PRIMARY SIX
SELF STUDY MATERIALS

ENGLISH LANGUAGE

PRIMARY SIX
LESSON 1: Use of Adverbs

Learning Outcomes
By the end of this lesson, you should be able to:

i) identify ways of doing things.

ii) use of adverbs in your daily life activities.

You will need:

• a pen
• a book

Introduction
An adverb is a word that tells more about a verb, an adjective and another adverb. Adverbs tell us how an action is done: when? why? how? and where?

Examples

i) The cyclist is riding slowly.

ii) Children should cross the road carefully.

Activity 1
Use the correct form of the word in the brackets to complete the sentences below. Examples have been given to guide you.

1. Tino cleverly avoided the punishment. (clever)

2. Uganda's population is steadily rising. (steady)

3. St Thomas choir sang the second compulsory song ____________. (beauty)

4. The host welcomed us __________________. (cheer)

5. We ____________________ waited for his return from Ojipaku market. (patience)

6. Italians have seen the __________________ coronavirus attacked. (worse)

7. They answered the question_________________. (wise)

8. A machete is ___________________________ bigger than a knife. (usual)

9. The hungry boy ate the mango ___________________. (greed)

10. The hunter _____________ attacked the lion in its den. (brave)

Activity 2
Order of Adverbs
When more than one adverb is used in a sentence, they usually follow in this order: manner (how?), place (where?) and time (when?).

Example
The pedestrian crossed the road carefully (how?) at the zebra crossing (where?) yesterday (when?).

From the sentences below, underline the adverbs of manner, place and time.

1. The traffic officer called the driver loudly at the junction in the morning.

2. Many cyclists ride carelessly at the traffic lights every day.

3. The bus driver spoke politely to the passenger on the bus on Tuesday.

4. My mother nicely made cakes from the kitchen last weekend.

5. It rained heavily in our area last year.

LESSON 2: Informal Letter Writing

Learning Outcomes
By the end of this lesson, you should be able to:

i) express your views on safety on the road.

ii) write a letter about safety on the road.

Introduction
Letter writing is one way of sending a message between or among people. You can write a letter to a friend, parents, relatives and many others.

Activity 1

1. (a) Write a letter to your father appreciating him for his effort to keep everybody well in this period of COVID-19 pandemic. Wish him a longer stay in this life. Use your school address.

(b) The letter below has some words missing. Using the words in the box, complete it by filling in the gaps correctly.

reap advise purpose academic not arua discussions hear dear examinations
1. (a) Quality refers to a product’s ability to meet customer needs and requirements
   OR fitness for use and performance to requirements
   OR performance of a product in relation to the consumer’s needs
   OR a measure of customer satisfaction over a product its life time.

   (ii) Techniques used by entrepreneurs to ensure quality in production (use present continuous tense)
   ◦ Using proper distribution channel
   ◦ Using quality raw materials
   ◦ Carrying out market research
   ◦ Using good and beautiful packaging materials
   ◦ Using good storage facilities
   ◦ Monitoring and supervision of workers
   ◦ Training of workers
   ◦ Giving clear instructions to workers
   ◦ Employing skilled workers
   ◦ Encouraging specialisation/division of labor
   ◦ Using better production methods/technology
   ◦ Observing technical specifications concerning quality.

(b) Utilities used by business enterprises
   ◦ Water
   ◦ Electricity/Power
   ◦ Communication services
   ◦ Transport services
   ◦ Security Services
   ◦ Warehousing services
   ◦ Insurance services
   ◦ Advertising services
   ◦ Banking services
   ◦ Education/ Training services

(c) (i) Innovation refers to the way of transforming resources of an enterprise through creativity of people into new resources and wealth OR it is the ability to apply creative solutions to problems and challenges to improve people’s lives.

   (ii) Sources of innovation
   ◦ Unexpected occurrences/events
   ◦ Demographic changes
   ◦ Shifts in people’s perception about the product
   ◦ Introduction of new knowledge
   ◦ Process needs to fill missing links in production process
   ◦ Incongruities which result from differences in business perception and reality

   (d) Personal branding refers to a process of developing a mark to express and communicate your skills, personality and value OR it is a practice of people/business/organisations marketing themselves/ careers as brands

(ii) Principles of personal branding
   ◦ Unity (reflects togetherness)
   ◦ Endurance/patience
   ◦ Specialisation (reflects single/core strengths)
   ◦ Leadership
   ◦ Distinctiveness / uniqueness
   ◦ Visibility
   ◦ Goodwill (yields good results and endures longer)

(e) Key players in capital markets
   ◦ Capital Market Authority
   ◦ Uganda Securities Exchange
   ◦ Brokers/dealers
   ◦ Stockjobbers
   ◦ Investment advisers
   ◦ Fund manager
   ◦ Custodians
   ◦ Ex-Dividend
   ◦ Shareholders

2(a). Explaining users of a business plan (state the point, explain by showing how the given stakeholder uses the business plan).
   ◦ Government
   ◦ Entrepreneur
   ◦ Employees/workers
   ◦ Suppliers
   ◦ Financiers (bankers, investors, donors)

b) Explaining factors considered when preparing a marketing plan
   (state a neutral/non-biased point. Give a consideration /choice in an explanation)
   ◦ Terms and conditions for selling
   ◦ Sales personnel recruitment plan
   ◦ Sales target/projected sales
   ◦ Sales promotion and advertising strategies
   ◦ Projected marketing expenses
   ◦ Distribution strategies
   ◦ Target customers
   ◦ Products offer/Nature
   ◦ Pricing strategies
   ◦ Position of competitors
   ◦ Terms and conditions for selling. An entrepreneur considers whether to sell on cash basis, credit or installment selling.

3(a). Monitoring tools used by entrepreneurs in business include;
   (state the tool, answer, Explanation may either be the definition of the tool, its importance/purpose/objective etc. of preparing it, how it is used, etc.)
   ◦ Sales target
   ◦ Production target
   ◦ Departmental records
   ◦ Books of accounts
   ◦ Balance sheet
   ◦ Work schedules/organisation of work
   ◦ Operational budget
   ◦ Stock records/cards
   ◦ Cash flow plan

   E.g., Operational budget. It is a summary of income and expenses for a given period of time. (Explaination by definition) OR
   ◦ Operational budget. It enables entrepreneurs to calculate cost of goods sold in a given period of time (explanation by importance)

(b) Explaining need for proper business monitoring
   Points may be stated as present continuous tense using to, in order to or for:
   ◦ To minimise time wastage by workers while at work
   ◦ To ensure production of high quality products e.g. by following set standards.
   ◦ To keep customer orders in time
   ◦ To Evaluation of worker’s performance in relation to the set target
   ◦ To find out how much and from where the business gets cash
   ◦ To check the financial position of the business at a particular time
   ◦ Following up the materials issued/received and taken out of usable interest
   ◦ For comparing the profits realised with the estimated or planned profits
   ◦ For calculating profits or losses suffered by a business in a given time

To assess whether all business departments are achieving their targets
To effective planning of production process
For keeping records of actual periodical sales on production to compute the set targets
To measure achievements of managerial through the use of a business plan
Showing organisation transactions with financiers e.g. banks
To find out the extent to which business targets are being met.

4(a) Justifying the need for charging taxes by the government
To generate revenue to the government
To reducing income inequality
Promotion of infant domestic industries
To make citizens responsible after contributing to the economy
Improvement of balance of payment by discouraging imports.
To encourage saving by reducing disposable income.
Recovering community wealth e.g. inheritance tax
Creation of employment
To check/control inflation
To encourage production of desirable goods and services.
Regulating exploitation/controlling over-exploitation of goods
Regulation of monopoly powers of business.
Encouraging hard work
To restrict consumption of harmful products
Reduction of dumping in a country
Providing a way of charging those who use government facilities

(b) Techniques used by government to increase taxable capacity
Increasing peoples incomes e.g. by creating more jobs
Encouraging industrialization to increase employment.
Manpower planning and development to reduce unemployment
Introducing and empowering tax authorities
Increasing peoples incomes e.g. by creating more jobs
Encouraging/supporting commercial agriculture

5(a) Insurance policies that a large scale business may take up
   Whole life policy (compensation paid after death)
   Endowment policy
   Life annuity
   Glass insurance policy
   Fidelity guarantee policy
   Group life policy
   Sickness policy
   Fire insurance policy
   Theft and burglary policy
   Loss of profits policy
   Money at promises or on transit policy
   Motor insurance policy
   Aviation policy
   Marine insurance policy
   Machinery breakdown and consequential loss policy
   Employers liability policy
   Multi-purpose policy (covers several policies under a single policy)

NB: State the point clearly. Explanation is got from what it covers. All points must reflect the word policy as a key word.

(b) Conditions under which an insurance policy may be terminated/ state the point using in case, if, when
   In case of destruction of the subject matter
   When the insured over declares or under declares the insured property
   In case of failure to pay premium/ breach of contract
   In case the insured insures the property in which he has no insurable interest
   If the insured had been compensated
   If the contract has expired
   In case of operation of law
ANSWERS (AENT005)

- In case of frustration; e.g., death/insanity
- In case of agreement between the insured and the insurer
- 6(a). Limitations to women active participation in business (points to be stated as negatively based)
  - Limited role models
  - Poor access to finance by women
  - Poverty
  - Education
  - Dynamic of role models

SECTION A: CASE STUDY

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

Mr. and Mrs. Pipeline operate a salon in Banda market, on Jinja Road, Kampala. There are many other salons in the market and the competition is very high. Mr. and Mrs. Pipeline have very hard working; they are always at their salon by 6:00am every day. They have specialized in hair styles like French cut, shaulion, back American cut, groove, balolette styles, marine etc. to serve their customers satisfactorily. They also provide other services like nail cutting, makeup and massage, customers are also given newspapers to read, a TV to watch various programmes and a bottle of soda.

While Mr. Pipeline strategically stands outside the salon to welcome his customers, Mrs. Pipeline gives them seats, takes their orders and ensures that barbers serve them promptly. After their service Mrs. Pipeline collects payments. Customers leave after catching up with the latest news from different parts of Uganda which Mr. Pipeline always has a farewell and come-back request. Mr. Pipeline always rings in the minds of the customers every time they think about cutting hair in Banda.

The Pipeline’s salon is always full of happy customers. The Pipelines know their customers by name, their favorite services. At point 1 above.

2. Advise the business on how to solve the challenges mentioned in d (i) above.

(a) (i) Identify personal entrepreneurial qualities possessed by Pipelines
   - Business orientation
   - Entrepreneurial spirit
   - Leadership skills
   - Adaptability
   - Innovation
   - Vision
   - Risk-taking

(b) Which other qualities should they have to be more successful?
   - Strategic thinking
   - Technical skills
   - Financial management
   - Customer service
   - Teamwork

Questions

1. 2\cos \theta - \frac{1}{\sin \theta} = 0
2. 2\cos \theta + \tan \theta = 1
3. 20 = \sin \theta
4. 2\alpha + 90,180,450,540
5. \theta = 45^\circ, 90^\circ, 225^\circ, 720^\circ

SECTION B: SCHOOL BUSINESS CLUB

2. With reference to the School Business project owned and operated by your club:
   a) Give the general description of the project
   b) Explain the measures that were taken to ensure proper cash management
   c) Describe the entrepreneurial skills acquired by club members
   d) (i) Outline the risks that were faced by the business
   (ii) What measures were taken to minimize risks mentioned in 2(d) (i) above

SECTION C: FIELD ATTACHMENT/FIELD TRIP

4. For any business you were attached to:
   a) Give the general description of the business
   b) How does the business motivate its workers?
   c) Describe the documents used by the business.
   d) What measures does the business use to ensure discipline of its employees?
   e) Outline the benefits of the business to the surrounding community.

5. For any field trip carried out as an individual or as a group:
   a) State the objectives of the field trip
   b) Describe the steps followed in the purchasing plan of the business
   c) Describe the internal control systems used by the business
   d) (i) What challenges are faced by the business?
   (ii) Advise the business on how to solve the challenges mentioned in d (i) above.

ENTREPRENEURSHIP EDUCATION QUESTIONS (AENT005)

THE TEACHERS

TIFF GHEE
ST MARY’S COLLEGE, KISUMU

AUGUSTUS KINOMA
ST JOHN’S SS, NYARUMA - SHERMA

MATHEMATICS ANSWERS (AMATHS005)

1. \(2\cos \theta - \frac{1}{\sin \theta} = 0\)
2. \(2\cos \theta + \tan \theta = 1\)
3. \(20 = \sin \theta\)
4. \(2\alpha + 90,180,450,540\)
5. \(\theta = 45^\circ, 90^\circ, 225^\circ, 720^\circ\)

At point m, \(m = \frac{-3(b^3)}{x}\)

Equation of the tangent at point m is,

\[y = \frac{-3x^3}{x^2} = \frac{-3x}{x^2}\]

Making y the subject of the formula gives \(y = -3x + 4\beta^2\)

3. Let the square root of \(5 + 12i = \alpha + \beta i\)

Squaring both sides gives

\[5 + 12i = \alpha^2 + \beta^2 + 2\alpha\beta\]

Equating real to real and imaginary to imaginary

- \(\alpha^2 - \beta^2 = 5\)
- \(2\alpha\beta = 12\)

Solving equation (i) and (ii) gives

\[\alpha = \pm 3\quad \text{and} \quad \beta = \pm 2\]

Therefore, the square root of \(5 + 12i = \pm(3 + 2i)\)

4. \(\alpha + \beta = -3\) and \(\alpha\beta = \frac{3}{2}\)

Sum of roots \(a^2 + \frac{\beta^2}{\alpha} = \frac{3a\beta (\alpha + \beta)}{\alpha\beta}\)

\[= \frac{(-3)^3 - 3 \frac{(-3)}{2}}{\frac{3}{2}}\]

\[= \frac{-117}{2}\]

Product of roots \(\frac{a^2}{\beta} + \frac{\beta^2}{\alpha} = (\alpha\beta)\)

\[= \frac{2}{5}\]

\[x^2 = \text{(sum of the roots)}x + \text{Product of the roots} = 0\]

\[= \frac{2}{5}\]
4.

\[
\text{Consider Equation of the tangent at point } \theta = \pi \text{ gives } \\
\frac{dv}{dt} = \frac{3}{2} \text{ at } (\theta) = 23
\]

\[y = \frac{3}{2} x + 2\]

The subject of the formula gives
\[\frac{dy}{dx} = 2 + \frac{4}{x^2 - 9}\]

\[\frac{dy}{dx} = 2 + \frac{4}{x^2 - 9}\]

5.

6.

Completing the square gives
\[(y - 3)^2 = 9 - x + 5 - 0\]
\[(y - 3)^2 = x + 4\]

Comparing with \(y^2 = 4ax\)
The vertex is at (-4, 3)
focus is at (-3, 3) and
the equation of the directrix is \(x = -5\).

Hence \(x = -5\) is the equation of directrix

7.

\[
\begin{align*}
\frac{dy}{dx} &= 1 \\
\frac{dx}{dy} &= -\cos2x
\end{align*}
\]

\[
\int y \sin 2\sin x dx = \frac{-\cos 2x}{2} + \frac{1}{2} \sin 2x dx
\]

\[
\int y^2 \sin 2\sin x dx = \left[ \frac{-\cos 2x}{2} + \frac{1}{2} \sin 2x \right]_0^\pi
\]

8.

\[
y = \ln x \sin \theta = \frac{2}{3} \ln \left( \frac{x + 3}{x - 3} \right)
\]

\[
v = 2x \ln x - \frac{2}{3} \ln \left( \frac{x + 3}{x - 3} \right)
\]

\[
\text{but } \ln e = 1
\]

\[
\frac{dy}{dx} = 2 - \frac{2(6 - 3)}{3x^2 - 9}
\]

\[
\frac{dy}{dx} = 2 + \frac{4}{x^2 - 9}
\]

9.

(a) \(1 + i, 1 - i\) are roots of \(z^2 + 3z^2 - 6z + 10 = 0\)

Some roots = \((1 + i) + (1 - i)\)

Product of the roots \((1 - i)(1 + i)\)

From \(z^2 + \text{sum of the roots} \cdot z + \text{product of the roots} = 0\)

Using long division,
\[
z^2 + 2z + 5
\]

\[
\frac{z^2 + 2z + 5}{2 + 4}
\]

\[
\frac{z^2 + 2z + 5}{z^2 + 4z + 4}
\]

\[
\frac{z^2 + 2z + 5}{2z^2 + 4z + 4}
\]

\[
\frac{z^2 + 2z + 5}{2z^2 + 4z + 4}
\]

Since the remainder is zero, then \(1 + i\) is a root of
the equation \(z^2 + 3z^2 - 6z + 10 = 0\)

Hence \(z^2 + 3z^2 - 6z + 10 = 0\) \((x^2 + 2x + 2)(x^2 + 2z + 5) = 0\)

Also \(z^2 + 2z + 5 = 0\)

\[
z = \frac{-2 + \sqrt{4(5)}}{2} = 2
\]

\[
z = \frac{-2 - \sqrt{16}}{2} = -5
\]

\[
z = -1 + 2i
\]

The other roots are \(1 - i\) and \(-1 - 2i\).

(b) \(x^2 + 2x + 2z = 5 - 4i\)

Let \(z = x + iy\) and \(\bar{z} = x - iy\).

\(x^2 + y^2 - 2x - 2iy + 2x^2 + 2y^2 = 5 - 4i\)

\(x^2 + y^2 - 4iy = 5 - 4i\)

Evaluating real to real and imaginary to imaginary
\(x^2 + y^2 = 5\) and \(4y - 4\)

\[
x^2 + 1 + 5
\]

\[
x^2 + 1 - 4
\]

\[
x = \sqrt{2}
\]

\[
x = \pm 2 + i\text{ and } \bar{z} = \pm 2 - i
\]

10.

\[
x + x + 1
\]

\[
x + x + 1
\]

\[
x + x + 1
\]

\[
x + x + 1
\]

\[
x + x + 1
\]

\[
x + x + 1
\]

Critical Values \(x = 0, x = -2\).

\[
\begin{align*}
x &< -2 \\
-2 &< x < 0 \\
x &> 0
\end{align*}
\]

The range of values for \(\frac{2x + 1}{x + 2} > \frac{1}{2}\) are \(x < -2\)

and \(x > 0\).

11. (a) Let \(r = x^2 - 25\)

\[
\frac{dr}{dx} = 2x
\]

\[
\int (\ln t) \frac{dt}{dx} = \frac{1}{2} \ln t dt
\]

\[
\frac{dy}{dx} = 1
\]

Let \(v = \ln t\)

\[
\frac{dv}{dt} = \frac{1}{t}
\]

\[
\frac{dy}{dx} = \frac{1}{t} = \frac{1}{1} = 1
\]

13. \(\frac{dy}{dx} = 4cos 2x \sin 2x\) OR \(2 \sin 4x\)

When \(x = 0\), \(y = -\frac{3}{25}\)
## ANSWERS (AMATHS006)

### b) (ii) \( d = \frac{3}{2} \)

<table>
<thead>
<tr>
<th>( \frac{dy}{dx} )</th>
<th>( \theta = \sin^{-1} \left( \frac{1}{\sqrt{2}} \right) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{3}{2} )</td>
<td>( \theta = \sin^{-1} \left( \frac{2}{\sqrt{15}} \right) )</td>
</tr>
<tr>
<td>( 0 )</td>
<td>( \theta = \sin^{-1} \left( \frac{5}{\sqrt{75}} \right) )</td>
</tr>
</tbody>
</table>

### 15. (a) \( 2a \theta = 4x \theta \)

For a triangle \( P - Q - R \),

\[
\begin{aligned}
&x = -2 + \mu \\
y = 0 + 3\mu \\
z = 1
\end{aligned}
\]

From \( 5x - y - 7z = 9 = 0 \)

\[
\begin{aligned}
x = 2 + \mu, \\
y = 0 + 3\mu, \\
z = 1, \\
\end{aligned}
\]

Thus \( x = (2 + 3) = 5 \)

\( y = 3(3) = 9 \)

\( z = 1 \)

The point of intersection is \( (5, 9, 1) \)

### 16. (i) \( \frac{d}{dt} (\theta - 15) \)

\[
\frac{d}{dt} (\theta - 15) = -\frac{1}{2} (\theta - 15)
\]

\[
\int \frac{d}{dt} (\theta - 15) = \frac{1}{2} (\theta - 15)
\]

\[
\ln(\theta - 15) = -\frac{1}{2} (\theta - 15)
\]

When \( \theta = 80^\circ \)

\[
\ln(80 - 15) = c
\]

\[
c = \ln(65)
\]

\[
\ln(\theta - 15) = -\frac{1}{2} (\theta - 15) + \ln(65)
\]

When \( \theta = 10, \) \( \theta = 60^\circ \)

\[
\ln(60 - 15) = -10k + 65
\]

\[
-\frac{k}{10} = \frac{45}{65}
\]

\[
k = \frac{10}{3}
\]

\[
\therefore \ln(\theta - 15) = \frac{10}{3} \left( \frac{\theta - 15}{10} \right) + \ln(65)
\]

(ii) To find \( \theta \) when \( \theta = 40^\circ \).

\[
\ln(40 - 15) = \frac{10}{3} \ln \left( \frac{9}{\sqrt{15}} \right) + \ln(65)
\]

\[
k = \frac{10}{3} \ln \left( \frac{9}{\sqrt{15}} \right)
\]

\[
t = 25.984, t = 26, \text{ Minutes}
\]

## MATHEMATICS QUESTIONS (AMATHS007)

1. Events A and B are such that \( P(A') = \frac{5}{16} \)

and \( P(A' / B) = \frac{3}{8} \). Find

(i) \( P(A \cap B) \),

(ii) \( P(A / B) \).

2. (a) Given that \( y = \theta \cos \theta \), where \( \theta \) is measured with a maximum possible error of 5%, find, for \( \theta = 120^\circ \),

(i) The maximum error in \( y \),

(ii) The interval within which the values of \( y \) lies, correct to 4 decimal places.

3. The table below show the original marks obtained by students in physics and mathematics examinations.

<table>
<thead>
<tr>
<th>Candidate</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>40</td>
<td>65</td>
<td>53</td>
<td>46</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Mathematics</td>
<td>75</td>
<td>93</td>
<td>71</td>
<td>83</td>
<td>79</td>
<td></td>
</tr>
</tbody>
</table>

a) Calculate the rank correlation coefficient and comment on it.

b) The mathematics papers are remarked and one of the students is awarded additional five marks. Given that the rank correlation coefficient is unchanged, state with reach the student who received the marks.

4. Particles of masses 4kg, 3kg, 2kg, 9kg and 2kg are placed at points with position vectors

\[2i + 4j, -4i - 2j, i - 4j, -3i + 5j \text{ and } 4i + 2j\]

respectively. Find the position vector of centre of gravity of the system of particles.

5. A hammer of mass 4.5kg falls through a vertical height of 1m and hits a nail of mass 50 grams directly without rebouncing. If the nail is driven into a piece of wood a depth of 2cm, find average resistance to penetration assuming that it is constant.

6. The foot lengths of different students were measured to the nearest centimetre and the results were as shown below.

<table>
<thead>
<tr>
<th>Candidate</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>20</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Mathematics</td>
<td>10</td>
<td>93</td>
<td>71</td>
<td>83</td>
<td>79</td>
<td></td>
</tr>
</tbody>
</table>

Using a mean working of 22cm, find the standard deviation of these foot length.

7. A particle of mass 2kg initially moving with a velocity \( i - 4j \) is acted upon by a force \( F = 4i + tj \). Find the speed of the particle when \( t = 2 \).

8. The temperatures \( ^\circ C \) of a cooling body measured every 10 minutes were recorded as 82, 70, 56, and 42, if the body’s initial temperature is 93\(^\circ\)C, find the:

(i) Time taken for the body to cool to 63\(^\circ\)C

(ii) Temperature of the body after 45 minutes.

### SECTIONS

9. The table below shows the weight of seeds of a certain type of plant.

<table>
<thead>
<tr>
<th>Weight (grams)</th>
<th>0.80</th>
<th>0.65</th>
<th>0.50</th>
<th>0.35</th>
<th>0.25</th>
<th>0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

a) Calculate the:

i. Standard deviation

ii. Number of seedling that weigh more 0.57g.

b) Draw a histogram and use it to estimate the modal weight.

10. a) Car P of mass 1500kg tow another car Q of mass 1000kg up a hill inclined at \( \sin^{-1} \left( \frac{1}{2} \right) \) to the horizontal. The resistance to motion of each car is \( 1.5N/Km^2 \).
If the power output of the towing car is 150kW, find the maximum speed with which P and Q can travel up the incline.

e) find the Instantaneous acceleration and tension in the coupling between the car P and the car Q. When P and Q are traveling at a speed of 54km\(^{-1}\) up the hill with the engine is working at the same rate.

11. In a machine producing firm, machine components are accepted if they pass through a gauge of 1.04cm and do not pass through a gauge of 0.96cm. It was discovered after a period of time that 3.5% and 1.5% of the smaller and larger gauge were rejected. Assuming that the distribution of the dimensions tested were normally distributed. Find the:
   a) Mean and the standard deviation.
   b) Interquartile range of the distribution
   c) If a sample of 6 machines is taken from the firm, find the probability that the mean of the sample is between 0.98cm and 1.0cm

12. A uniform ladder of length 2l and weight, W rests in a vertical plane with one end against a rough vertical wall and the other against a rough horizontal surface, the angles of friction at each angle being \(\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)\) and \(\tan^{-1}\left(\frac{1}{2}\right)\) respectively.
   a) If the ladder is in limiting equilibrium at either end, find 0, the angle of inclination of the ladder to the horizontal
   b) A man of weight 10 times that of the ladder begins to ascend it, how far will he climb before the ladder slips?

13. At 2pm two ships A and B have position and velocity vectors \((10i + 5j), (-2i + 4j)\) and \((2i + 7j)\) respectively. If the speeds are in km\(^{-1}\),
   a) Find the distance of ship A from the origin at the point of collision.
   b) Find the distance and direction of ship A from the origin at the point of collision.
   c) Find the position vector of centre of gravity of the system of particles.

14. Study the flow chart below.

15. a) By plotting graphs of \(y = \sin x\) and \(y = e^{-2x}\) on the same axes, show that there is only one positive root in the interval \([0, 1.4]\) of the equation \(e^{-2x} \sin x = 1\).
   b) Show that the iterative formula based on the Newton-Raphson method for estimating the root in (a) is \(x_{n+1} = x_n + \frac{(2x_n - 1)\sec x_n + e^{-2x_n}}{1 + 2\tan x_n}\).
   c) Use the formula to find the root of the equation correct to 3 decimal places.

Look out for answers next Tuesday

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**MATHEMATICS (AMATHS007)**

(i) Show that if the two ships continue with their consequent motions then a collision will definitely occur and find the time of this collision.

(ii) Find the distance and direction of ship A from the origin at the point of collision.

14. Study the flow chart below.

15. a) By plotting graphs of \(y = \sin x\) and \(y = e^{-2x}\) on the same axes, show that there is only one positive root in the interval \([0, 1.4]\) of the equation \(e^{-2x} \sin x = 1\).
   b) Show that the iterative formula based on the Newton-Raphson method for estimating the root in (a) is \(x_{n+1} = x_n + \frac{(2x_n - 1)\sec x_n + e^{-2x_n}}{1 + 2\tan x_n}\).
   c) Use the formula to find the root of the equation correct to 3 decimal places.

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**CHEMISTRY ANSWERS (ACHEMS006)**

1. (a) Mass of carbon = \(\frac{12}{44}\times 2.64 = 0.72\) g
   Mass of hydrogen = \(\frac{2}{18}\times 0.9 = 0.1\) g
   Mass of oxygen = 0.98-(0.72+0.1) = 0.16 g

<table>
<thead>
<tr>
<th>Elements</th>
<th>C</th>
<th>H</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moles</td>
<td>0.72</td>
<td>0.1</td>
<td>0.16</td>
</tr>
<tr>
<td>Moles (g)</td>
<td>0.06</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**Molecular Formula of Q is C₆H₁₀O₂**

(b)(i) \(\text{mass of } Q \text{ in distillate} = \frac{V \cdot P \cdot f \cdot Q \cdot M_r}{V \cdot P \cdot f \cdot \text{water distillate}}\)

\[\begin{align*}
14.88 &= \frac{(1-0.18) \times M_r}{0.60} \\
14.88 &= \frac{0.82 \times 18}{0.60} \\
M_r &= 97.99
\end{align*}\]

**Empirical Formula of Q is C₆H₁₀O₂**

**Empirical Formula of X is C₆H₁₀O₂**

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2. (a) (i) Carbon, silicon, germanium, and tin react with dry air when heated to form dioxides while lead reacts with dry air when heated to form lead(II) oxide.

\[ C(s) + O_2(g) \rightarrow CO_2(g) \]

(\(X = \text{Si, Ge, Sn}\))

(ii) Carbon does not react with bromine when heated, silicon, germanium and tin react with bromine when heated to form tetrabromides.

\[ 2X(s) + 2Br_2(g) \rightarrow XBr_4(s) \]

(\(X = \text{Si, Ge, Sn}\))

(iii) Carbon reacts with hot concentrated nitric acid to form carbon dioxide nitrogendioxide and water.

\[ C(s) + 4\text{HNO}_3(aq) \rightarrow CO_2(g) + 4\text{NO}_2(g) + 2\text{H}_2\text{O}(l) \]

Silicon does not react with nitric acid.

Germanium reacts with hot concentrated nitric acid to form germanium(IV)oxideoxidinedioxide and water.

\[ \text{Ge}(s) + 4\text{HNO}_3(aq) \rightarrow \text{GeO}_2(s) + 4\text{NO}_2(g) + 2\text{H}_2\text{O}(l) \]

Tin reacts with hot concentrated nitric acid to form tin(IV)oxideoxidinedioxide and water.

\[ \text{Sn}(s) + 4\text{HNO}_3(aq) \rightarrow \text{SnO}_2(s) + 4\text{NO}_2(g) + 2\text{H}_2\text{O}(l) \]

Lead reacts with hot concentrated nitric acid to form lead(II)nитрат nitrogendioxide and water.

\[ \text{Pb}(s) + 4\text{HNO}_3(aq) \rightarrow \text{Pb(NO}_3)_2(aq) + 4\text{NO}_2(g) + 2\text{H}_2\text{O}(l) \]

(b) Two layers are formed with carbonotetrachloride. With siliconotetrachloride effervescence of white fumes and a white solid are formed.

\[ \text{(ii) yellow precipitate is formed.} \]

\[ 2\text{NH}_4^+(aq) + \text{PbCl}_6^{2-}(aq) \rightarrow (\text{NH}_4)_2\text{PbCl}_6(s) \]

3(a) (i) Electrolytic conductivity is the conductance of a given solution containing one mole of an electrolyte enclosed between electrodes of cross sectional area of \(1\text{cm}^2\) or \(1\text{m}^2\) and a distance of \(1\text{cm}\) or \(1\text{m}\) apart.

(ii) Molar conductivity is the conductance of a given solution of an electrolyte enclosed between electrodes of cross sectional area of \(1\text{cm}^2\) or \(1\text{m}^2\) and a distance of \(1\text{cm}\) or \(1\text{m}\) apart.

(b) (i) Excess of silver chromate is shaken with a given volume of distilled water. It is left to stand until equilibrium is established. The mixture is filtered to obtain a filtrate which is a saturated solution of silvery chromate. The electrolytic conductivity of the saturated solution is measured using a conductivity meter. If the electrolytic conductivity of water is known the electrolytic conductivity of silvery chromate can be determined.

\[ K_{\text{solution}} = K_{\text{water}} \]

The molar conductivity of silver ions and chromate ions at infinite dilution can obtained books and can be used to determine the molar conductivity of silver chromate.

\[ \Lambda_{\text{Ag}^+\text{CrO}_4^{2-}} = \frac{2\Lambda_{\text{Ag}^+} \Lambda_{\text{CrO}_4^{2-}}}{\text{mol dm}^{-3}} \]

The molar concentration of silver chromate which is the solubility can now be calculated.

\[ \text{solubility} = \frac{\text{molar conductivity}}{2\text{Ag}^+ \text{CrO}_4^{2-}} \]

If C mol dm\(^{-3}\) is the solubility of silver chromate, the solubility product can be determined as follows; electrolyticconductivity

\[ K_{\text{sp}} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}] \]

[\(\text{Ag}^+\) = 2C][\(\text{[CrO}_4^{2-}\)] = C

\[ K_{\text{sp}} = (2C)^2 xC \]

\[ K_{\text{sp}} = 4C^3 \text{Mol}^{2}\text{dm}^{-8} \]

More chemistry answers next Tuesday