



HOME SCHOOLING MATERIAL

PASS A' LEVEL

**CHEMISTRY, MATHEMATICS &
ENTREPRENEURSHIP**



YOUR GUIDE AWAY FROM SCHOOL

ENTREPRENEURSHIP EDUCATION ANSWERS (AENT003)

SECTION A

1. CASE STUDY

(a) Behavioural characteristics associated with a strong need for achievement Ben possesses. Note: Evidence is a must (connect all your points with the case study, they may be direct or implied)

- ▶ He works for long hours by utilizing his free time
- ▶ Highly motivated and action oriented.
- ▶ Formulated concrete and moderate goals based on his abilities and efforts.
- ▶ He gets involved in positive activities e.g. during free time he reads useful materials
- ▶ Had internal involvement with goals and personal responsibility for the outcome.
- ▶ Analysed the business environment to create opportunities.
- ▶ Sought advice from entrepreneurs in similar business.
- ▶ Learnt from feedback to see if right methods were used and right goals were set.
- ▶ He has faith with the strong desire for success
- ▶ Ensures that there is high efficiency in the business

(b) Factors that affected Ben's choice of business idea:

- ▶ Personal skills through training acquired in Bachelors of Building and construction Engineering.
 - ▶ Government policies as the business is legally accepted
 - ▶ Acceptability in the community
 - ▶ Personal Interest for the occupation
 - ▶ Personal capacity to raise the needed capital
 - ▶ Presence of market
 - ▶ Social costs as it has less social costs
 - ▶ Availability of raw materials
 - ▶ Availability of require technology
 - ▶ Return on investment
- NB: Evidence is a required

(c) Steps Ben could have followed when taking out the insurance policy:

- ▶ Making inquiries on different companies and different policies
 - ▶ Filling a proposal form
 - ▶ Calculating the premium by the insurance company basing on the information that was provided by Mr. Ben in the proposal form
 - ▶ Issuing the cover note/binder as evidence of payment of first premium
 - ▶ Receiving an insurance policy/insurance certificate
- NB: They must be in a logical order. Evidence is not required.

(d) Ben ensures better time management in business as follows:

- ▶ Delegates duties to employees.
 - ▶ Selects priorities
 - ▶ Avoids unnecessary interruptions through prior planning
 - ▶ Makes decisions in time like as it is on the mode of sale
 - ▶ Establishing the hardware shop and consultancy office on the same building.
 - ▶ Reduces paper work through use of computers
 - ▶ Motivates his staff to avoid unrest
- NB Evidence required

(e) (i) Benefits enjoyed by modern building and construction Centre for selling goods on cash basis:

- ▶ Provides cash to meet day to day cash requirements
- ▶ Facilitates the Centre to sell small value items

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KEDRETH ASHIMWE,
MBARARA HIGH SCHOOL



ALLAN AHABWE BUHAMIZO,
NTARE SCHOOL

- ▶ Helps to reduce losses that arise out of bad debts
 - ▶ Facilitates selling to customers from unknown places
 - ▶ Enjoys reduced administrative expenses associated with credit sales
- NB. No evidence required.**

(ii) Challenges that could be faced by the business as a result of selling on credit basis:

- ▶ Changing economic conditions leading to losses
- ▶ Challenge of bad debts
- ▶ Increasing administrative costs
- ▶ Difficulty in planning for the business
- ▶ Challenge of maintaining a good relationship with customers

SECTION B

SCHOOL BUSINESS CLUB

Note: In the final exams, use the past tense in all questions referring to business clubs. Evidence must be provided except in questions requiring personal opinion.

2. (a) General description of the business should include the following:

- ▶ Business name, address and contact
- ▶ Location of the business
- ▶ Mission, vision, goals and objects
- ▶ Products offered
- ▶ Customers served
- ▶ Sources of finance
- ▶ Description of the business assets
- ▶ Date of commencement
- ▶ SWOT analysis
- ▶ Uniqueness of the business
- ▶ Nature of the business/legal framework

(b) The business maintained the safety of its assets in the following ways:

- ▶ By keeping accurate asset records
- ▶ By keeping cash in a lockable room
- ▶ Covering fixed assets/machines when out of use
- ▶ Switching on security lights at night
- ▶ Conducting regular checks and repairs on machines
- ▶ Banking cash with the bursar, headteacher, etc
- ▶ Ensuring close supervision of all club members
- ▶ By assigning a member to keep guarding during production and selling of goods
- ▶ Adequate lighting in the operating room
- ▶ Using skilled/qualifying staff
- ▶ Supervising the production system

- ▶ Improving quality
- ▶ Unique packaging
- ▶ Pricing of the product differently
- ▶ Using different technology
- ▶ Using unique labels
- ▶ Using unique sizes/quantities/volumes/weights for the product

(c) (i) Challenges that were faced by the business:

- ▶ Inadequate funds
 - ▶ Limited market
 - ▶ Limited space for operation
 - ▶ Challenge of low entrepreneurial skills
 - ▶ Interference from school administration
 - ▶ Inadequate time
 - ▶ Unethical behaviours from rival businesses around school
 - ▶ Low technology
 - ▶ Lack of continuity during holidays
 - ▶ Being despised by teachers and students
- NB: Evidence is required**

(ii) How the challenges were managed:

- ▶ The club acquired a loan from the school
- ▶ Intensifying advertising amongst students to increase the market
- ▶ More knowledge on business was acquired to boost the entrepreneurial ability
- ▶ Some time out of class was utilised on top of the normal weekend time
- ▶ The business acquired some machines to use in place of manual work

SECTION C

FIELD ATTACHMENT/FIELD TRIP

Note: evidence is required for questions on field attachment and field trip except on questions requiring personal opinion

4. (a) Description of the business visited Refer to question 2. (a).

(b) Forms of written communication used by the business:

- ▶ Letters
- ▶ Memos
- ▶ Circulars
- ▶ Reports
- ▶ Notices

(c) Methods used by the business to manage credit sales:

- ▶ Fixing the minimum amount/value of credit sales
- ▶ Giving a shorter credit period
- ▶ Inducing debtors to pay like giving discounts
- ▶ Documenting all credit sales
- ▶ Reminding debtors to pay
- ▶ Using authorised personal to approve credit sales; e.g, accountant
- ▶ Asking for collateral security
- ▶ Imposing late payment penalty on debtors
- ▶ Contracting independent legal companies
- ▶ Insuring against bad debtors
- ▶ Factoring/selling off the debts
- ▶ Providing convenient means of payment; e.g, mobile money.

(d) Insurance policies the business can undertake to minimise the likely risks:

- ▶ Fire policy
- ▶ Theft and burglary policy
- ▶ Life assurance
- ▶ Loss of profits policy
- ▶ Cash in transit policy
- ▶ Motor insurance policy
- ▶ Workman's compensation policy
- ▶ Endowment policy

ANSWERS (AENTO03)

- ⊖ Machinery break down policy
- ⊖ Fidelity guarantee policy

(e) Measures used by the business to ensure discipline of employees

- ⊖ Recording the reporting and departure time
- ⊖ Monitoring workers
- ⊖ Punishing indiscipline workers
- ⊖ Warning undisciplined workers
- ⊖ Respecting employees
- ⊖ Motivating employees e.g. timely and adequate pay
- ⊖ Setting deadlines
- ⊖ Scheduling workers
- ⊖ Conducting regular and objective performance appraisals
- ⊖ Ensuring self-discipline by the employer
- ⊖ Exemplary leadership

5. (a) General description of the business Refer to question 2(a)

(b) Factors which favoured the location of the business

- ⊖ Presence of water source.
- ⊖ Presence of necessary labour both unskilled and skilled
- ⊖ Presence of cheap/free industrial land.
- ⊖ Availability of raw materials
- ⊖ Presence of adequate power
- ⊖ Developed other infrastructure such as roads railway, and communication facilities
- ⊖ Presence of adequate market.
- ⊖ Adequate/presence of security

(c) The strength of the business using SWOT analysis

- ⊖ Production of a variety of products
- ⊖ Production of high quality products/services
- ⊖ Good branding /strong brand image.
- ⊖ Excellent advertising.
- ⊖ Use of modern technology
- ⊖ Wide distribution network
- ⊖ Good time management practices
- ⊖ Adequate capital raised by owners
- ⊖ Entrepreneurial skills/Abilities to manage the business by owners/Employment of skilled and qualified personnel.
- ⊖ Ready market provided by large labour force.

(d) (i) Marketing mix strategies used in the business.

- ⊖ Product.
- ⊖ Price/pricing
- ⊖ Promotion of business products
- ⊖ Place/distribution channel used in marketing of products.
- ⊖ Packaging
- ⊖ People
- ⊖ Positioning

(ii) Challenges faced in marketing business products

- ⊖ Stiff competition.
- ⊖ Theft of business products and cash during marketing/Theft and robbery
- ⊖ Adulteration of business products
- ⊖ Inadequate transport facilities
- ⊖ Change in customer's taste and preference
- ⊖ Bad debtors/identifying credit worthy customers to be offered credit.
- ⊖ Theft of business funds by sales team
- ⊖ Fixing low but unprofitable prices
- ⊖ Unfavourable weather like rain that hinders movements
- ⊖ Under developed infrastructure, especially roads causing unnecessary delays and break down of vehicles

ENTREPRENEURSHIP EDUCATION QUESTIONS (AENTO04)

1. You have started a new mineral water bottling company, competing with other business in the same industry.

- a) Give the vision and mission statement of your company.
- b) Design an advert for promoting your products
- c) Develop a programme for launching your producers.
- d) Write a letter to the District Environment Officer requesting for advice on how to reduce the business effects to the environment.

2. You own a factory producing plastics and customers are complaining about the quality of your products.

- a) Write a memo to the production manager about the complaints raised by customers.
- b) Prepare guidelines to be followed by the workers for improving the quality of the products.
- c) Design a market survey guide for your new products.
- d) Design a Stock card for your improved products.

3. You want to revive a meat packing factory in Mbarara town by inviting share holders to discuss about restocking the farm, installing new machines and recruiting employees.

- a) Write a notice inviting shareholders for the meeting to discuss the revival of the project.
- b) Develop a programme for recruiting employees.
- c) Design a schedule for the routine maintenance of machines.
- d) Prepare an organisational plan for the factory.

4. The following information relates to ABEINE ENTERPRISES LTD being projectors for the month of July, August SEPT and OCTOBER 2019.

- i) On July 1st 2019 cash balances was shs 26,000,000
 - ii) The Sales manager expects to sell goods on credit worth shs 40,000,000 monthly, payment from credit customers is expected as follows, 60% of credit in the month of sale and the balance in the month following sale.
 - iii) The finance Manager expects to get two loans of shs 20,000,000 each in the month of August and October 2019.
 - iv) The monthly cash sales are expected to be shs 60,000,000. A Commission of 10% is paid to the sales men each time cash is received.
 - v) Monthly cash purchases worth 40,000,000 are expected to be made.
 - vi) A delivery van is to be bought in the month of August 2019 at a cost of shs 35,000,000.
 - vii) Monthly wage bill is estimated to be shs 12,500,000 but an increase of 10% is expected in the month of October 2019.
 - viii) A loan interest of 5% per month is payable starting in the month following acquisition of the loan.
 - x) Expansion of the business building is expected to cost shs 62,000,000 in the month of July 2019 and shs 30,000,000 in the month of August 2019.
 - xi) General expenses are expected to amount to shs 7,100,000 per month. All expenses are paid in the month in which they are incurred.
 - xii) Income tax of the shs 12,000,000 for the first quarter of the year is to be paid in September.
- a) Prepare a cash flow statement for the business.
 - b) Suggest to Abaine enterprises Ltd, ways of managing cash flow short falls in the cash flow Statement.

5. MARYHILL HIGH SCHOOL STAFF CANTEEN INCOME STATEMENT FOR THE PERIOD ENDING 31ST DECEMBER 2019

	Shs
Sales	240,000,000
Less cost of Sales	180,000,000
Gross Profit	60,000,000
Less. Operating expenses	25,000,000
Net Profit	35,000,000
Net Profit as at the start of 2019 was shs	35,000,000.

MARYHILL HIGH SCHOOL STAFF CANTEEN BALANCE SHEET AS AT 31ST DECEMBER 2019

Liabilities	shs	shs	Assets:	shs	shs
Capital	89,000,000		<u>Fixed Assets</u>		
Add: Net Profit	35,000,000		Building	82,000,000	
	124,000,000		Furniture	50,000,000	
Less: Drawings	10,000,000		Total Fixed Assets		132,000,000
Net worth		114,000,000	<u>Current Assets</u>		
<u>Long Term Liabilities</u>			Stock	47,000,000	
3 Year Loan		72,000,000	Debtors	38,000,000	
<u>Current Liabilities</u>			Bank	25,000,000	
Bank overdraft		34,000,000	Cash	18,000,000	
Creditors		40,000,000	Total Current Assets		128,000,000
		260,000,000			260,000,000

Questions:

Calculate the following ratios using the balance

- i) Gross profit margin
- ii) Net profit to sales
- iii) Net profit to owners equity
- iv) Acid test ratio
- v) Stock turnover
- vi) Fixed Assets turnover
- vii) Gearing ratio

b) Interpret the following ratios above

- i) Gearing ratio
- ii) Net profit to sale

6. NSIKYE ENTERPRISE LTD is a VAT registered business dealing in the Production of chicken marsh and employs a number of workers who include: Tushemereirwe, Abaine, Okumu and Turyahikayo who are paid monthly salary of shs 200,000, shs 300,000, shs 400,000 and shs 800,000 respectively.

Given the Income (PAYE) tax rate as follows:

Chargeable Income (monthly income)	Tax Liability
0 – shs 235,000	NIL
Exceeding shs 235,000 but Not exceeding shs 335,000.	10% of the amount by which chargeable Income exceeds shs 235,000.
Exceeding shs 335,000 but Not exceeding shs 410,000.	Shs 10,000 plus 20% of the amount by which chargeable income exceeds shs 335,000.
Shs 410,000 and above	Shs 25000 plus 30% of the amount by which chargeable income exceeds shs 410,000.

Compute the Income tax payable by

- i) Tushemereirwe
- ii) Abaine
- iii) Turyahikayo
- iv) Okumu

MATHEMATICS ANSWERS (AMATHS005)

1. For a uniform function in the range $a < x < b$

The function, $f(x) = \frac{1}{b-a}$

Therefore, $f(x) = \begin{cases} \frac{1}{b-a}, & a < x < b \\ 0, & \text{elsewhere} \end{cases}$

For the lower quartile

$$\int_a^{\frac{3}{4}(b-a)} \frac{1}{b-a} dx = \frac{1}{4}, \quad \frac{x}{b-a} \Big|_a^{\frac{3}{4}(b-a)} = \frac{1}{4} \quad \frac{5-a}{b-a} = \frac{1}{4}$$

For the upper quartile

$$\int_a^{\frac{3}{4}(b-a)} \frac{1}{b-a} dx = \frac{3}{4}, \quad \frac{x}{b-a} \Big|_a^{\frac{3}{4}(b-a)} = \frac{3}{4}$$

$$\frac{9-a}{b-a} = \frac{3}{4} \quad \text{---(ii)}$$

(ii) \div (i)

$$\frac{9-a}{b-a} \times \frac{b-a}{5-a} = \frac{3}{4} \times \frac{4}{1} = \frac{9-a}{5-a} = 3$$

$$9-a = 15-3a$$

$$\frac{2a}{2} = \frac{6}{2}, a = 3$$

from

$$\frac{5-a}{b-a} = \frac{1}{4}$$

$$\frac{5-3}{b-3} = \frac{1}{4}$$

$$8 = b-3 = 11$$

$$\therefore a = 3, b = 11$$

$$E(X) = \int_a^b x \cdot \frac{1}{b-a} dx = \frac{x^2}{2(b-a)} \Big|_a^b = \frac{b^2 - a^2}{2(b-a)}$$

$$= \frac{(b+a)(b-a)}{2(b-a)} = \frac{b+a}{2} = \frac{11+3}{2} = 7$$

$$\therefore E(X) = 7$$

$$2. \quad \left| \frac{\Delta x}{x} \right| \times 100 = 0.5, \quad \left| \frac{\Delta x}{x} \right| = 0.005$$

$$\left| \frac{\Delta y}{y} \right| \times 100 = 0.45, \quad \left| \frac{\Delta y}{y} \right| = 0.0045$$

$$\left| \frac{\Delta z}{z} \right| \times 100 = 0.02, \quad \left| \frac{\Delta z}{z} \right| = 0.0002$$

$$p = \frac{xy}{z}$$

$$\text{Let } \Delta p = \frac{z(y\Delta x + x\Delta y) - xy\Delta z}{z^2} = \frac{y\Delta x}{z} + \frac{x\Delta y}{z} - \frac{xy\Delta z}{z^2}$$

Maximum possible absolute error

$$|\Delta p| = \left| \frac{y\Delta x}{z} + \frac{x\Delta y}{z} - \frac{xy\Delta z}{z^2} \right|$$

$$\left| \frac{y\Delta x}{z} + \frac{x\Delta y}{z} - \frac{xy\Delta z}{z^2} \right| \leq \left| \frac{y\Delta x}{z} \right| + \left| \frac{x\Delta y}{z} \right| + \left| \frac{xy\Delta z}{z^2} \right|$$

$$\Delta p \leq \left| \frac{y\Delta x}{z} \right| + \left| \frac{x\Delta y}{z} \right| + \left| \frac{xy\Delta z}{z^2} \right|$$

Relative error

$$= \left| \frac{\Delta p}{p} \right| \leq \left| \frac{y\Delta x}{z} \right| \times \frac{z}{xy} + \left| \frac{x\Delta y}{z} \right| \times \frac{z}{xy} + \left| \frac{xy\Delta z}{z^2} \right| \times \frac{z}{xy}$$

$$\leq \left| \frac{\Delta x}{x} \right| + \left| \frac{\Delta y}{y} \right| + \left| \frac{\Delta z}{z} \right| \leq 0.005 + 0.0045 + 0.0002 \leq 0.0097$$

Therefore the maximum possible relative error in $\frac{xy}{z}$ is 0.0097

THE TEACHERS



IVAN GIMEI,
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AUGUSTUS ISINGOMA,
ST JOHN'S SS, NYABWINA - SHEEMA

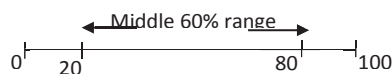
Height (cm)	frequency	Cumulative frequency
148 - < 152	5	5
152 - < 156	8	13
156 - < 160	12	25
160 - < 164	15	40
164 - < 168	6	46
168 - < 172	4	50

$$(i) \text{ Median} = l_b + \left(\frac{\frac{N}{2} - cfb}{f_m} \right) \times C$$

$$\text{Position of the median value} = \frac{N}{2} = \frac{50}{2} = 25^{\text{th}} \text{ value}$$

The median = 160 cm (the upper class boundary of the class whose cumulative frequency is 25)

- (ii) Range of the middle 60% of the candidates height



$$\frac{100-60}{2} = \frac{40}{2} = 20\%$$

Middle 60% range = 80th and 20th percentile range

$$\text{The } 20^{\text{th}} \text{ percentile } P_{20} = l_{20} + \left(\frac{\frac{20}{100}N - cfb}{f_{20}} \right) \times C$$

$$\text{Position of } P_{20} = \frac{20}{100} \times N = \frac{20}{100} \times 50 = 10^{\text{th}} \text{ value}$$

The P_{20} class is 152 - < 156

$$l_{20} = 152, cfb = 5, C = 4, f_{20} = 8$$

$$P_{20} = 152 + \left(\frac{\frac{20}{100} \times 50 - 5}{8} \right) \times 4$$

$$P_{20} = 152 + \frac{20}{8} = 154.5 \text{ cm}$$

$$\text{The } 80^{\text{th}} \text{ percentile } P_{80} = l_{80} + \left(\frac{\frac{80}{100}N - cfb}{f_{80}} \right) \times C$$

$$\text{Position of } P_{80} = \frac{80}{100} \times N = \frac{80}{100} \times 50 = 40^{\text{th}} \text{ value}$$

$P_{80} = 164$ (The upper class boundary of a class whose cumulative frequency is 40)

$$80^{\text{th}} \text{ and } 20^{\text{th}} \text{ percentile range} = 164 - 154.5 = 9.5 \text{ cm}$$

Therefore, the range of the middle 60% of candidates height is 9.5 cm

4. Let the resultant force be F and moment of the force about the origin be G

$$F = \begin{pmatrix} 1 \\ 1 \end{pmatrix} + \begin{pmatrix} -4 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ -2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} N$$

$$G = \begin{vmatrix} 1 & 2 \\ 1 & 2 \end{vmatrix} + \begin{vmatrix} -4 & -1 \\ 1 & 4 \end{vmatrix} + \begin{vmatrix} 3 & 4 \\ -2 & -2 \end{vmatrix} = 0 + -15 + 2 = -13 \text{ Nm}$$

$G = 13$ Nm anticlockwise

Since $F = 0N$ and $G = 13$ Nm (not zero) anti-clockwise, the forces reduce to a couple

5. Mass, $m = 12$ kg

$$r = 4t\hat{i} + t^3\hat{j} + \frac{1}{2}t^2\hat{k}$$

$$V = \frac{dr}{dt} = \frac{d}{dt} (4t\hat{i} + t^3\hat{j} + \frac{1}{2}t^2\hat{k}) = 4\hat{i} + 3t^2\hat{j} + t\hat{k}$$

$$a = \frac{dv}{dt} = \frac{d}{dt} (4\hat{i} + 3t^2\hat{j} + t\hat{k}) = 6t\hat{j} + \hat{k}$$

$$F = ma$$

$$F = 12(6t\hat{j} + \hat{k}) = 72t\hat{j} + 12\hat{k}$$

Work done (W.D)

$$W.D = \int P dt = \int_1^4 F \cdot v dt = \int_1^4 \begin{pmatrix} 4 \\ 3t^2 \\ t \end{pmatrix} \cdot \begin{pmatrix} 0 \\ 72t \\ 12 \end{pmatrix} dt$$

$$= \int_1^4 (216t^3 + 12t) dt = \left[\frac{216t^4}{4} + \frac{12t^2}{2} \right]_1^4 = 54t^4 + 6t^2 \Big|_1^4$$

$$= (54 \times 4^4 + 6 \times 4^2) - (54 + 6) = 13920 - 60 = 13860 \text{ joules}$$

Therefore work done is 13860 joules

6. $\sum XP(X=x) = 9.2$

$$\sum P_{\text{all}}(X=x) = 1$$

$$b + 0.1 + b + 0.4 + 0.1 = 1$$

$$0.6 + 2b = 1$$

$$2b = 1 - 0.6 = 0.4$$

$$2b = 0.1$$

$$b = 0.2$$

$$E(X) = \sum_{\text{all}} Xp(X=x)$$

X	5	8	9	11	12
$P(X=x)$	0.2	0.1	0.2	0.4	0.1
$xP(X=x)$	1.0	0.8	1.8	4.4	1.2

$$E(X) = 9.2$$

$$E(5X-7) = E(5X) - E(7) = 5E(X) - 7$$

$$= 5 \times 9.2 - 7 = 39$$

$$\therefore E(5X-7) = 39$$

- 7.. 4th second \rightarrow 25.6m

$$8^{\text{th}} \text{ second} \rightarrow 32 \text{ m}$$

$$S_4 = 4u + \frac{1}{2}a \times 4^2 = 4u + 8a$$

$$S_3 = 3u + \frac{1}{2}a \times 9 = 3u + 4.5a$$

$$S_4 - S_3 = (4u + 8a) - (3u + 4.5a) = 25.6$$

$$= u + 3.5a = 25.6 \text{ ---(i)}$$

$$S_8 = 8u + \frac{1}{2}a \times 8^2 = 8u + 32a$$

$$S_7 = 7u + \frac{1}{2}a \times 7^2 = 7u + 24.5a$$

MATHEMATICS ANSWERS (AMATHS005)

$$S_8 - S_7 = (8u + 32a) - (7u + 24.5a) = 32$$

$$= u + 7.5a = 32 \text{ --- (ii)}$$

(ii) - (i)

$$4a = 6.4,$$

$$a = \frac{6.4}{4} = 1.6 \text{ms}^{-2}$$

The acceleration is 1.6ms^{-2}

8.

c	d	x
1	1	1
2	3	4
3	5	9
4	7	16
5	9	26

$$x = c^2$$

To compute and print the first five Natural numbers and their squares.

SECTION B

9. Probability of success, $p = \frac{2}{20} = \frac{1}{10} = 0.1$

Probability of failure, $q = 1 - 0.1 = 0.9$

Sample size $n = 500$

$$P(47 < x < 62) = P(48 \leq x \leq 61)$$

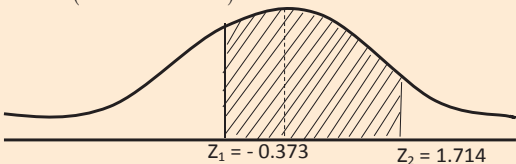
$$\text{mean, } \mu = np = 500 \times 0.1 = 50$$

$$\text{Variance, } \sigma^2 = npq = 500 \times 0.1 \times 0.9 = 45$$

Standard deviation $\sigma = \sqrt{45}$

$$= P(48 \leq x \leq 61) = P\left(\frac{(48 - 0.5) - 50}{\sqrt{45}} \leq z < \frac{((61 + 0.5) - 50)}{\sqrt{45}}\right)$$

$$= P(-0.373 < z < 1.714)$$



$$p(-0.373 < z < 1.714) = p(0 < z < 0.373) + p(0 < z < 1.714)$$

$$= 0.1454 + 0.4567 = 0.6021$$

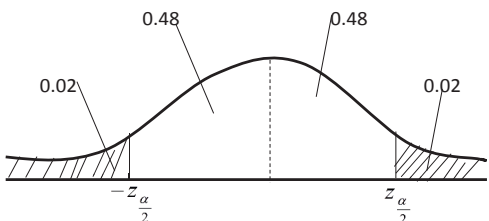
The probability that between 47 and 62 patients are found with sickle cell is 0.6021

b). $n = 120, \bar{X} = 16.5, \sigma^2 = 18, \sigma = \sqrt{18}$

$$(1 - \alpha)100 = 96$$

$$1 - \alpha = 0.96$$

$$\alpha = 0.04, \frac{\alpha}{2} = 0.02$$



$$p\left(0 < z < z_{\frac{\alpha}{2}}\right) = 0.48, z_{\frac{\alpha}{2}} = 2.054$$

Confidence interval =

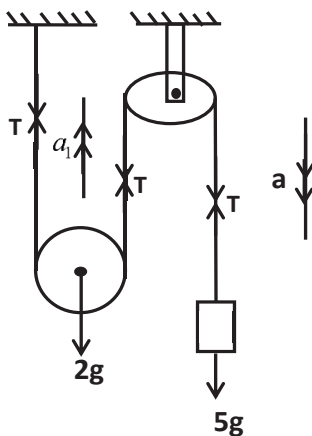
$$\left(\bar{X} - z_{\frac{\alpha}{2}} \frac{\delta}{\sqrt{n}} < \mu < \bar{X} + z_{\frac{\alpha}{2}} \frac{\delta}{\sqrt{n}}\right)$$

$$= \left(16.5 - 2.054 \times \frac{\sqrt{18}}{\sqrt{180}} < \mu < 16.5 + 2.054 \times \frac{\sqrt{18}}{\sqrt{180}}\right)$$

$$= (15.8505 < \mu < 17.1495)$$

Therefore the 96% confidence interval is $(15.8505 < \mu < 17.1495)$

10.



(i) For 5kg mass

$$5g - T = 5a \text{ --- (i)}$$

For the movable pulley

$$2T - 2g = 2a_1$$

$$T - g = a_1$$

but

$$a_1 = \frac{1}{2}a$$

$$2T - 2g = a \text{ --- (ii)}$$

$$2(i) + (ii)$$

$$10g - 2g = 10a + a$$

$$8g = 11a$$

$$a = \frac{8g}{11} = 7.1273$$

The acceleration of the system is 7.1273ms^{-2}

$$a_1 = \frac{1}{2}a = \frac{1}{2} \times \frac{8g}{11} = 3.5636 \text{ms}^{-2}$$

(ii) $T = \frac{1}{2}a + g = \frac{8g}{11} + g = 16.9273 \text{N}$

(iii) $u = 0 \text{ms}^{-1}$

$$t = 1.5 \text{s}$$

$$a_1 = \frac{4g}{11}$$

$$S = ut + \frac{1}{2}a_1 t^2 = \frac{1}{2} \times \frac{4g}{11} \times 1.5^2 = 4.0091 \text{m}$$

11. a)

$$h = \frac{\left(\frac{\pi}{2} - 0\right)}{7 - 1} = \frac{\pi}{12}$$

$$\text{let } y = \frac{1}{\sqrt{2 - \cos x}}$$

$$\int_0^{\frac{\pi}{2}} y dx = \frac{1}{2} h ((y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1}))$$

x	y_0, y_n	y_1, y_2, \dots, y_{n-1}
0	1.00000	
$\frac{\pi}{12}$		0.98339
$\frac{\pi}{6}$		0.93907
$\frac{\pi}{4}$		0.87947
$\frac{\pi}{3}$		0.81650
$\frac{5\pi}{12}$		0.75784
$\frac{\pi}{2}$	0.70711	
Total	1.70711	4.37627

b) $\int_0^{\frac{\pi}{2}} y dx = \frac{1}{2} h ((y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1}))$

$$\int_0^{\frac{\pi}{2}} y dx = \frac{1}{2} \times \frac{\pi}{12} ((1.70711) + 2(4.37627)) = \frac{\pi}{24} \times 10.45965$$

$$= 1.36916$$

$$\therefore \int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{2 - \cos x}} dx = 1.369(3dp)$$

Exact value of $\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{2 - \cos x}} dx$ (obtain this value by direct

integration of the function given using methods of integration learnt in paper 1)

$$\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{2 - \cos x}} dx = 1.37017 \text{ (We have quoted the value in the interest of space)}$$

The exact value is 1.370 (3dp)

$$\text{percentage error} = \frac{\text{relative error}}{\text{exact value}} \times 100\%$$

$$= \frac{|\text{exact value} - \text{approximate value}|}{\text{exact value}} \times 100\%$$

$$= \frac{|1.370 - 1.369|}{1.370} \times 100\% = 0.0729927\%$$

Therefore the percentage error in the estimation is 0.073% (3dp)

12(i) Let a

Email be denoted by E

Letter be denoted by L

Telephone be denoted by T

Receiving be denoted by R

$$P(R) = P(RnE) + P(RnL) + P(RnT)$$

$$P(R) = P(R/E) \times P(E) + P(R/L) \times P(L) + P(R/T) \times P(T)$$

$$P(R/E) = 0.6, P(R/L) = 0.8, P(R/T) = 0.1$$

$$P(E) = 0.4, P(L) = 0.1, P(T) = 0.5$$

$$P(R) = 0.6 \times 0.4 + 0.8 \times 0.1 + 0.1 \times 0.5 = 0.37$$

More questions and answers next Tuesday

CHEMISTRY ANSWERS (ACHEMS005)

Qn.1 (a) 50g of water dissolved 30g of Y

$$1000\text{g of water dissolves } \frac{1000 \times 30}{50} \text{ g of Y}$$

6.2°C Freezing point depression caused by 600g of Y

$$1.86^\circ\text{C Freezing point depression caused by } \frac{1.86 \times 600}{6.2} \text{ g} = 180\text{g}$$

b) RFM of $(\text{CH}_2\text{O})_n = 180$

$$(12x_n) + (1x2n) + (16x_n) = 180$$

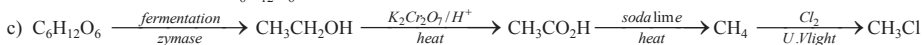
$$12n + 2n + 16n = 180$$

$$30n = 180$$

$$n = \frac{180}{30}$$

$$n = 6$$

Molecular formula of Y is $\text{C}_6\text{H}_{12}\text{O}_6$

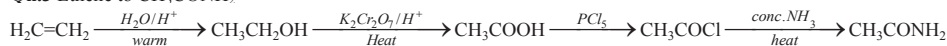


Qn. 2 (a) Silicon in silicon (IV) oxide is unable to form double bonds with oxygen so it satisfies its valence by forming single bonds with four oxygen atoms. This leads to a giant molecular structure with a network of covalent bonds in which the heat energy at room temperature is not enough to break the bonds to cause melting hence remaining in solid state. Carbon in carbon dioxide is able to form double bonds with oxygen so it satisfies its valence by forming double bonds with only two oxygen atoms. This leads simple discrete molecules held with weak vanderwaals forces

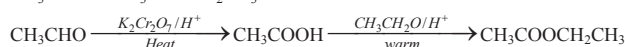
in which the heat energy at room temperature is enough to break them to cause evaporation hence remaining in gaseous state.

b) Ammonium nitrate is readily soluble in water because the ammonium ion is a conjugate acid of ammonia making it a weaker base than water. So water molecule abstracts a proton from it thereby undergoing hydrolysis. The standard enthalpy of solution has a positive value because the lattice energy for ammonium nitrate is greater than its hydration energy.

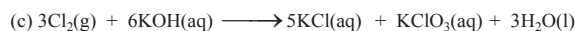
Qn.3 Ethene to CH_3CONH_2



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



Qn.4



Qn.5. (a) Graham's law states that the rate of diffusion of a gas is inversely proportional to the square root of its density at constant temperature and pressure.

(b) Let the rate of diffusion of CO_2 be R_{CO_2} . Then the rate of diffusion of CO_2 be R_w

$$\frac{R_{\text{CO}_2}}{R_w} = \frac{\sqrt{M_w}}{\sqrt{M_{\text{CO}_2}}}$$

$$\frac{v}{120} \times \frac{112}{v} = \frac{\sqrt{M_w}}{\sqrt{44}}$$

$$\frac{112}{120} = \frac{\sqrt{M_w}}{\sqrt{44}}$$

$$\frac{112^2}{120^2} = \frac{M_w}{44}$$

$$M_w = 44 \times \frac{112^2}{120^2}$$

$$M_w = 38.3$$

Qn.6. a) $\text{Sn}(\text{s}) + 2\text{HCl}(\text{g}) \longrightarrow \text{SnCl}_2(\text{s}) + \text{H}_2(\text{g})$
Condition: dry hydrogen chloride gas and heated tin

b) $\text{Sn}(\text{s}) + 2\text{Cl}_2(\text{g}) \longrightarrow \text{SnCl}_4$
Condition: heated tin and dry chlorine

THE TEACHERS



MOSES MUGOGO,
SEETA HIGH SCHOOL



ANDREW HANNINGTON NSERENKO
BISHOP'S SENIOR SCHOOL - MUKONO

- ◊ Reagent: ammoniacal copper (I) chloride solution.
- ◊ With but-1-yne: a red precipitate is formed.
- ◊ With but-2-yne: no observable change

Qn.10 (a)(i) Osmotic pressure is the pressure which must be applied on the solution end to prevent the passage of solvent molecules into the solution through a semipermeable membrane. (ii) Conditions under which laws of osmotic pressure are not obeyed.

- ◊ When the solution is not dilute.
- ◊ When association or dissociation occurs
- ◊ When there is a chemical reaction between solute and solvent.

(b) Mass of polymer used = 1.24g

$$\text{Volume of solution used} = 100\text{cm}^3 = \frac{100}{1000} = 0.1\text{dm}^3$$

$$\pi v = \frac{mRT}{M}$$

$$3.1 \times 10^{-3} \times 0.1 = \frac{1.24 \times 0.0821 \times (25+273)}{M}$$

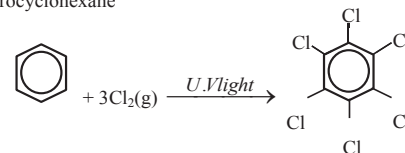
$$M = \frac{1.24 \times 0.0821 \times 298}{3.1 \times 10^{-3} \times 0.1}$$

$$\text{RMM of the polymer is} = 97863.2$$

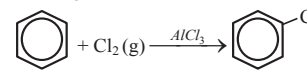
Qn.11.

(a) Benzene

Chlorine reacts with benzene under sunlight to form 1, 2, 3, 4, 5, 6 - hexachlorocyclohexane



Chlorine also reacts with Benzene in presence of aluminium chloride as a catalyst to form chloro-benzene and Hydrogen Chloride gas



(b) Sodium hydroxide

Chlorine reacts with cold dilute sodium hydroxide forming sodium chloride, sodium chlorate (I) and water.



Chlorine reacts with hot concentrated sodium hydroxide forming sodium chloride, sodium chlorate (V) and water.



Qn.12. a) i) Let the rate of diffusion of Y be X
Then the rate of c

$$\frac{R_y}{R_{\text{O}_2}} = \frac{\sqrt{M_{\text{O}_2}}}{\sqrt{M_y}}$$

$$M_y = \frac{32 \times 1.3^2}{1^2}$$

$$M_w = 54.08\text{g}$$

$$\frac{x}{1.3x} = \frac{\sqrt{32}}{\sqrt{M_y}}$$

$$\frac{1^2}{1.3^2} = \frac{32}{M_y}$$

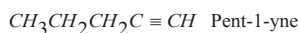
$$M_y = \frac{32 \times 1.3^2}{1^2}$$

ii) RFM of $(\text{C}_n\text{H}_{2n-2}) = 54.08$
 $(12x_n) + (1x2n) - 2 = 54.08$
 $12n + 2n = 54.08 + 2$
 $14n = 54.08$
 $n = 54.08/14$
 $n = 5$

Molecular formula of Y is C_5H_8

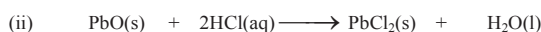
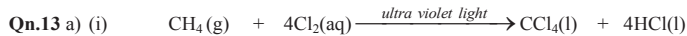
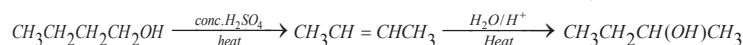
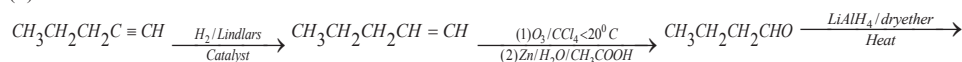
CHEMISTRY ANSWERS (ACHEMS005)

(b) The possible isomers are;



(i) Y is. $CH_3CH_2CH_2C \equiv CH$ Pent-1-yne

(ii) Y to butan-2-ol

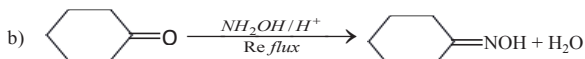
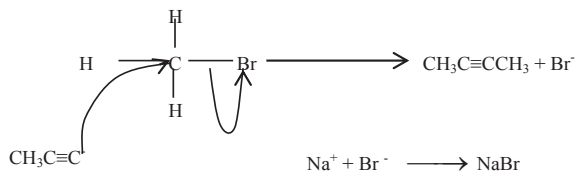
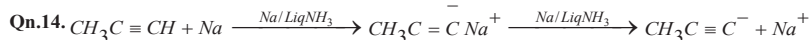


(b) Carbon tetrachloride does not decompose on heating while lead (IV) chloride decompose to lead (II) chloride and chlorine gas.

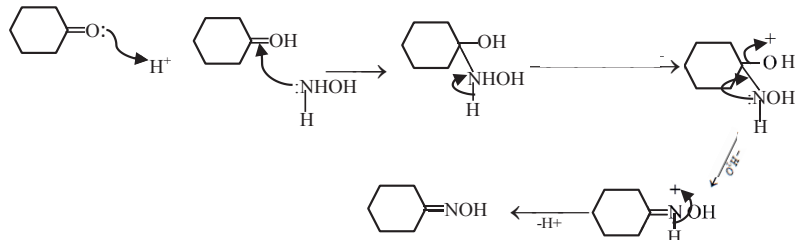


(c) Lead (IV) ion in Lead (IV) chloride has got a bigger charge hence higher charge density. This gives it higher polarizing power than lead (II) ions in lead (II) chloride, so it distorts the electron cloud of the chloride ion resulting in electron sharing instead of complete transfer of electrons thus covalent character of lead (IV) chloride. Lead (II) ion

in Lead (II) chloride has got a smaller charge hence lower charge density. This gives it lower polarizing power than lead (IV) ions in lead (IV) chloride. so it does not distort the electron cloud of the chloride ion resulting in complete transfer of electrons thus ionic character of the lead (II) chloride.

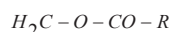
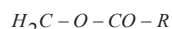


Mechanism



Qn.15. 5 a) A soap is the sodium or potassium salt of a fatty acid while a detergent is a sodium or potassium alkylated benzene sulphonic acid

b)



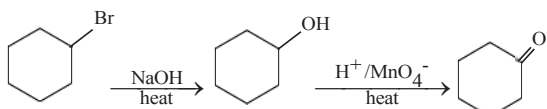
(c) Cleansing action of soap

Soap acts by lowering the surface tension between water and dirt. This is so because soap contains a hydrophobic part which dissolves in the dirt and a hydrophilic part which is attracted to the water. On agitation, the dirt dislodges off the fabric into the water.

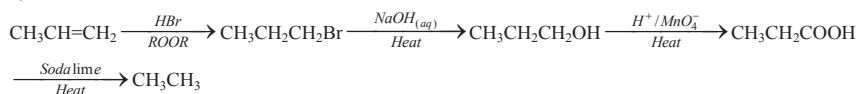
(d) i) It does not form scum with hard water.

(ii) It is non-biodegradable

Qn.17 (a)



b)



Qn.16 (a)

ClO_3^-		Trigonal pyramidal
H_2O		V-shaped / Bent
SO_3		Trigonal Planar
NH_3		Trigonal Pyramidal

a) In 2 nitrophenol, the hydroxyl group is closer to the nitro group which favours intermolecular hydrogen bonding between the hydrogen atom of hydroxyl group and oxygen atom of the nitro group. Therefore the molecules of 2 nitro phenol interact via weak van der Waals forces of attraction that easy to break.

In 4 nitrophenol, the hydroxyl group is far away from the nitro group which does not favour intermolecular hydrogen bonding between the hydrogen atom of hydroxyl group and oxygen atom of the nitro group. Therefore, the molecules of 4 nitro phenol interact inter molecular hydrogen bonding which requires more heat energy to be broken.



More questions and answers next Tuesday



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