SADIQ PUBLIC SCHOOL

Do the right, fear no man

Class: H1   Homework Worksheet

Thursday, 8th February 2024

Subject: Physics

Topic: Superposition (Stationary waves revision)

A: Inquiry: We have studied about the superposition of two waves travelling in the same direction. But what happens when two waves of same frequency travelling in the opposite direction superpose each other. This gives rise to a phenomenon called stationary waves or standing waves.

B: Information:

Formation of Stationary waves

- A stationary wave is formed when two progressive waves of the same frequency, amplitude and speed, travelling in opposite directions are superposed.
- Node: region of destructive superposition where waves always meet out of phase by π, displacement = zero (closed end)
- Antinode: region of constructive superposition where waves meet in phase, particle vibrate with max amplitude (open end)
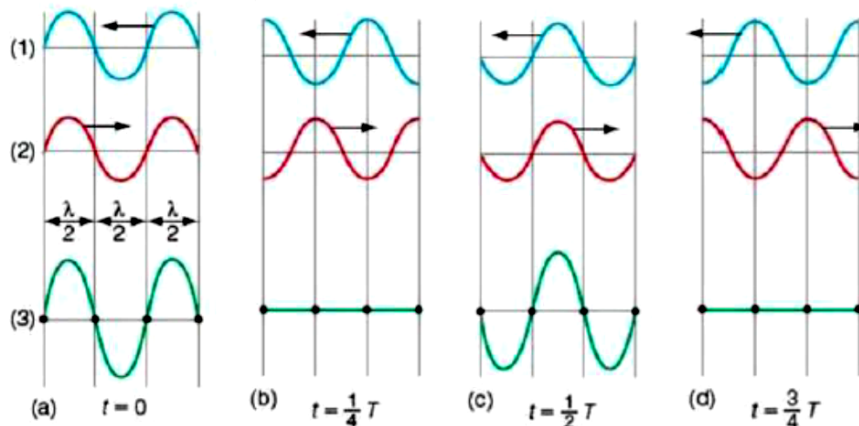
- Neighboring nodes & antinodes separated by $\lambda/2$.
- Two consecutive nodes or antinodes are separated by $\lambda/4$.
- Between 2 adjacent nodes, particles move in phase; they are out of phase with the particles between the next two nodes by π.
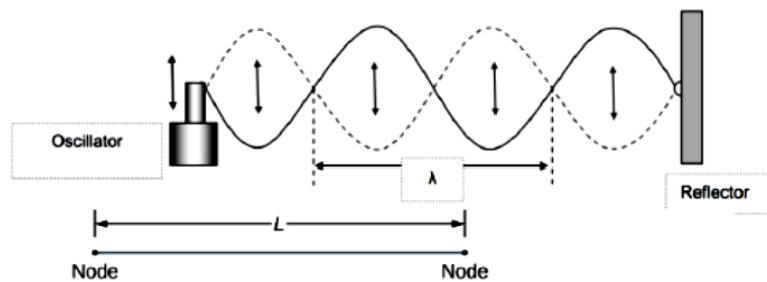- Stationary waves cannot transfer energy.

Harmonics:

- A guitar string supports different modes of vibration for stationary waves (i.e. harmonics)
- The first harmonic is the mode of vibration with the longest wavelength
- The second harmonic is the mode of vibration with the next longest wavelength

Stationary Wave Experiments

Stretched String:

- String either attached to wall or attached to weight
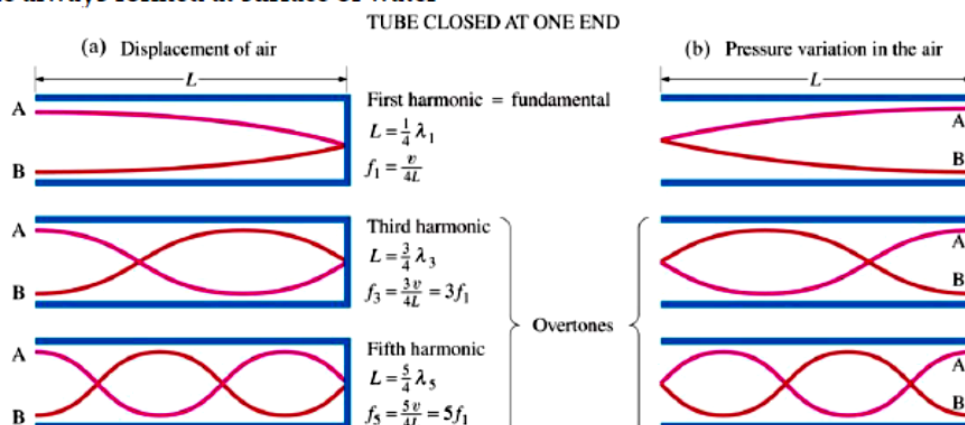- Stationary waves will be produced by the direct and reflected waves in the string.

$$\frac{1}{2}\lambda_1 = L \qquad \lambda_1 = \frac{2}{1}L$$

$$\lambda_2 = L \qquad \lambda_2 = \frac{2}{2}L$$

$$\frac{3}{2}\lambda_3 = L \qquad \lambda_3 = \frac{2}{3}L$$

$$\frac{4}{2}\lambda_4 = L \qquad \lambda_4 = \frac{2}{4}L$$

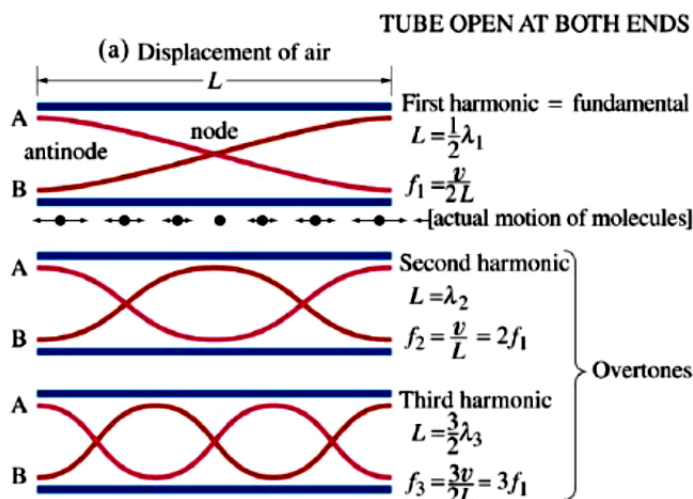$$\lambda_n = \frac{2}{n}L \qquad n = 1, 2, 3, \dots$$

$$\lambda_n = \frac{2}{n}L \qquad n = 1, 2, 3, 4, 5\dots$$

$$f_n = n\frac{v}{2L} = nf_1 \qquad n = 1, 2, 3, 4, 5\dots$$

Air Columns:

- A tuning fork held at the mouth of an open tube projects a sound wave into the column of air in the tube.
- The length can be changed by varying the water level.
- At certain lengths tube, the air column resonates
- This is due to the formation of stationary waves by the incident and reflected sound waves at the water surface.
- Node always formed at surface of water

TUBE CLOSED AT ONE END

(a) Displacement of air

First harmonic = fundamental
$$L = \frac{1}{4}\lambda_1$$
$$f_1 = \frac{v}{4L}$$

Third harmonic
$$L = \frac{3}{4}\lambda_3$$
$$f_3 = \frac{3v}{4L} = 3f_1$$

Overtones

Fifth harmonic
$$L = \frac{5}{4}\lambda_5$$
$$f_5 = \frac{5v}{4L} = 5f_1$$

(b) Pressure variation in the air

TUBE OPEN AT BOTH ENDS

(a) Displacement of air

A
antinode
node

B
[actual motion of molecules]

First harmonic = fundamental
$L = \frac{1}{2}\lambda_1$
$f_1 = \frac{v}{2L}$

A

B

Second harmonic
$L = \lambda_2$
$f_2 = \frac{v}{L} = 2f_1$

A

B

Third harmonic
$L = \frac{3}{2}\lambda_3$
$f_3 = \frac{3v}{2L} = 3f_1$

} Overtones

Microwaves:

- A microwave emitter placed a distance away from a metal plate that reflects the emitted wave. By moving a detector along the path of the wave, the nodes and antinodes could be detected.

Microwave emitter

λ

Microwave detector

Metal plate (Reflector)
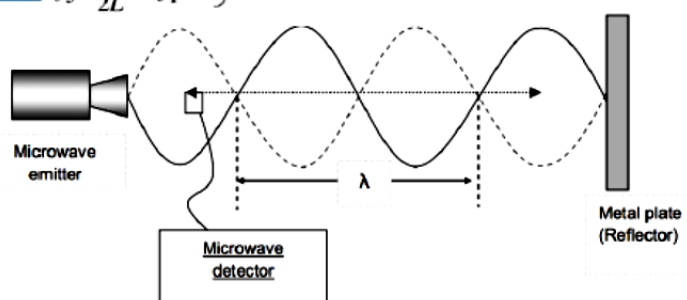
Stationary and Progressive Waves

Stationary Waves	Progressive Waves
Stores energy (cannot transfer energy)	Transmits energy
Have nodes & antinodes	No nodes & antinodes
Amplitude increases from node to antinode	Amplitude constant along length of the wave
Phase change of π at node	No phase change

C: Synthesising/absorbing information:

Complete your notes in the notebooks.

D: Practising:

Q1. Solve the following questions and practice from past papers.

1. Two waves of equal frequency and amplitude are travelling in opposite directions along a stretched string. When they meet, they form a stationary wave with three nodes and two antinodes. The frequency of both waves is doubled and a new stationary wave is formed. How many antinodes are there in the new stationary wave?

A 1   B 2
C 3   D 4

2. A string is stretched between a vibration generator and a fixed point. When the vibration generator is vibrating at a frequency f, a stationary wave with five nodes is created on the stretched string, as shown. There is a node at the end of the string that is attached to the vibration generator.

The frequency of vibration of the vibration generator is slowly increased. What is the next frequency that produces a stationary wave on the string?
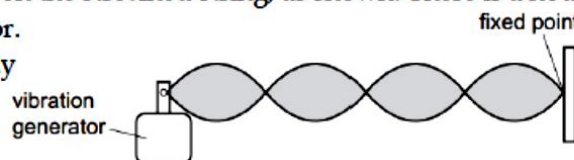
A 1.25f   B 1.50f
C 1.75f   D 2.00f

3. A stationary wave is formed by two progressive waves travelling in opposite directions along the same line of travel. Which statement about the two progressive waves is not correct?

A They must have a constant phase difference.   B They must have the same frequency.
C They must have the same wavelength.   D They must travel at the same speed.

4. The sound from a loudspeaker placed above a tube causes resonance of the air in the tube. A stationary wave is formed with two nodes and two antinodes, as shown.
The tube has height 60 cm. The speed of sound in the air is 340 m s^{-1}.
What is the frequency of the sound?
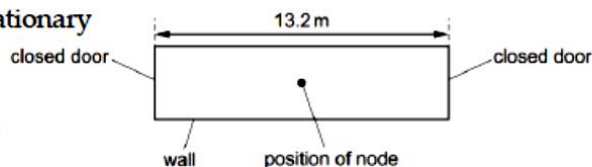
A 430Hz   B 570Hz
C 850Hz   D 1700Hz
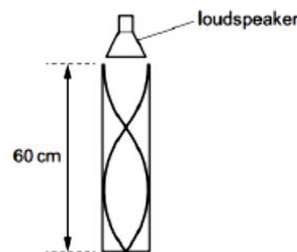
5. A corridor is 13.2 m long and has closed doors that reflect sound at both ends. The speed of sound in the air in the corridor is 330 m s^{-1}.
What is the lowest frequency of sound that could create a stationary wave in the corridor with a node halfway along it?

A 0.040 Hz   B 13 Hz
C 25 Hz   D 50 Hz

Q2. A horizontal string is stretched between two fixed points A and B. A vibrator is used to oscillate the string and produce an observable stationary wave. At one instant, the moving string is straight, as shown in Fig. 2.1
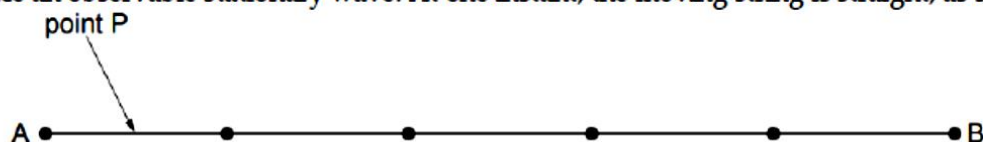
The dots in the diagram represent the positions of the nodes on the string. Point P on the string is moving downwards. The wave on the string has a speed of 35 m s^{-1} and a period of 0.040 s. (

a) Explain how the stationary wave is formed on the string. [2]

(b) On Fig. 2.1, sketch a line to show a possible position of the string a quarter of a cycle later than the position shown in the diagram. [1]

(c) Determine the horizontal distance from A to B. [3]

(d) A particle on the string has zero displacement at time t = 0. From time t = 0 to time t = 0.060 s, the particle moves through a total distance of 72 mm. Calculate the amplitude of oscillation of the particle. [2]

4

Subject: Chemistry

Lesson 1-This lesson is about: the chemistry of Alcohols

You know that The complete combustion of alcohols forms carbon dioxide and water.

A nucleophilic substitution reaction takes place between alcohols and hydrogen halides to form halogenoalkanes. Alcohols react with sodium metal to give sodium alkoxides and hydrogen gas.

An alcohol will react with a carboxylic acid, in the presence of a strong acid catalyst, to form an ester and water. Esters can be hydrolysed by an acid or by a base. Acid hydrolysis is a reversible reaction but base hydrolysis is not reversible.

Elimination of water from an alcohol produces an alkene; the reaction is called dehydration. Dehydration may be carried out by passing alcohol vapour over heated pumice, porous pot or aluminium oxide, or by using a concentrated acid catalysts.

A primary alcohol can be oxidised to an aldehyde by heating the alcohol gently with acidified potassium dichromate(VI) (and distilling out the aldehyde as it forms: see Section 18.2). The primary alcohol can be further oxidised to a carboxylic acid by refluxing the alcohol with excess acidified potassium dichromate(VI).

A secondary alcohol can be oxidised to a ketone by heating the alcohol with acidified potassium dichromate(VI). Acidified potassium dichromate(VI) changes colour from orange to green when it oxidises a primary or secondary alcohol. However, tertiary alcohols cannot be oxidised by refluxing with acidified potassium dichromate(VI).

Carboxylic acids can be formed from the oxidation of primary alcohols or aldehydes by refluxing with excess potassium dichromate(VI) and dilute sulfuric(VI) acid. They can also be made by refluxing nitriles with dilute hydrochloric acid. Carboxylic acids are weak acids that react with reactive metals, alkalis or carbonates to form carboxylate salts. The carboxylic acids can be reduced by LiAlH4 in dry ether, to form primary alcohols

Write answers of following questions from the book exercise on

Subject: Biology

Chapter No1: Cell structure

This lesson is about structure and function of Mitochondria and Lysosomes.

A: Inquiry:

Do you know why mitochondrion is considered as an important organelle of cell? What

will happen to the cell if the cell lost its mitochondria?

Why lysosome is very important for developmental process?
B: Information

Mitochondria

"Mitochondria are membrane-bound organelles present in the cytoplasm of all eukaryotic cells,that produces Adenosine tri phosphate(ATP),the main energy molecule used by the cell."

What is Mitochondria?

Popularly known as the "Powerhouse of the cell," mitochondria (singular: mitochondrion) are a double membrane-bound organelle found in most eukaryotic organisms. They are found inside the cytoplasm and essentially function as the cell's "digestive system."

They play a major role in breaking down nutrients and generating energy-rich molecules for the cell. Many of the biochemical reactions involved in cellular respiration take place within the mitochondria. The term 'mitochondrion'isderivedfromtheGreekwords*"mitos"*and*"chondrion"*whichmeans"thread"and"granules- like", respectively.

Structure of Mitochondria

- The mitochondrion is a double-membraned, rod-shaped structure found in both plant and animal cell.
- Its size ranges from 0.5 to 1.0 micro meter in diameter.
- The structure comprises an outer membrane, an inner membrane, and a gel-like material called the matrix.
- Theoutermembraneandtheinnermembranearemadeofproteinsandphospholipidlayersseparatedby the inter membrane space.
- The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins.
- It is freely permeable to ions, nutrient molecules, energy molecules like the ADP and ATP molecules.

Cristae

The inner membrane of mitochondria is rather complex in structure. It has many folds that form a layered structure called cristae, and this helps in increasing the surface area inside the organelle. The cristae and the proteins of the inner membrane aids in the production of ATP molecules. The inner membrane is strictly permeable only to oxygen and to ATP molecules.A number of chemical reactions take place within the inner membrane of mitochondria.

Mitochondrial Matrix

The mitochondrial matrix is a viscous fluid that contains a mixture of enzymes and proteins. It also comprises ribosomes, inorganic ions, mitochondrial DNA, nucleotide cofactors, and organic molecules. The enzymes present

in the matrix play an important role in the synthesis of ATP molecules.
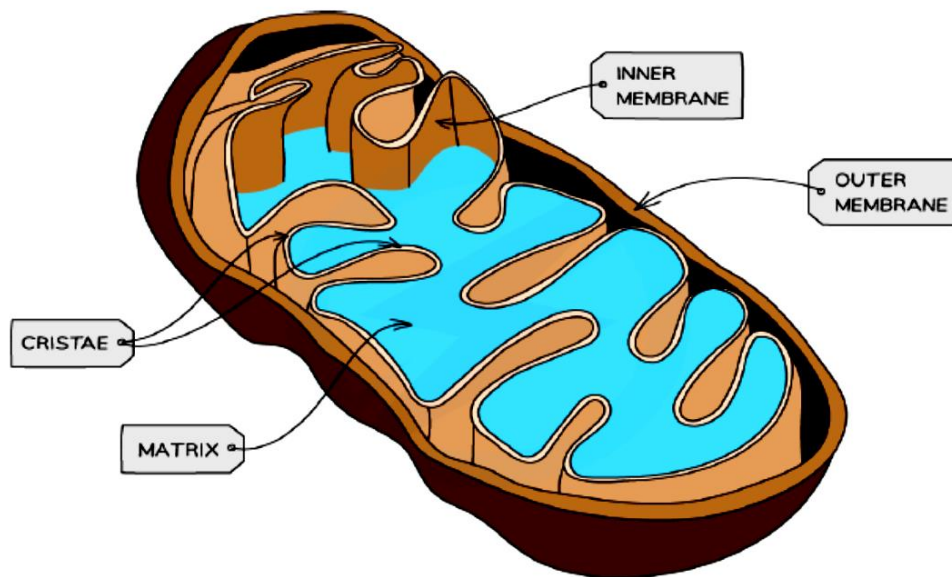
Functions of Mitochondria

The most important function of mitochondria is to produce energy through the process of **oxidative phosphorylation**. It is also involved in the following process:

1. Regulates the metabolic activity of the cell

2. Promotes the growth of new cells and cell multiplication

3. Helps in detoxifying ammonia in the liver cells

4. Plays an important role in apoptosis or programmed cell death

5. Responsible for building certain parts of the blood and various hormones like testosterone and oestrogen

6. Helps in maintaining an adequate concentration of calcium ions within the compartments of the cell

7. It is also involved in various cellular activities like cellular differentiation, cell signalling, cell sensecence, controlling the cell cycle and also in cell growth.

Lysosomes:

- Lysosomes are membrane-bound, dense granular structures containing hydrolytic enzymes responsible mainly for intracellular and extracellular digestion.

- The word "lysosome" is made up of two words "lysis" meaning breakdown and "soma" meaning body.

- It is an important cell organelle responsible for the inter and extracellular breakdown of substances.

- They are more commonly found in animal cells while only in some lower plant groups(slime molds and saprophytic fungi).

- Lysosomes occur freely in the cytoplasm. In animals, found in almost all cells except in the RBCs.

- They are found in most abundant numbers in cells related to enzymatic reactions such as liver cells, pancreatic cells, kidney cells, spleen cells, leucocytes, macrophages, etc.

Structure of Lysosomes

- Lysosomes are without any characteristic shape or structure i.e. they are pleomorphic
- They are mostly globular or granular in appearance.
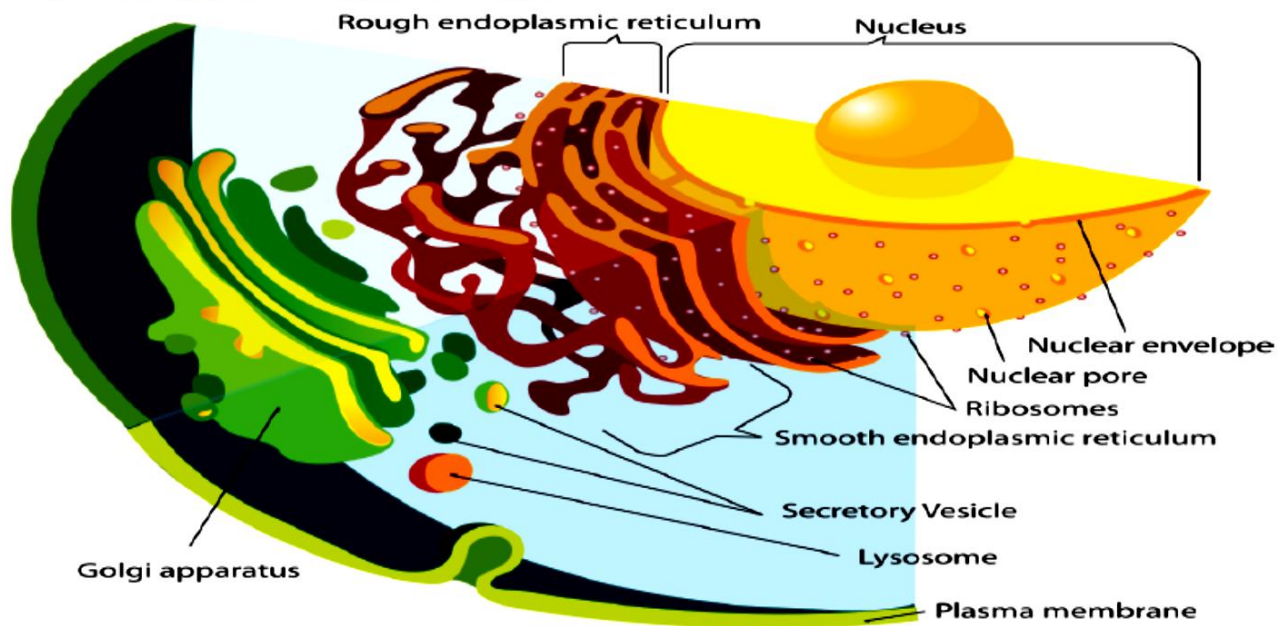
- It is 0.2-0.5 μm in size and is surrounded by a single lipoprotein membrane unique in composition.

Types of Lysosomes

Primary Lysosomes

- Small sac-likes structures enclosing enzymes synthesized by the rough endoplasmic reticulum.
- Simply called as storage granules storing enzymes.

Secondary Lysosomes

- Formed by the fusion of primary lysosome with phagosomes.
- Contain engulfed material plus enzymes.
- Materials are progressively digested.

Functions of Lysosomes:

Lysosomes serve two major functions:

1. **Intra cellular Digestion**
- To digest food, the lysosome membrane fuses with the membrane of food vacuole and squirts the enzymes inside.
- The digested food then diffuses through the vacuole membrane and enters the cell to be used for energy and growth.
2. **Auto lytic Action**
- Cell organelles thatneed to be get ridden are covered by vesicles or vacuoles by the process of autophagy to form autophagosome.
- The autophagosome is then destroyed by the action of lysosomal enzymes.

Processes in which lysosomes play crucial roles include:

a. Heterophagy

The taking into the cell of exogenous material by phagocytosis or pinocytosis and the digestion of the ingested material after fusion of the newly formed vacuole with a lysosome.

b. Autophagy

A normal physiological process that deals with the destruction of cells in the body. It is essential for maintaining homeostasis, for normal functioning by protein degradation, turnover of destroyed cell organelles for new cell formation

c. Extracellular Digestion

Primary lysosomes secrete hydrolases outside by exocytosis resulting in degradation of extracellular materials. Eg. Saprophytic fungi

d. Autolysis

It refers to the killing of an entire set of cells by the breakdown of the lysosomal membrane.It occurs during amphibian and insect metamorphosis.

e. Fertilization

The acrosome of the sperm head is release lysosome that rupture sand releases enzymes on the surface of the egg. This provides the way for sperm entry into the egg by digesting the egg membrane.

f. As Janitors of the Cell

Lysosomes remove'junk'that may accumulate in the cell helping to prevent diseases.
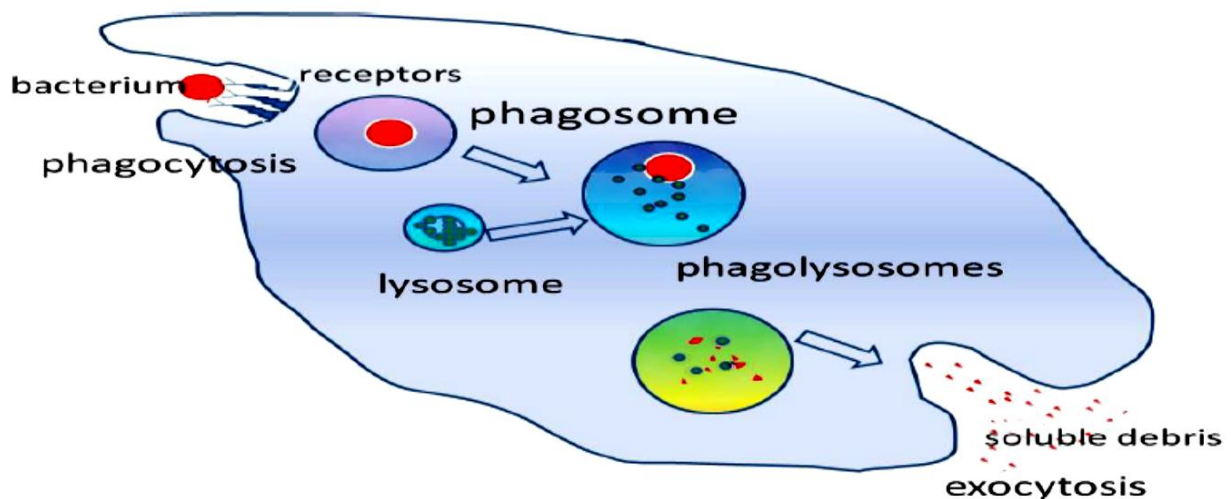
C:Synthesising/ absorbing the information

Write your own summary-notes in your notes book based on information you read in information section and what your book says about mitochondria and Lysosomes.

D:Practising.(Readyourtextbookfordetailedinformation)

1. What are mitochondria?

2. Why are mitochondria called the power house of the cell?

3. Briefly describe the structure of mitochondria.

4. What are cristae?

5. What is a mitochondrial matrix?

6. What are the functions of Mitochondria?

7. Why lysosomes are important for normal development?

8. What are the functions of lysosomes?

Subject: Mathematics

1   Evaluate $\int_0^1 \sqrt{(3x+1)}\, dx.$ [4]

2
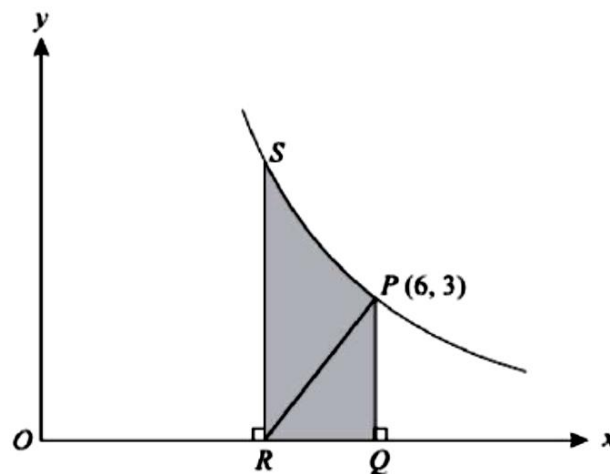
The diagram shows part of the graph of $y = \dfrac{18}{x}$ and the normal to the curve at $P\,(6,\ 3)$. This normal meets the x-axis at R. The point Q on the x-axis and the point S on the curve are such that PQ and SR are parallel to the y-axis.

   (i) Find the equation of the normal at P and show that R is the point $(4\frac{1}{2},\ 0)$.   [5]

   (ii) Show that the volume of the solid obtained when the shaded region $PQRS$ is rotated through $360°$ about the x-axis is 18π.   [4]

3 A curve is such that $\dfrac{dy}{dx} = \dfrac{6}{\sqrt{(4x-3)}}$ and $P(3, 3)$ is a point on the curve.

    (i) Find the equation of the normal to the curve at P, giving your answer in the form $ax + by = c$.

                                                                        [3]

    (ii) Find the equation of the curve.   **[4]**

4 A curve has equation $y = x^2 + \dfrac{2}{x}$

    (i) Write down expressions for $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$.   **[3]**

    (ii) Find the coordinates of the stationary point on the curve and determine its nature.   **[4]**

    (iii) Find the volume of the solid formed when the region enclosed by the curve, the x-axis and the lines $x = 1$ and $x = 2$ is rotated completely about the x-axis.   **[6]**

Subject: Computer

Lesson: This lesson is about writing pseudocode from a structures English description.

Inquiry:
Structured English is a way of describing an algorithm using a small subset of the English language and a few simple conventions. Why Structured English is easier to understand than a pseudocode?

Information
Structured English is somewhere between Standard English and a programming language. It uses things you find in programming languages like indentation and using keywords (like IF for selection) whereas pseudocode is like program code but without being limited to the syntax of a specific language. It should be easy to convert into an executable program in any programming language. You could think of it as being a step closer to program code from structured English.

- For more information, please Read what your textbook says about the topic (pages 229 -231)
- Please watch the YouTube video (https://youtu.be/phTgadEg6QU)

Practising
Practice Question 1.
Read, understand and then solve Activity 9G at page 231 of your textbook.

Practice Question 2.
In a Race, positions of the riders and calculated as follows:
Riders complete one stage of a cycle race and their finishing position and time is recorded.
- The time is entered by the user as two integers:
    - Number of minutes
    - followed by the number of seconds
- The rider's stage race position is entered.
- The time is converted to seconds.
- If they finish in first, second or third position they get a time bonus, see table below.
- The time bonus is deducted from their race time.

Position	Time Bonus (Seconds)
1	20
2	10
3	5

Structured English for above description is given as:

      INPUT rider name
      INPUT rider's race time in minutes
      INPUT rider's race time in seconds
      INPUT rider's position
      CALCULATE race time in seconds
      STORE race time in seconds
      CALCULATE time bonus
      STORE time bonus
      SUBTRACT time bonus from race time in seconds
      STORE adjusted race time
      OUTPUT rider's name, position, adjusted race time

(a). Study the structured English and complete the identifier table below.

Identifier	Data type	Description
RiderName	STRING	Name of the rider

(b). Write a pseudocode for above Structured English description. The code should process the data only for one rider.

Inquiry

Approaches to costing

Calculating the cost of each product (or department, process or location) is not easy. Managers use two main methods to help with this costing process: full costing and contribution costing.

Costing methods: a major problem

In calculating the cost of a product, both direct labour and direct materials should be easy to identify and allocate to each product. For instance, the materials used in making a coat are allocated directly to the cost of that product. These are not the only costs involved, of course. Overheads, or indirect costs, cannot be allocated directly to particular units of production. They must be shared between all of the items produced by a business.

There is more than one way of sharing or apportioning these costs and, therefore, there may be more than one answer to the question: 'How much does a product cost to produce?'

This uncertainty causes potential problems when pricing products, when deciding whether to continue producing them, and when deciding whether to accept a new order for the product.

Lets discuss some important concepts;

Before studying the two main costing methods, four important concepts need to be understood:

Cost centres

Examples of cost centres are:

• in a manufacturing business: products, departments, factories, particular processes or stages in production, such as assembly

• in a hotel: the restaurant, reception, bar, room letting and conference section

• in a school: different subject departments.

Different businesses will use different cost centres as appropriate to their own needs.

Profit centres

Examples of **profit centres** are:

• each branch of a chain of shops

• each department of a department store

• in a multi-product firm, each product in the overall portfolio of the business.

The benefits of using cost and profit centers are:

• Managers and employees have targets to work towards. If these are reasonable and achievable, this should have a positive impact on motivation.

• These targets can be used to compare with actual performance and help identify those areas that are performing well and not so well.
• The individual performances of divisions and their managers can be assessed and compared.
• Work can be monitored and decisions made about the future. For example, should a profit center be kept open or should the price of a product be increased?

Overheads

These indirect expenses of a business are usually classified into four main groups:
• Production overheads: including factory rent and rates, depreciation of equipment and power.
• Selling and distribution overheads: including warehouse, packing and distribution costs, and salaries of sales employees.
• Administration overheads: including office rent and rates, clerical and executive salaries.
• Finance overheads: including interest on loans.

Average cost

Average cost provides useful information for business managers. It is sometimes referred to as unit cost.

The average cost of producing each unit of output is calculated by this formula:

average cost = Total Cost/Number of units produced

Example: A firm produces 20 000 desks at a total cost of $1 000 000. Unit cost is $1 000 000 divided by

20 000 = $50. Clearly, finding the unit cost is an essential step towards pricing the desks.

Synthesis/Absorption of this information

Try to attempt this case;

Amazon sells around $500bn of goods worldwide. All of these products have to be delivered, sometimes to remote locations.

Increases in transport costs, fuel costs and the decision by Amazon to pay its warehouse workers in the USA at least $15 per hour, have all increased the indirect costs of delivering parcels. However, Amazon can use its power over suppliers to achieve other cost reductions. The chance of Amazon recording an annual financial loss appears remote.

• How important is keeping control over indirect costs for a large business such as Amazon?

Practice Questions

Exam Style Question 3 and 4

Subject: Accounting

Company Final Accounts

Inquiry

Do you know the difference between profit and loss account and balance sheet? What is the effect of depreciation in final accounts? Why capital and revenue expenditure are distinguished?

Information

The financial statements:

UK law recognizes a company as a separate legal 'person', an entity that is distinct from its owners. It can therefore sue and be sued, and take out contracts in its own name. Sole traders and partnerships, however, are not separate entities from their owners in the eyes of the law. In financial accounting, the (business) entity concept requires accountants to treat all businesses – including sole traders and partnerships – as separate entities from their owners.

The main financial statements are the **profit and loss account** and the **balance sheet.**

Profit and loss account:

- is an income statement
- shows calculation of profit
- information from expense and revenue accounts

Balance sheet

- shows net assets and capital employed
- summarizes the financial position
- information from asset and liability accounts

Depreciation in financial statements:

The consistency concept ensures that the same calculation method – straight line, reducing balance and revaluation are the most popular ones – will normally be used for similar assets. The accruals concept, where costs are matched to the period to which they refer, means that each year's profit will be charged with its own share of the total depreciation. The firm can change its depreciation policy and method of calculation, but only for good reason.

The purpose of applying depreciation is therefore to adjust annual profits, to avoid charging the full amount of depreciation in a single year (which would distort that year's profits). This leads to a fairer comparison between the profit figures for the years over which the asset is owned.

Depreciation is subjective: the accountant has to decide which method of calculation to use. If selecting the straight-line method, decisions must be made concerning two of the three figures involved in the calculation (the estimated life of the asset, and its expected resale value); if the reducing balance method is used, the percentage written down each year must be decided.

Since depreciation is a provision, an adjustment will be made when the asset is disposed of. The firm will make either a loss or a profit on sale, which is recorded in the profit and loss account. Over the full life of the asset, the total depreciation charged will be the same regardless of method selected and amounts charged, because of this final adjustment. For this reason, total profits over the asset's life will also be the same, even though the individual figures will vary.

Capital and revenue expenditure in financial statements:

- Capital expenditure appears in the balance sheet
- Revenue expenditure appears in the profit and loss account

This is an important distinction in the financial statements because:

If revenue expenditure is wrongly classified as capital expenditure:

- expenses will be understated
- net profit will be overstated

If capital expenditure is wrongly classified as revenue expenditure:

- expenses will be overstated
- net profit will be understated

Synthesising /Absorbing

Students write your own summary- notes in your notes book based on information given above.

Practice

Solve last twenty MCQs from topical past papers.

Assessment

Solve question no. 3 from 9706/21/O/N/20

Subject: Law

Read the topic powers of police to stop and search a suspect and answer the following questions:

1. Discuss the power of police to stop and search a suspect.

2. Discuss the protective rights given to citizens.

Subject: Psychology

Thursday 08th Feb 2024
Chap No. 3 - Cognitive Approach
Page No. 121 - 122
Solve Exam style questions