PROTECTIONISM? Outline five tools of protectionism.

3. What is a central BANK? Discuss Six (6) tools of monetary policy.

4. Economic planning is less important in Developing countries than Developed countries. Do you agree?

5. What are the informal sectors? Outline six merits of informal sectors in our economy.

6. What do you understand by a government budget deficit? .Budget deficit is always harmful to general public .**Comment on this statement.**

7. Write short notes on the following:
   a) Characteristics of public and private goods.
   b) Negative externalities.
   c) Free rider problem.
   d) Trasfrontier externalities.

8. "Economic integration is an imperative for the economic development of the LCDs like Tanzania although it is also a bitter pill to be swallowed by them". With reference to East African community (EAC) briefly explain the benefits and factors which act as a stumbling block to the region.
9. "In Tanzania we consume what we don't produce and produce what we don't consume". Critically discuss this statement by tracing the root cause of this economy and showing the role played by the agricultural and industrial sector in the Tanzanian economy.
10. (a) Outline THREE main accounts of the Balance of payment.
    (b) Given

COUNTRY	COTTON	WHEAT
U.S.A.	3	2
BRITAIN	12	4
WORLD OUTPUT	15	6

(i) Explain what we mean by absolute advantage.
(ii) Between the two countries which of them has got absolute advantage in the production of Cotton, Wheat?
(iii) Which country has got more comparative advantage in the production of Wheat, Cotton?
(iv) In this case how should the two countries specialize in order to enjoy the benefits of specialization?

HISTORY

ANSWER ALL QUESTIONS

1. "The development of industries in Britain passed through different stages to complete" highlight the signpost of cottage industries in Britain during 16th C. six points
2. Account for the situation which led”Nedd Ludd” from shire wood forest (1811-1813) to organize riot against the impact brought the by industrial revolution in Europe. Give six points
3. Explain six (6) causes of Glorious Revolution in 1680s in Britain.
4. "The internal contradiction among the European nations soared up the occurrences of various crisis worldwide. With critical arguments exemplify the crisis and stick on the resultant of the World War II in Africa. Give six resultant
5. Explain why Russia was not affected by Great Economic depression of 1929-33. 6pont
6. Account for the rise of Britain as a capitalist super power even before the occurrence of various crisis including I and II world wars. Provide six points
7. The collapse of the ujamaa ideology in Tanzania could not be escaped. discuss by providing six (6) points
8. Examine six (6) factors that led to the disintegration of USSR and Communist Bloc in the late 1980s.
9. Examine the content and effects of bandit report to the developing countries
10. Highlights exogenic factors for underdevelopment in third world countries. Six points

KISWAHILI

Jibu maswali yote

1. Ushairi na Tamthilia ni tanzu za fasihi andishi zenye kufanana na kutofautiana. Tumia hoja tano kuthibitisha tofauti na mbili kuonesha mfanano.
2. " Mhakiki ni mtu muhimu sana katika jamii ya leo" kwa hoja sita fafanua sifa za Mhakiki.

USHAIRI

Kimbunga- Haji Gora
Mapenzi Bora- Shaaban Robert
Chungu Tamu- Theobald A. Mvungi
Fungate ya uhuru- Mohamed S. Khatibu

3. Kwa kutumia vitabu viwili (2) vya ushairi kati ya kati ya ulivyovisoma, eleza jinsi wahusika walivyotumiwa kufikisha ujumbe. Toa hoja nne kwa kila kitabu .
4. "Washairi wengi ni wafichuaji wa maovu yaliyokithiri katika jamii zao ili kuzinusuru na madhira yanayoweza kuleta maafa". Tetea kauli hii kwa kutumia hoja nne katika Diwani mbili ulizosoma.

RIWAYA

Usiku utakapokwisha- Mbunda Msokile

- Kufukurika- Shaaban Robert
- Mfadhili- Hussein Tuwa
- Vuta N'kuvuta- Shati Adam Shati

5. "Maisha ya wasanii ni kilio cha kudai haki za wanyonge". Thibitisha kauli hii kwa kutoa hoja nne kwa kila kitabu kutoka katika riwaya mbili ulizosoma.
6. "Mwandishi katika kazi ya sanaa hutumia mandhari mbalimbali kufikisha ujumbe kwa walengwa" Tumia vitabu viwili ulivyovisoma kuthibitisha usemi huo.

TAMTHILIA

- Kwenye ukingo wa Thim – Ebrahim Hussein
- Kivuli Kinaishi- Said Mohamed
- Nguzo Mama- Penina Muhando
- Morani - Emmanuel Mbogo

7. Eleza matumizi ya vipengele vya fasihi simulizi yanayojidhihirisha kujenga kazi za wasanii wa Tamthlia mbili ulizosoma. Toa hoja nne kwa kila kitabu.
8. Dhamira ya usaliti imejitokeza vipi katika Tamthlia mbili ulizozisoma. Toa hoja tatu kutoka katika vitabu viwili ulivyovisoma.

9. Soma matini ifuatayo kwa makini, kIsha onesha mbinu za kifani zilizotumika.

Saa tatu usiku wa siku ya Jumamosi, niliamua kwenda kukaa katika baa moja maarufu mtaani kwetu iitwayo “WANYEJANDA” ili kupata moja moto moja baridi na nyama choma. Nilikaa meza moja peke yangu huku nikijisemea kimoyomoyo “Lenadi nimetulia katika ubora wangu” Pembeni ya meza yangu walikuwepo vijana watatu ambao kwa kweli walikua wamedorora na kuyumbayumba kutokana na kupiga maji kwa wingi. Kila mmoja alionekana akitazama chini huku midomo imetota uderere. Lakini hawakusahau mara kwa mara kuikusanya midomo hiyo wakijirejesha katika mazungumzo.

Wakati wakienda msalani kujisaidia, mmojawa wale vijana waliokuwa wamekaa karibu na meza niliyokuwepo mimi alinisabahi kwa kuniambia;

Mambo vipi burooooo?
Poa! Nikamjibu
Unatuchunia siyo, wajifanya hututambui?

Kwa mwanga hafifu uliokuwepo, tayari nilikuwa nimeshavaa miwani ya mbao. Haikuwa rahisi kuwatambua ni akina nani hao. Ikanipasa niwasogolee kwa karibu.”Aisee, ni wewe?” Ni mimi bwana, hunioni? Kweli ni wewe? Siamini! Amini bwana au umeshalewa? Alikuwa ni Masineki jirani yangu pale mtaani ninapoishi. Alikuwa pamoja na rafiki zake mahewa na Kishefu.Ilinibidi kuwaomba msamaha ili kuyamaliza.

Meza yao ilikuwa ikitazama matokeo ya chupa za pombe ambazo zilikua zimenuna. Siku hiyo nilikuwa na ukwasi wa kutosha na mkono wa birika kwangu ni haramu. Nilipapasa mfuko nikakuta umejaa mawe ya kutosha. Nilimwita mhudumu “Oya mrembo wape kila mmoja kinywaji akipendacho!” “Thank you brother” Mahewa alisema. Kishefu alikuwa bado akitafakari jambo Fulani, baadaye naye akasema “ Burooo uko vizuri!” Wote tulitazamana takakenua meno.

Ah.. Ahaaaaa….aaaa! Dunia ni tamu jamani, ni tamu mno! Dunia ya sasa kila mtu anapambana na hali yake. Magumashi na madili siku hizi hakuna. Viongozi wapenda rushwa wapo roho juu wanajua siku yoyote kitanuka. Biashara haramu zimedhibitiwa kisawa sawa katika kila kona. Kweli “Dunia hadaa, ulimwengu shujaa” Nilimsikia Mahewa akisema.

Wakati wa ujana wetu, mimi baba yenu,
Shati dukani shilingi sita unapata!

Lakini sasa shilingi sita, hata mkate

Kwa hiyo wanangu, tuishi kufuatana na wakati x2 (Kibwagizo)

Jiepusheni na anasa, fanyeni kazi kwa bidii,
Kama kuna mkorofi kati yenu aache mara moja

Hayo ni maneno ya mzee mmoja wa makamo aliyekuwa akiimba huku akiwanyanyua watoto wake alioongozana nao ili waondoke kurudi nyumbani baada ya kushibisha roho zao.

Mnyaaau..mnyaaau……mnyaaau! Sauti ya paka aliyekuwa uvunguni mwa meza ilisikika. Mara simu ikaita kutoka mfukoni mwa suruali yangu. Nilipoangalia alikua ni “wife” aliyenipigia akitaka nirudi nyumbani. Kwa jinsi nilivyomfahamu mke wangu huwa ni pilipili hasa ninapochelewa kurudi nyumbani; nilitii wito huo, hivyo mimi na Masineki tuliongozana njia moja kwa kuwa tulikuwa majirani. Kishefu na Mahewa waliamua kula kona kivyao kwa kuwa walikua na bodaboda yao.

CHEMISTRY

INSTRUCTIONS:

1. For your calculation you may use the following:- N = 14, H = 1, C = 12, O = 16, Na = 23, Ba = 137, cl = 35.5 and S = 32.
2. ANSWER ALL QUESTIONS

1. (a) (i) State the chatellier's principle.
(ii) Study the gases equilibrium

(b) Study the gases equilibrium

$N_2O_{4(g)} \rightleftharpoons 2NO_{2\,(g)} \qquad \Delta H = +54KJ/Mol$

(i) Write an expression for the equilibrium constant Kp in terms of partial pressure.
(ii) State with reasons, the effect on the equilibrium position of
I. An increase in partial pressure
II. An increase in temperature

(c) At 60^0, 1.00dm^3 of the gases weighed 2.585q under a pressure of 1.01 x $10^5 N/M^2$. Find the degree of dissociation of N_2O_4 and the value of Kp.

(d) For equilibrium $2P_{(g)} + Q_{(g)} \rightleftharpoons 2R_{(g)}$. Ke is numerically equal to a 1.00dm^3 flask are introduced 3.0mol of P, 3.0 mole of Q and 3.0 mole of R.
(i) State the unit in which Ke is expressed
(ii) Is the mixture at equilibrium
(iii) If not, what must the volume of the flask be on order for such mixture to exist in equilibrium at the temperature for which Ke is given?

2. (a) Explain briefly the following terms:
(i) Buffer solution
(ii) Indicator
(iii) Salt hydrolysis

(b) (i) Sketch he change in PH that occurs during the titration of a querns ammonia into hydrochloric acid of the same concentration.
(ii) Suggest an indicator which could be used for the titration, and name one that should be avoided.

(c) A 1.00g sample of a mixture of Na_2Co_3 (an hydrous) and $NaHCO_3$ was dissolved in water. With phenolphthalein as indicator, 17.05cm^3 of 0.200M hydrochloric acid were required to neutral lise the solution. Calculate the percentage by mass composition of the mixture.

(d) Calculate the number of grams of ammonium sulphate $(NH_4)_2SO_4$ which are to be added to 500cm^3 of 0.176M ammonia to give buffer solution of P^H 9.42 (Assume

the volume of the solution doesn't change on addition of ammonium sulphate) (Kb (NH_3) = 1.75 x 10^{-5})

3. (a) Define the following terms giving one example in each case
   (i) Standard enthalpy or combustion
   (ii) Lattice energy
   (iii) Electron affinity
   (iv) Solubility product

   (b) State Hess's law of constant heat of formation.

   (c) (i) Draw a Born Harber cycle to illustrate the formation of solid $Bacl_2$ from its elements in their standard states.
   (ii) Name the enthalpy change involve at each stage.

   (d) Using the following data, calculate the enthalpy of formation of $Bacl_{2\,(s)}$

Process	**ΔH°/KJ/Mol**
$Ba_{(s)} \rightarrow Ba_{(g)}$	176
$Ba_{(g)} \rightarrow Ba^{+}_{(g)} + e^{-}$	508
$Ba^{+}_{(g)} \rightarrow Ba2+_{(g)} + e^{-}$	972
$\frac{1}{2}\, Cl_{2\,(g)} \rightarrow Cl_{(g)}$	121
$Cl_{(g)} + e^{-} \rightarrow Cl^{-}_{(g)}$	-364
$Ba^{2+}_{(g)} + 2Cl^{-}_{(g)} \rightarrow BsCl_{(2)(s)}$	-2018

   (e) The mass concentration of sulphate ions in a saturated solution of barium sulphate is 9.55 x 10^{-4}g/dm^3. Calculate the solubility product of Barium sulphate.

4. (a) (i) What is an electric chemical cell (voltaic cell)?
   (ii) Describe the components of an electrochemical cell (voltaic).

   (b) Draw a diagram of electrochemical cell based on the following oxidation – reduction reaction.

   $Ni_{(s)} + CuBr_{2\,(aq)} \rightleftharpoons Ni_{(aq)}{}^{2+} + 2Br_{(aq)}{}^{-} + 2Cu_{(s)}$

   (i) Label the cathode and anode, and draw arrows to show the direction of movement of cartons, anions and electrons.
   (ii) Indicate whether the electrode gains or loses mass during electrochemical process that occurs at each electrode.
   (iii) What voltage would this cell produce under standard condition?

   (c) The standard electrode potential of silver is +0.80V. What do you understand by this.

   (d) Calculate the voltage produce the following cell
   Al/Al^{3+} (0.25M) //Co^{2+}(0.05M)/Co

5. (a) Complex compound can sometimes exhibit isomerism. The compound

$[CO(NH_3)_5Br]So_4$ is isomeric to compound $[CO(NH_3)_5 So_4]Br$

(i) Give the IUPAC name for each isomer
(ii) What ions will each isomer yield in solution?
(iii) What is the oxidation state and the coordination number of cobalt in each complex compound?
(iv) How can you distinguish the two isomers?

(b) Explain in terms of electronic configuration why iron (atomic number 26)
(i) Conducts electricity
(ii) State which oxidation state is most stable and why.

(c) Write the formula for each of the following complexes
(i) Tetra amine copper (II) sulphate monohydrate
(ii) Potassium heptaoxidichromate (vi)
(iii) Tri chlorotriammine platinum (iv) chloride

(d) Explain how atomic size, ionization energy and electron affinity vary a long the period in the period table.

6. (a) (i) State five(5) anomalous properties of nitrogen
(ii) Although ammonia and phosphine are the hydrides of group five, ammonia is Lewis base while phosphine is not. Explain

(b) Explain the following
(i) Hard water form leather reading with soapless detergents but not with soapy detergents.
(ii) Although nitric acid is an oxidizing agent, it is transported by using aluminium containers.
(iii) Silver chloride salt is insoluble in water but readily soluble in aqueous ammonia.
(iv) Ionization energy increases from left to right across a period but the first ionization energy of magnesium is larger than that of aluminium.
(v) The boiling point of H_2O is higher than that of H_2S although the relative molecular mass of H_2S is larger than of H_2O.

7. (a)Using relevant balanced chemical equations describe the process of extracting copper from copper pyrites under the following headings:-
(i) Concentration of the ore
(ii) Roasting of the ore
(iii) Removal of iron impurities
(iv) Self reduction

(b) Describe purification of copper under the leadings
(i) The chemical nature of the electrodes
(ii) The chemical nature of the electrolytes
(iii) The redox reaction involved

(c) Explain the following chemical phenomena

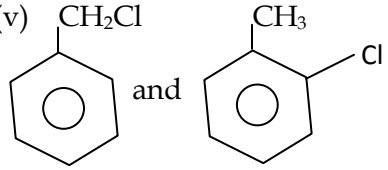
(i) Copper has been used from ancient time but aluminium has been extracted commercially only in recent times.
(ii) Copper metal resists attack by both dilute sulphuric acid and hydrochloric acid, but react with dilute nitric acid.
(iii) Copper II hydroxide is insoluble in sodium hydroxide solution but it is readily soluble in aqueous ammonia solution.
(iv) Sample sugars such as glucose and fructose are called "reducing sugars".

8. (a) Compound A have the molecular formula $C_9H_8O_2$. They are insoluble in water but soluble in aqueous sodium carbonate. A is reduced by hydrogen in the presence of Nickel catalyst to B. $C_9H_{10}O_2$. benzoic acid is formed when A or B is oxidized by alkaline potassium per manganate (vii), and the solution is later acidified. B reacts with phosphorous pento-chloride to give C, and react with sodium carbonate solution to give carbon dioxide. Identify compound A to C, giving reasons, and explain the reaction mentioned.

(b) How would you distinguish between the member of the following pair of compound.

(i) $CH_3\,CO\,CH_3$ and $CH_3\,CH_2\,OH$
(ii) $CH_3\,CH(OH)CH_3$ and $CH_3\,CH_2\,CH_2OH$
(iii) CH_4 and CH_3Cl
(iv) $CH_3\,CH_2\,NH_2$ and CH_3CN

a(v)



9. (a) Compose the reactivities of benzene and cyclohexene in their respective reaction with

(i) Potassium per manganate solution
(ii) Sulphuric acid
(iii) Gaseous hydrogen
(iv) Bromine (in dark)

Include the condition required (eg. Catalyst, temperature, concentration) for the above reaction to occur.

(b) Give reaction which low that the following alk-di-yne structure (C_6H_6) does not represent the structure of benzene $H - C = C\text{-}CH_2\,CH_2 = C\text{-}H$

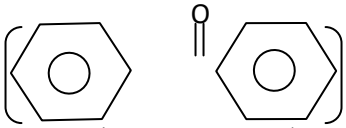
(c) Account for the following observations

(i) Primary alcohols can not be halogenated by HCl alone; $Zncl_2$ must be also be present in order to form haloalkane. However tertiary alcohol will react with Hcl without a centalyst.
(ii) Alcohol react with carboxylic acid (in the presence of conc. Sulphuric acid) to give ester. However phenol (which like alcohols, contain a hydroxyl group) do not react with carboxylic acid under this condition. Alkaline condition are required if phenol is to be estarified.
(iii) Phenol is nitrated by dilute metric acid, but benzene require a mixture of conc nitric acid and conc sulphuric acid in order to achieve nitration.

10. (a) Write the structure which corresponding to each of the following compounds
    (i) bromo-2, 4 – dimethylhexane
    (ii) 2-melthyl cyclohexene
    (iii) 2-chloro-3-cyclopentyl-5,5-diethy (-4-(1-methylpropy) octane
    (iv) m-chloro nitro benzene

(b) A solution of bromine and benzene is stable indefinitely, but when iron nail is put into the solution, bromination of benzene occur fairly rapidly. Explain the function of iron. Write equation and mechanism of the reactions of the bromination of benzene.

(c) Starting from benzene outline the synthesis of each of the following
    (i) m-Bromonitrobenzene
    (ii) o-Chloronitrobenzere

(d) One ring of phenyl benzoate 

Under goes electrophilic aromatic substitution much more reading then the other
    (i) Which one is it?
    (ii) Explain your answer
    (iii) What product (or products) would you expect to obtain when pheny/benzoate under goes bromination with Br_2 and $FeBr_3$