

HOME SCHOOLING MATERIAL

PASS A'LEVEL

**CHEMISTRY, MATHEMATICS
& ENTREPRENEURSHIP**



YOUR GUIDE AWAY FROM SCHOOL

ENTREPRENEURSHIP EDUCATION ANSWERS (AENT002)

SECTION A (20 MARKS)

1(a)(i) Paid employment is where an individual works for another person/organisation and is paid a wage or salary on a regular specified basis for a specific assignment given while/yet/but/whereas self-employment is where someone starts his own income-generating project in which he/she employs himself to earn a living.

(ii) **Reasons self employment may not easily be attained in Uganda**

- ▷ Limited entrepreneurial skills
- ▷ Low income levels
- ▷ Unfavourable economic conditions; e.g., inflation
- ▷ Unfavourable government policies; e.g., high taxes
- ▷ Undeveloped/poor infrastructure
- ▷ Financial mismanagement/embezzlement/corruption
- ▷ Poor business planning
- ▷ Limited capital/finance
- ▷ High operational costs
- ▷ Limited supply of raw material
- ▷ Inadequate supply of utilities; e.g., power
- ▷ Political instability
- ▷ High competition

(b) **Hindrances to promoting small and medium enterprises in Uganda**

- ▷ Unsuitable location of the business
- ▷ Limited market for business products
- ▷ Poor management of the business e.g poor records
- ▷ Poor handling of customers; e.g., failure to handle their complaints
- ▷ Limited market research; e.g., information relating to customer needs
- ▷ Overexpansion which limits management
- ▷ Inadequate capital/finance to start/expand business
- ▷ Choosing a business that is not profitable/poor choice of business
- ▷ Low quality products offered for sale
- ▷ Inadequate credit facilities/loans
- ▷ Inadequate support services/utilities; e.g., water
- ▷ Limited skilled manpower
- ▷ Unreliable source of raw materials
- ▷ Unfavourable government policies; e.g., high taxes
- ▷ High competition
- ▷ Limited skills of the owner
- ▷ Political instabilities; e.g., wars
- ▷ Industrial unrest/workers' strikes
- ▷ Natural calamities
- ▷ Using poor technology
- ▷ Overdependence on family labour

(c) (i) **Tools used in efficient time management**

- ▷ Having alternative plans
- ▷ Choosing the quickest, safest and most convenient time
- ▷ Making quick decisions
- ▷ Selecting priorities
- ▷ Delegating duties
- ▷ Avoiding unnecessary interruptions
- ▷ Conducting meetings properly
- (ii) **Methods of time wastage in business**
- ▷ Talking to people about personal matters
- ▷ Holding unnecessarily long meetings
- ▷ Allowing too many interruptions at work
- ▷ Being disorganised
- ▷ Failing to make decisions in time
- ▷ Failing to delegate work
- ▷ Being late/absent from duty
- ▷ Unnecessary long procedures/bureaucracy
- ▷ Lack of time warning tools
- ▷ Lack of administrative hierarchy

THE TEACHERS



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(d) **Techniques of handling customer objections**

- ▷ Ignoring the objection
- ▷ Acknowledging and convert objection into sale
- ▷ Agreeing and neutralising
- ▷ Accepting the objection
- ▷ Denying the objection
- ▷ Closing the sale
- ▷ Referring the objection to future date
- ▷ Convincing customers to understand your point of view
- ▷ Compensate customers; e.g., with price reductions, refund or replacement
- ▷ Make customers open up further so that you can understand more

(e) (i) Feasible business refers to a business that can possibly be implemented using the available resources while/yet/whereas/but a viable business refers to a business that is profitable.

(ii) **Characteristics of a feasible/viable business**

- ▷ It should have good/reasonable returns on investment
- ▷ It should have reasonable ease of entry and the market
- ▷ It should have a good income potential
- ▷ It should have a sizeable market gap
- ▷ It must have a good growth potential
- ▷ It must be related to ones skills
- ▷ It must be properly timed
- ▷ It should have a moderate start-up capital
- ▷ It should have ability to use available resources
- ▷ It should be able to attract government supply
- ▷ It should be acceptable by the community

SECTION B (80 MARKS)

2(a) **Justifying the need for adopting changes in business**

- ▷ Increases efficiency/output/productivity
- ▷ To respond to customer needs
- ▷ Facilitating growth opportunities
- ▷ Encouraging innovation
- ▷ To help in challenging the status quo; i.e., change result in new ways of doing things
- ▷ To foster team work due to continued consultations
- ▷ Determining the direction of the economy
- ▷ To cope with competition
- ▷ It instils employee confidence when ideas work successfully.
- ▷ To help the business to stay up to date with

business trends

- ▷ Coping with change in company strategy

(b) **Factors that limit entrepreneurs from adopting change**

- ▷ Lack of time and effort to effect change
- ▷ Change hurts/negatively affects some people
- ▷ It is costly/requires additional financial investment which may result in economic hard ships
- ▷ Lack of self-confidence.
- ▷ Being stubborn and independent; i.e., letting pride interfere with change
- ▷ Need to feel secure as change may be a threat to one's position
- ▷ Inability to cope with change/lack of skills
- ▷ Failure to involve all stakeholders in the change process
- ▷ Fear for taking up new responsibilities

3(a) **How an entrepreneur can manage competition in market**

- ▷ Charging cheaper/affordable prices
- ▷ Producing high quality goods
- ▷ Using attractive packaging materials
- ▷ Ensuring added convenience to customers
- ▷ Treating customers well
- ▷ Offering credit
- ▷ Communicating regularly with customers
- ▷ Maintaining up-to-date records
- ▷ Using after sales services
- ▷ Advertising the products
- ▷ Motivating employees
- ▷ Rewarding loyal customers
- ▷ Using modern technology
- ▷ Training workers

(b) **Effects of business struggle for customers**

Positive effects

- ▷ Leads to better customer satisfaction
- ▷ Promotes efficiency
- ▷ Leads to better payment of workers
- ▷ Leads to production of a variety of products
- ▷ Leads to reduction in prices
- ▷ Promotes hard work
- ▷ Increases business profits
- ▷ Leads to production of better quality products
- ▷ Increases innovation/creativity
- ▷ Increases workers' skills
- ▷ Leads to social recognition/reputation

Negative

- ▷ Makes resources more expensive
- ▷ Reduces the number of customers
- ▷ May lead to collapse of business

- ▷ Creates unemployment
- ▷ Lowers business profits
- ▷ Misleads customers
- ▷ Lowers self-esteem of the losing entrepreneur
- ▷ Leads to production of fake goods

4(a). **Components of entrepreneurial environment that influence business intentions**

- ▷ Economic factors; i.e., conducive economic factors encourage entrepreneurial intentions from unfavourable economic factors.
- ▷ Demographic factors; e.g., high population encourages entrepreneurial intentions unlike low population.
- ▷ Political factors; e.g., political stability encourages entrepreneurial intentions unlike political instability.
- ▷ Socio-cultural factors; conducive socio-cultural factors encourage entrepreneurial intentions unlike unfavourable ones.
- ▷ Global factors; conducive global factors encourage entrepreneurial intentions unlike unfavourable global factors.
- ▷ Technological factors; e.g., use of modern technology encourages entrepreneurial intentions unlike traditional technology

(b) **Economic factors that discourage entrepreneurial intentions**

- ▷ Unfavourable economic policy; e.g., closed market economy
- ▷ Hard/harsh administrative issues; e.g., hard rules and regulations
- ▷ Unfavourable infrastructure; e.g., poor roads
- ▷ Poor financial system; e.g., poor banking systems
- ▷ Unnecessary/excessive legal requirements; e.g., unclear laws
- ▷ Resource scarcity; e.g., lack of raw materials.

5(a) **Community threats that effect development in Uganda**

- ▷ Corruption which involves redirecting resources for private benefit
- ▷ Exploitation; i.e., taking unfair advantage of a person
- ▷ Diseases; e.g., cancer
- ▷ Violence; e.g., domestic violence
- ▷ Poverty; e.g., due to unlimited incomes
- ▷ Discrimination; i.e., unfair treatment of one person/group due to judgements about their origin, religion, gender, etc.
- ▷ Dependency; i.e., relying on someone/something for help or support
- ▷ Dishonesty; i.e., lies or misleading actions
- ▷ Environmental degradation; i.e., all human activities that negatively affect the environment and reduce its productivity; e.g., pollution

(b) **Possible solutions to community threats in Uganda**

- ▷ Strengthening/implementing government laws of punishing the corrupt officials
- ▷ Increasing education/awareness of masses
- ▷ Increasing opportunities for the disadvantaged
- ▷ Improving hygiene/cleanliness
- ▷ Empowering the community; e.g., through education
- ▷ Encouraging the establishment of income-generating activities
- ▷ Improving the quality of education system
- ▷ Involving community members in making decisions
- ▷ Controlling environmental degradation through afforestation

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ANSWERS (AENT002)

6(a) Beneficiaries of accounting information that is prepared within a business

- Owners and the management of the business for purposes of decision making
- Employees of the business; e.g., to find out whether the organisation shall meet their salary payments
- Creditors; to determine the creditworthiness of the business
- Government; to assess taxes
- Donors; to decide whether to give assistance to the business
- Investors; to know the financial position of business before purchasing shares.
- Competitors that are in the same business or related business; to develop counter competitive strategies
- Researchers/students need information for study purposes.
- Shareholders; to calculate the amount of dividends.
- Customers for consumer protection and requesting for social responsibility.

(b) Significance of systematic financial recording of all business transactions

- Helps government to assess taxes
- Helps financial institutions to make decisions in giving loans
- Helps a business to calculate financial position
- Helps investors to decide whether to invest in the business
- Acts as a tool of control; i.e., it allows the business to keep accurate data concerning its resources
- Helps a business to plan for expansion; e.g., on sales, purchaser, etc.
- Acts as future reference; e.g., reminding the entrepreneur when the transaction took place.
- Showing debtors and creditors of the business for easy follow-up
- Comparison of different business to determine which business is better
- Measures the performance of the business manager; i.e., good management is reflected in the profit made.
- Shows the most profitable products or departments and loss-causing products

7(a) Circumstance under which communication may be effective

- When the message is clear
- When the message is correct
- If the message is complete; i.e., contains all factors
- In case the sender is precise; i.e., specific
- If the sender is courteous; i.e., avoids hurting others
- When the receiver is considerate; i.e., uses positive words
- When there is proper timing
- When the environment is good

(b) Factors considered when selecting the channel of communication

- Language to be used in the message
- The nature of the message to be communicated
- Speed and urgency of the message
- The coverage of the medium
- The cost of communication channel
- The social and education status of the sender and receiver
- Availability of communication medium
- Secrecy and confidentiality of the message
- Age group of the receiver
- Level of feedback required
- Message performance; e.g., need for reference
- Government policy on the medium

ENTREPRENEURSHIP EDUCATION QUESTIONS (AENT003)

SECTION A: CASE STUDY

1. Read the case study below and answer the questions that follow.

Ben, a graduate of Kyambogo University, completed his training in Bachelors of Building and Construction Engineering in 2014. From the time he joined the university, the highly motivated and action-oriented Ben was determined to start his own business of consultancy in building and construction as well as operating a hardware shop. He formulated concrete and moderate goals based on his abilities and efforts.

Before generating the business idea, Ben convinced himself of his strong internal involvement with the goals and personal responsibility for the outcome. He was satisfied with his skills, interest and the amount of personal capital he could raise. He analysed the business environment to create opportunities, read related literature about the industry, sought advice from entrepreneurs in similar business and learnt from feedback to see if right methods were used and right goals were set.

Ben has established a business in Mbarara town. The ground level of the building houses the hardware shop while the upper level is for the consultancy office.

The business is run under the name Modern Building and Construction Centre. To protect the business against risks, Ben insured his business with an insurance company.

He ensures that there is high efficiency in the business, he delegates duties, selects priorities and motivates staff.

During his free time, he reads useful

materials, he uses computers to reduce paper work and keeps diaries for noting down activities to be performed.

He has instructed his sales persons and representatives to strictly sell on cash basis to retailers and wholesalers who benefit from a 10% discount.

Questions

- (a) What behavioural characteristics associated with a strong need for achievement does Ben possess?
- (b) Identify the factors that affected Ben's choice of business idea.
- (c) Describe the basic steps Ben could have followed when taking out the insurance policy.
- (d) How does Ben ensure better time management in business?
- (e) (i) What benefits are enjoyed by Modern Building and Construction Centre for selling goods on a cash basis?
- (ii) What challenges may be faced by the business if it sells goods on credit basis?

SECTION B: SCHOOL BUSINESS CLUB

2. With reference to the school business project operated by your school business club:

- (a) Give the general description of the business project.
- (b) How did the business maintain the safety of its assets?
- (c) What business ethics did you observe towards customers?
- (d) (i) What were the objectives of sales promotion of your project?
- (ii) Give the benefits of sales promotion to the business.

3. In relation to a business project owned by your school club:

- (a) Explain the way the startup capital was raised.
- (b) State the techniques that were used to make products unique in the market.
- (c) (i) What challenges were faced by the business?
- (ii) How were the challenges mentioned in 3c (i) above managed?

SECTION C: FIELD ATTACHMENT/TRIP

4. For any business enterprise you were attached to;

- (a) Describe the business you were attached to.
- (b) Outline the forms of written communication used by the business.
- (c) Explain the methods used by the business to manage credit sales.
- (d) Suggest the insurance policies the business can undertake to minimise the likely risks.
- (e) What measures are used by the business to ensure discipline of employees?

5. For any field trip you made as individual or as a group:

- (a) Give the general description of the business.
- (b) Outline four factors which favoured its location.
- (c) Using the SWOT analysis identify the strengths of the business.
- (d) (i) Explain the marketing mix strategies used in the business.
- (ii) What challenges are faced in marketing business products?

MATHEMATICS PAPER 2 QUESTIONS (AMATHS005)

SECTION A (40 MARKS)

1. The continuous random distribution X is uniformly distributed in the interval $a < x < b$. The lower quartile is 5 and the upper quartile is 9. Find the (i) value of a and b
(ii) $E(X)$

2. The numbers x, y, z are rounded off with corresponding percentage errors of 0.5, 0.45 and 0.02, calculate the maximum possible relative error made in $\frac{xy}{z}$.

3. The heights (cm) of senior six candidates in a certain school were recorded as in the table below.

Height (cm)	148 - < 152	152 - < 156	156 - < 160	160 - < 164	164 - < 168	168 - < 172
Frequency	5	8	12	15	6	4

Calculate the: (i) median height
(ii) range of the middle 60% of the candidates heights.

4. Forces $(i + j)$, $(-4i + j)$ and $(3i - 2j)$ N act at points with position vectors $(2i + 2j)$, $(-i + 4j)$ and $(4i - 2j)$ m respectively. Show that the forces reduce to a couple

5. A body of mass 12 kg moves along a curve under the action of a resultant force F N. At time t seconds the position vector r of the body

$$\text{is } \mathbf{r} = 4t\mathbf{i} + t^3\mathbf{j} + \frac{1}{2}t^2\mathbf{k}.$$

- (a) Find an expression for F in terms of t .
- (b) Find the work done by F between $t = 1$ and $t = 4$.

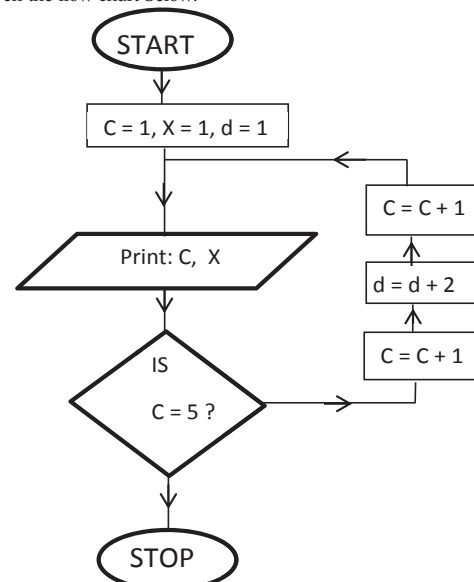
6. A discrete random variable Y has the probability distribution function given by

X	5	8	9	11	12
$P(X=x)$	b	0.1	b	0.4	0.1

Find the; (i) value of b.
(ii) $E(5X - 7)$

7. A lorry covers a distances of 25.6 m and 32 m in the fourth and eighth seconds of its motion respectively. Determine the acceleration of the lorry. (5 Marks)

8. Given the flow chart below.



- (i) Perform a dry run for the flow chart
- (ii) State the purpose of the flow chart

MATHEMATICS PAPER 2 QUESTIONS (AMATHS005)

SECTION B: (60 MARKS)

9.(a) Records from the health department show that two in every 20 patients are found with sickle cell. A sample of 500 patients is checked at random. Find the probability that between 47 and 62 patients are found with sickle cell. (6 marks)

(b) A random sample of 120 girls taken from a normally distributed population of school girls gave a mean age of 16.5 and variance of 18. Determine the 96% confidence interval for the mean age of all the school girls. (6 marks)

10. A light inextensible string has one end attached to a ceiling. The string passes under a smooth moveable pulley of mass 2 kg and then over a smooth fixed pulley. Particle of mass 5 kg is attached at the free end of the string. The sections of the string not in contact with the pulleys are vertical. If the system is released from rest and moves in a vertical plane, find the:

- acceleration of the system.
- tension in the string.
- distance moved by the moveable pulley in 1.5 s. (12 marks)

11.(a) Using the trapezium rule with 7 ordinates, estimate

$$\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{2-\cos x}} dx, \text{ correct to 3 decimal places. (7 marks)}$$

(b) Calculate the percentage error in your estimation in (a) above. (5 marks)

12. (a) John wishes to send a message to Mary. The probability that he uses e-mail, letter or telephone are 0.4, 0.1 and 0.5 respectively. He uses only one method. The probabilities of Mary receiving the message if John uses e-mail, letter or telephone are 0.6, 0.8 and 0.1 respectively.

- Find the probability that Mary receives the message.
- Given that Mary receives the message, find the probability that she received via e-mail.

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(b) A box A contains 1 red, 3 green and 1 blue balls. Box B contains 2 red, 1 green and 2 blue balls. A balanced die is thrown and if the throw is a six, box A is chosen, otherwise box B is chosen. A ball is drawn at random from the chosen box. Given that a green ball is drawn, what is the probability that it came from box A? (6 marks)

13.(a) To an observer on a bus travelling due east at 60kmh^{-1} , wind appears to be blowing at a speed of 40kmh^{-1} from the north-west. Determine the true speed of the wind. (5 Marks)

(b) A ship P is steaming south at a rate of 12kmh^{-1} , and a ship Q is steaming east at 16kmh^{-1} . Given that ship Q is initially 2000 m on a bearing 330° from P, find:

- the relative velocity of ship P to Q.
- when the ships are closest together. (7 marks)

14. (a) Show that the equation $x^2 - 5x + 2 = 0$ has a root in the interval $x = 4$ and $x = 5$. Hence use linear interpolation to find a better approximation to the root of the equation.

(b) Use the approximation above, in each of the formulae below twice.

$$(i) x_{n+1} = \frac{x_n^2 + 2}{2}$$

$$(ii) x_{n+1} = \left(5 - \frac{2}{x_n}\right)$$

(c) State a more suitable formula for approximating the root of the equation $x^2 - 5x + 2 = 0$. Hence find the root of the equation approximate to 3 decimal places. (12 marks)

15. A continuous random variable X has a probability

$$\text{distribution function given by } f(x) = \begin{cases} \frac{2}{13}(x+1) & 0 < x < a \\ \frac{2}{13}(5-x) & a < x < b \\ 0 & \text{elsewhere} \end{cases}$$

(a) Determine the values of a and b . (6 marks)

(b) Find $F(x)$ and sketch it. (6 marks)

16. (a) A body of mass 5 kg slides a distance of 8 m down a rough plane inclined at an angle of $\sin^{-1} \frac{4}{5}$ to the horizontal.

If the coefficient of friction is 0.4, find the velocity attained by the body. (6 marks)

(b) A particle of mass 50 kg is suspended by two light inelastic strings of lengths 9 m and 12 m attached to two points distant 15 m apart. Calculate the tensions in the strings. (6 marks)

SECTION A

1. 30g of a compound Y depressed the freezing point of 50g of water by 6.2°C .

a) Calculate the relative molecular mass of Y. ($K_f = 1.86^\circ\text{C}$ per 1000g of water).

b) The empirical formula of Y is CH_2O . Determine the molecular formula

c) Write equations to show how Y can be converted to chloromethane.

2. Explain the following explanations.

- Silicon (IV) oxide is a solid at room temperature whereas carbon dioxide is a gas at room temperature.
- Ammonium nitrate is readily soluble in water even though the standard enthalpy of solution has a positive value.

3. Write equations to show how the following conversions can be effected:

a) Ethene to CH_3CONH_2

b) CH_3CHO to $\text{CH}_3\text{COOCH}_2\text{CH}_3$

4. Write equations for the reaction(s) between concentrated sodium hydroxide solution and:

- Silicon (VI) oxide
- Beryllium oxide
- Chlorine

5. (a) State Graham's law.

b) A certain volume of a gas diffused through a porous in 120s. Under the same conditions, the same volume of a gas W diffuses in 112s. Calculate the relative molecular mass of W.

6. Write equations and state conditions leading to the formation of:

i. Tin(II) chloride

ii. Tin(IV) chloride

7. A bromoalkane Z with a molecular formula $\text{C}_4\text{H}_9\text{Br}$ formed compound X when heated with sodium hydroxide solution. X when reacted with concentrated hydrochloric acid in the presence of anhydrous zinc chloride, formed two layers of liquids immediately.

CHEMISTRY QUESTIONS (ACHEMS005)

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a) Write the name and structural formula of Z.

b) Write an equation and indicate a mechanism for the reaction between Z and sodium methoxide in methanol.

8. The table shows values for the atomic and ionic radii of the alkali metal.

Element	Atomic radii(nm)	Ionic radii(nm)
Lithium	1.23	0.68
Sodium	1.57	0.97
Potassium	2.03	1.33
Rubidium	2.16	1.47
Caesium	2.35	1.67

a) In every case, the radius of an ion is smaller than that of the corresponding atom. Explain.

b) Explain the increase in atomic radius along the series lithium to caesium.

c) Which of the alkali metals in gaseous state is likely to have highest hydration energy.

9. Name a reagent that can be used to distinguish between each of the following pairs of compounds and in each case state what is observed when the named reagent is used.

a) Propan-1-ol and propan-2-ol

b) But-1-yne and but-2-yne

SECTION B

10. a) (i) Explain what is meant by osmotic pressure

ii) State the conditions under which solutions do not obey osmotic pressure.

(b) The osmotic pressure of a solution containing 1.24 percent of a polymer is 3.1×10^{-3} atm at 25°C . Determine the relative molecular mass of the polymer.

11. Describe the reaction(s) between chlorine and:

(a) Benzene

(b) Sodium hydroxide

12. Oxygen diffuses through a porous plug in 1.3 times than an alkyne Y.

a) i) Calculate the formula mass of Y.

ii) Determine the molecular formula of Y.

b) Write the formula and names of all possible isomers of Y.

c) Y forms a red ppt with ammoniacal copper I chloride solution.

i) Identify Y.

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CHEMISTRY QUESTIONS (ACHEMS005)

ii) Write equations to show how Y can be converted to butan-2-ol.

13. a) Write equations to show how the following chlorides of group IV elements can be prepared.

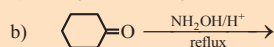
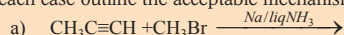
i) Carbon tetrachloride

ii) Lead (II) chloride

iii) Lead (IV) chloride

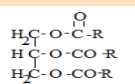
b) Compare the thermo stability of carbon tetrachloride and lead IV chloride (include equation for the reactions if any).
c) Lead (IV) chloride is covalent while as lead (II) chloride is ionic. Explain this observation.

14. Complete the following reactions and in each case outline the acceptable mechanisms.



15. a) Differentiate between soap and soapless detergents.

b). Write the equation to show how soap can be prepared from an ester of molecular formula.



c) Explain the cleansing action of soap

d) State the advantage and disadvantage of using soapless detergents instead of soap in washing

i) Advantage

ii) Disadvantage

16. a) Draw and name the shape of the following molecules.

Molecule	Shape	Name
ClO_3^-		
H_2O		
SO_3		
NH_3		

b) The boiling point of 2-nitrophenol is lower than that of 4-nitrophenol, yet they have the same molecular mass, explain this observation.

17. Using equations show how the following conversions can be effected.

a) Bromocyclohexane to cyclohexanone

b) $\text{CH}_3\text{CH}=\text{CH}_2$ to CH_3CH_3

c) $\text{CH}_3\text{C}\equiv\text{CH}$ from $\text{HC}\equiv\text{CH}$

Find answers only in
New Vision next Tuesday

CHEMISTRY ANSWERS (ACHEM04)

Qn1.

(a) Mn; $1\text{S}^22\text{S}^22\text{P}^63\text{S}^23\text{P}^64\text{S}^23\text{d}^5$

b) Manganese is a transition element because it has a partially filled d-sub energy level in at least one of its ions or oxidation states.

ii) Manganese has variable oxidation states because there is a small energy gap between the 4S and 3d sub-energy levels so it can make use of electrons from both energy levels in turns leading to formation of different ions or fairly stable compounds.

iii) Manganese has a higher melting point than calcium because Manganese atoms contribute a higher number of electrons to the electron cloud than calcium atoms do. So there are stronger metallic bonds in manganese than in calcium. Consequently more heat energy must be supplied to break the metallic bonds in manganese than in calcium.

c) Hot Manganese reacts with steam forming trimanganese tetraoxide and hydrogen gas.



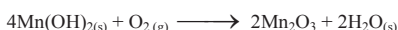
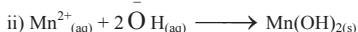
ii) Manganese reacts rapidly with dilute sulphuric acid to form Manganese (II) sulphate and hydrogen gas.



Manganese is oxidized by hot concentrated sulphuric acid to Manganese (II) sulphate and the acid reduced to Sulphur dioxide and water.



d) i) White precipitate insoluble in excess turns brown on standing.

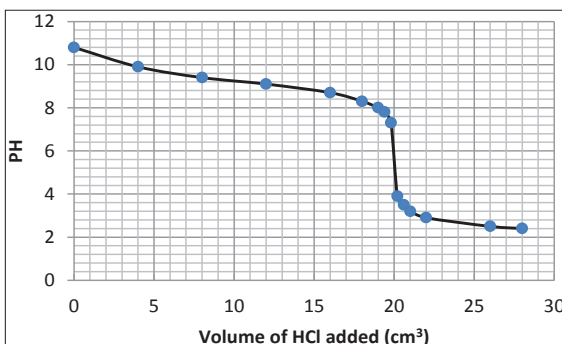


Qn2.

Volume of HCl	0	4	8	12	16	18	19
PH	10.8	9.9	9.4	9.1	8.7	8.3	8.0

Vol	19.4	19.8	20.2	20.6	21	22	26	28
PH	7.8	7.3	3.9	3.5	3.2	2.9	2.5	2.4

a) A graph of PH against volume of HCl added (cm³)

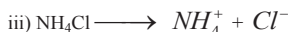


b) i) P^{H} at endpoint = 5.5
volume of HCl added at end point = $19.8 - 20.2\text{cm}^3$
ii) molarity of hydrochloric acid
moles of ammonia that reacted = $\left(\frac{0.2 \times 30}{1000}\right)$ moles



Moles of HCl that reacted = $\left(\frac{0.2 \times 30}{1000}\right)$ moles

$$[\text{HCl}] = \frac{0.2 \times 30}{1000} \times \frac{1000}{20.2} = 0.297 \text{ mol dm}^{-3}$$



$$K_{\text{h}} = \frac{[\text{NH}_3][\text{H}_3\text{O}^+]}{[\text{NH}_4^+]} = \frac{[\text{H}_3\text{O}^+]^2}{[\text{NH}_4^+]}; \text{ since } [\text{NH}_3] = [\text{H}_3\text{O}^+]$$

$$\text{But } \text{P}^{\text{H}} = -\text{Log}_{10} [\text{H}_3\text{O}^+]$$

$$5.5 = -\text{Log} [\text{H}_3\text{O}^+]$$

$$[\text{H}_3\text{O}^+] = (\text{antilog}) \ln \text{Log } -5.5$$

$$\Rightarrow [\text{H}_3\text{O}^+] = 3.16 \times 10^{-6} \text{ M}$$

$$\text{Also } [\text{NH}_4^+] = \frac{0.2 \times 30}{1000} \times \frac{1000}{(20.2 + 30)} = 0.12 \text{ M}$$

$$K_{\text{h}} = \frac{(3.16 \times 10^{-6})^2}{0.12} = 8.32 \times 10^{-11} \text{ mol dm}^{-3}$$

$$\text{iii) } \text{P}^{\text{H}} = \text{P}_{\text{kb}} + \text{Log}_{10} \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]}, \text{ but } \text{P}^{\text{H}} \text{ when } 10\text{cm}^3 \text{ is added} = 9.2$$

$$\Rightarrow \text{P}^{\text{OH}} = 14 - 9.2 = 4.8$$

$$4.8 = -\text{Log}_{10} 1.78 \times 10^{-5} + \text{Log}_{10} \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]}$$

$$4.8 = 4.75 + \text{Log}_{10} \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]}$$

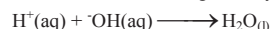
$$\text{Log}_{10} \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]} = 4.8 - 4.75 = 0.05$$

$$\Rightarrow \frac{[\text{NH}_4\text{Cl}]}{[\text{NH}_3]} = 10^{0.05} = 1.122$$

So ratio $[\text{NH}_4\text{Cl}] : [\text{NH}_3] = 1.122 : 1 = 1 : 1$

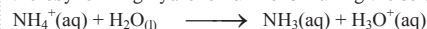
c) Initially at A, P^{H} of the solution is high although less than 14 (10.8). This is because ammonia is a base although a weak base which ionises partially, generating a low concentration of hydroxide ions into solution.

• P^{H} of the solution decreases but gently as volume of hydrochloric acid added increases along AB. This is because hydroxide ions in solution decrease reacting with hydrogen ions from the acid.



P^{H} of the solution decreases sharply when a small volume of hydrochloric acid is added along BC. This is because of complete neutralisation whereby a small excess of the acid from the base makes a big decrease in P^{H} .

• The P^{H} at end point is less than 7 (5.5). This is because the salt formed, ammonium chloride exists alone and undergoes hydrolysis thereby forming hydroxonium ions making the solution acidic.



• P^{H} of the solution decreases as volume of hydrochloric acid added increases along CD. This is because of excess hydrochloric acid which increases the concentration of hydrogen ions in solution, hence lowering P^{H} .

(d) Methyl red indicator is the suitable indicator for this titration. This is because the P^{H} at end point is 5.5, which lies between 4.2 – 6.3 the P^{H} range of methyl red, hence it can detect the end point of the titration.

Qn. 3 a (i) Mass of CO_2 given off = $\frac{11.2}{22.4} \times 44 = 22\text{g}$

$$\text{Mass of C in } \text{CO}_2 = \frac{12}{44} \times 22 = 6\text{g}$$

$$\text{Mass of H in } \text{H}_2\text{O} = \frac{2}{18} \times 4.5 = 0.5\text{g}$$

$$\text{Mass of O in Q} = (7.5 - (6 + 0.5)) = 1\text{g}$$

Elements	C	H	O
Mass	6	0.5	1.0
RAM	12	1	16
Moles	$\frac{6}{12}$ 0.5	$\frac{0.5}{1}$ 0.5	$\frac{1}{16}$ 0.0625
Mole Ratio	$\frac{0.5}{0.0625}$	$\frac{0.5}{0.0625}$	$\frac{0.0625}{0.0625}$
	8	8	1

CHEMISTRY ANSWERS (ACHEM04)

∴ EF is C₈H₈O

ii) MF of Q

$$\text{From density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass of Q = 5.357g

$$PV = \frac{m}{Mr} RT$$

$$Mr = \frac{5.357 \times 8.314 \times 273}{1.0 \times 10^5 \times 1 \times 10^{-3}} = 121.589$$

$$n(\text{C}_8\text{H}_8\text{O}) = 121.589$$

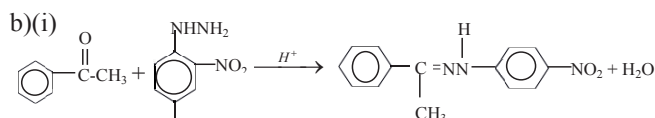
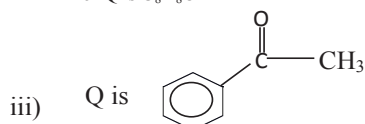
$$12 \times 8 \times n + 1 \times 8 \times n + 1 \times 16 \times n = 121.589$$

$$120n = 121.589$$

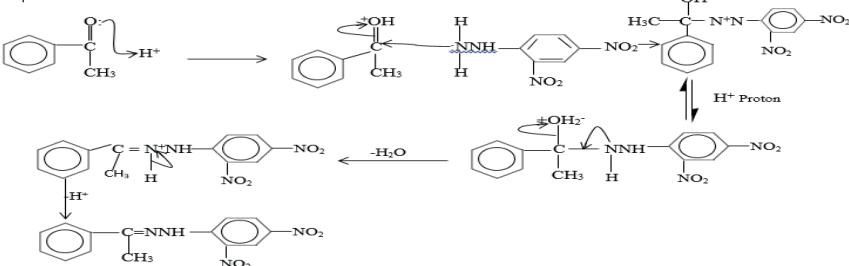
$$n = 121.589/120 = 1$$

$$1(\text{C}_8\text{H}_8\text{O}) = \text{C}_8\text{H}_8\text{O}$$

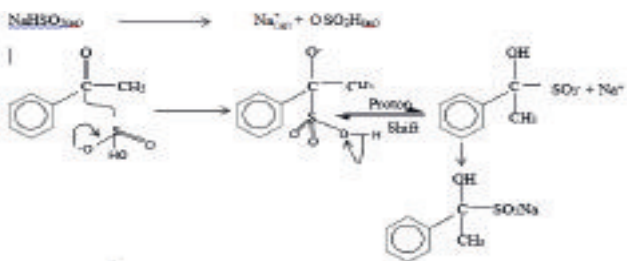
∴ MF of Q is C₈H₈O



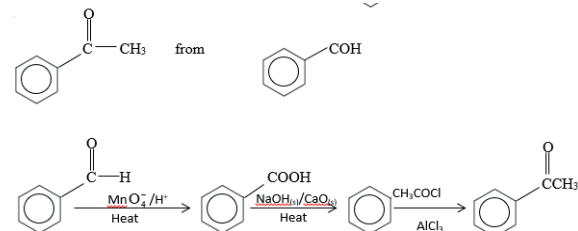
Mechanism



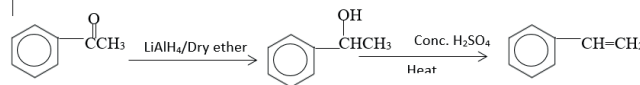
ii)



c(i)



ii)



Qn.4

a) i) Le Chatelier's principle states that when a reversible reaction is exposed to an external constraint, it adjusts itself in such a way that it counteracts the effects of the external constraint.

ii) – Temperature

– Pressure for gaseous reactants and products

– Concentration of reactants and products

(any two)

iii) **Temperature:**

For an endothermic reaction, as temperature increases, the equilibrium constant increases and equilibrium position shifts from the left to the right and vice versa. For an exothermic reaction, as temperature increases, the equilibrium position shifts from the right to the left and vice versa.

Pressure:

As pressure increases, the equilibrium constant remains unchanged, but the position of equilibrium shifts from the left to the right if the forward reaction occurs by a decrease in volume and vice-versa.

As pressure increases, the equilibrium constant remains unchanged but the position of equilibrium shifts from the right to the left if the forward reaction occurs by an increase in volume and vice-versa.

As pressure increase, equilibrium constant remains unchanged and also the position of equilibrium remains unchanged if there is no volume change for the forward reaction.

Concentration:

As concentration of one of the reactants increases, the equilibrium constant remains unchanged but the position of equilibrium shifts from the left to the right and vice-versa.

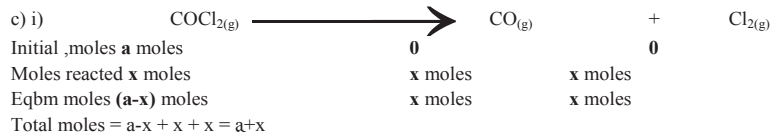
As concentration of one of the products increases, the position of the equilibrium shifts from the right to the left and vice-versa.

Note that the explanation was not required and two factors were required for description.

$$b) \text{ (i) } K_c = \frac{[\text{CO}]^4}{[\text{Ni}(\text{CO})_4]} \text{ mol}^3 \text{ dm}^{-9}$$

$$K_p = \frac{P_{\text{CO}}^4}{P_{\text{Ni}(\text{CO})_4}} (\text{atmosphere})^3 \text{ or } (\text{Nm}^{-2})^3 \text{ or } \text{N}^3 \text{m}^{-6}$$

ii) The position of equilibrium remains unchanged on adding a catalyst.



$$\% \text{ of } \text{Cl}_2 = \frac{x}{a+x} \times 100 = 20.25 \Rightarrow \frac{x}{a+x} = \frac{20.25}{100} = 0.2025$$

But a = 1 from the question

$$\begin{aligned} \frac{x}{1+x} &= 0.2025 \\ 0.2025(1+x) &= x \\ 0.2025 + 0.2025x &= x \\ 0.2025 &= 0.7975x \\ x &= \frac{0.2025}{0.7975} = 0.2539 \end{aligned}$$

moles of COCl₂ = 1 – 0.2539 = 0.7461

moles of CO = 0.2539 moles

moles of Cl₂ = 0.2539 moles

$$K_c = \frac{[\text{CO}][\text{Cl}_2]}{[\text{COCl}_2]}$$

$$= \frac{(0.2539)}{2} / \frac{0.7461}{2}$$

$$= 0.0432 \text{ moldm}^{-3}$$

Turn to next page

CHEMISTRY ANSWERS (ACHEM04)

c(ii)



$$\therefore \alpha = \frac{x}{a} \Rightarrow x = a\alpha$$

$$\alpha = 15/100 = 0.15$$

Moles of $\text{COCl}_2 = 2 - (0.15 \times 2) = 1.7$ moles

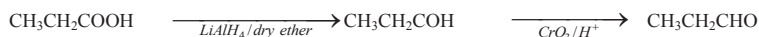
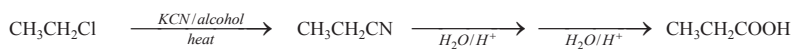
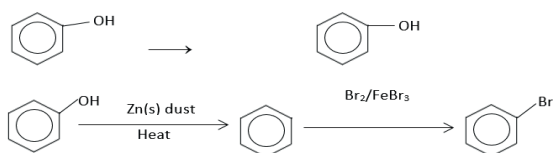
Moles of $\text{CO} = 2 \times 0.15 = 0.30$ moles

Moles of $\text{Cl}_2 = 2 \times 0.15 = 0.30$ moles

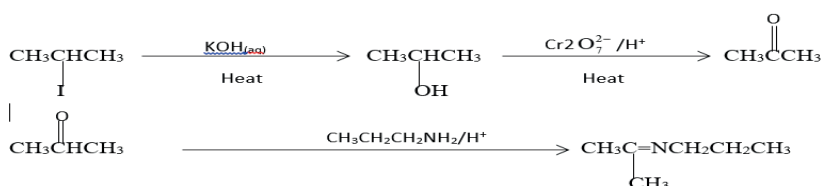
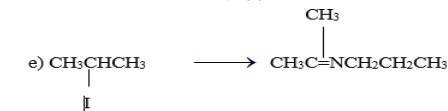
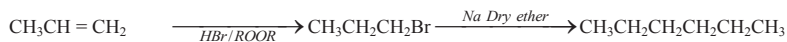
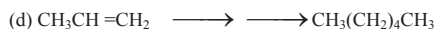
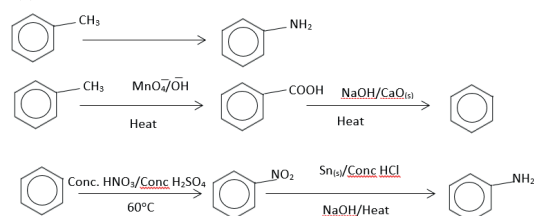
$$K_c = \frac{0.3^2}{2^2} \times \frac{1.7}{2}$$

iii) The reaction is exothermic. This is because increase in temperature caused a decrease in the value of equilibrium constant.

Qn.5

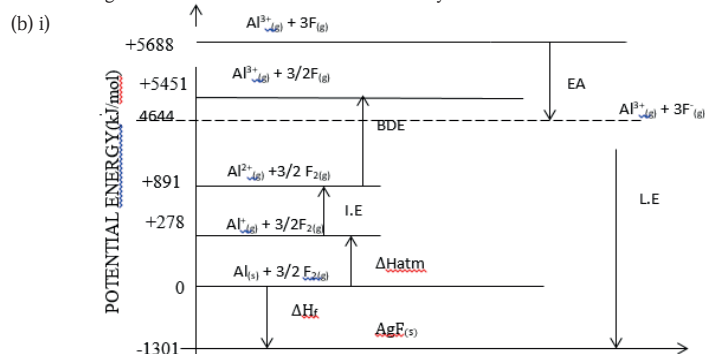


(c)



Qn.6 (a)(i) Lattice energy is the energy change that occurs when one mole of an ionic compound broken into or formed from its constituent gaseous ions.

(ii) Hydration energy is the energy change that occurs when one mole of gaseous ions combines with excess water molecules to form hydrated ions.



ii)

$$-1301 = 4644 + \text{L.E.}$$

$$\text{L.E.} = -5945 \text{ kJ/mol}$$

$$(c) \text{DHAlF}_3 = -4690 + (3 \times -364) = -578 \text{ kJ/mol}$$

$$\text{DHsol} = +5945 + -578 = +158 \text{ kJ/mol}$$

(d) The factors that affect lattice energy are:

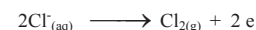
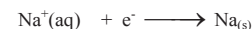
I) **Ionic charge**; the higher the ionic charge, the bigger is the lattice energy value and vice-versa. This is because the force of attraction between oppositely charged ions increases hence amount of energy given out or absorbed when forming or breaking the crystal lattice respectively increases and vice-versa.

II) **Ionic radius**; the higher the ionic radius, the smaller is the lattice energy value and vice-versa. This is because charge density decreases thus the force of attraction between oppositely charged ions decreases hence amount of

energy given out or absorbed when forming or breaking the crystal lattice respectively decreases and vice versa.

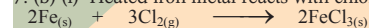
Qn.7

(a) industrial preparation of chlorine
Chlorine is prepared by electrolysis of brine. Brine is electrolysed using steel cathode and titanium anode. Sodium ions are discharged at the cathode and form sodium metal while chloride ions are discharged at the anode to liberate chlorine gas.



The liberated chlorine is then collected in a tight gas cover. The sodium metal reacts with water to give sodium hydroxide and hydrogen gas as byproducts.

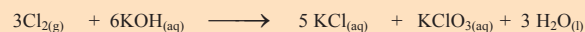
7. (b) (i) Heated iron metal reacts with chlorine gas forming iron(III)chloride.



(ii) chlorine reacts with cold dilute potassium hydroxide forming potassium chloride, Potassium chlorate(I) and water.



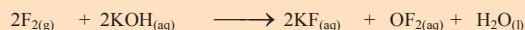
chlorine reacts with hot concentrated potassium hydroxide forming potassium chloride, potassium chlorate(V) and water.



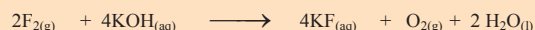
(c)(i) Fluorine oxidises water to oxygen and itself reduced to hydrofluoric acid



(ii) Fluorine reacts with cold dilute potassium hydroxide forming potassium Fluoride, Oxygen difluoride and water.



Fluorine reacts with hot concentrated potassium hydroxide forming potassium Fluoride, Oxygen gas and water.



7. (d) Fluorine in hydrogen fluoride is more electronegative than chlorine in hydrogen chloride. So hydrogen fluoride molecule is more polar than hydrogen chloride molecule. Consequently hydrogen fluoride molecules associate via stronger hydrogen bonds than does hydrogen chloride molecules. Hence the heat energy at room temperature is sufficient to break the weaker hydrogen bonds and vapourised hydrogen chloride but not hydrogen fluoride.

other earthly material by creating a difference in their densities. Usually the ore is ground into fine powder to increase its surface area and then mixed with water. A frothing agent, preferably xanthates of palm oil, is added and the mixture stirred. The earthly materials, now of higher density, sink to the bottom while the less dense ore floats on the surface, where it is skimmed off, washed and dried.

(ii) Roasting is a chemical process of concentrating an ore and also separating it from other earthly material by strongly heating it in air to form its oxide that can be reduced to the metal easily while changing the non-metallic impurities to gases that easily escape to the atmosphere.

Qn. 8

(a)(i) Floation is a physical method of concentrating an ore and also separating it from