SADIQ PUBLIC SCHOOL

Do the right, fear no man

Class: H1   Homework Worksheet

Friday, 9th February 2024

Subject: Physics

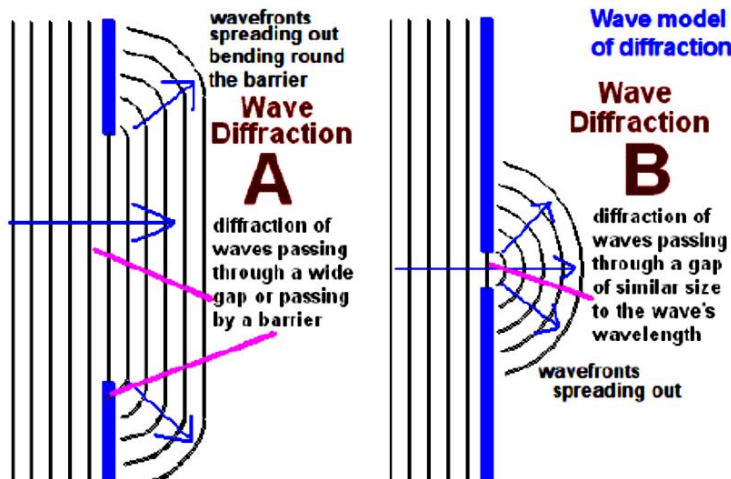**Topic: Diffraction and diffraction grating (Revision)**

A: Inquiry: Waves can pass through different media exhibiting different phenomena. One of these phenomena is the spreading of waves around and obstacle just like radio waves can pass through hilly areas as used for communication. This property is known as diffraction. We will study diffraction of different types of waves in this lesson.
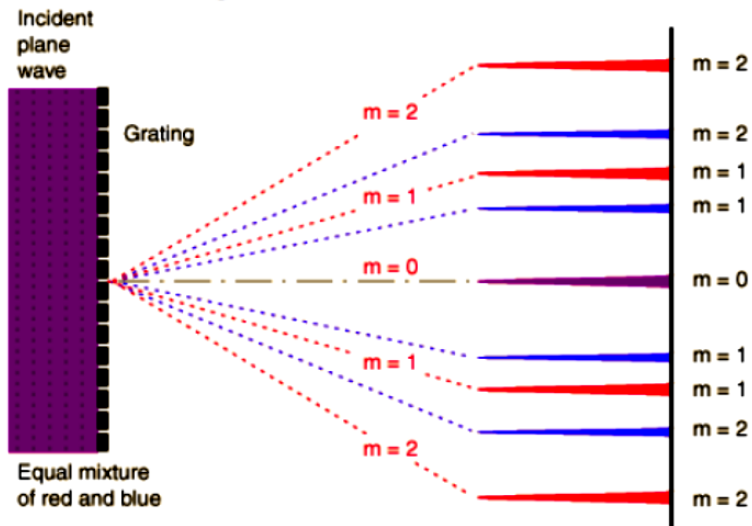
B: Information:

Diffraction

The spreading of waves as they pass through a narrow slit or near an obstacle
- For diffraction to occur, the size of the gap should be equal to the wavelength of the wave.

Gap Width	Amount of diffraction
$\gg \lambda$	smallest
$\lambda <$ Gap $< 2\lambda$	limited
$\leq \lambda$	greatest

Diffraction Grating

When a parallel beam of monochromatic light is directed normally (at right angles to it!) at a diffraction grating, light is transmitted by the grating in certain directions only.
This is because:
- the light passing through each slit is diffracted,
- the diffracted light waves from adjacent slits reinforce each other in certain directions only, including the incident light direction, and cancel out in all other directions.

It is excellent at separating the colors in incident light because different wavelengths are diffracted at different angles, according to the grating relationship:

$$d\sin\theta = n\lambda$$
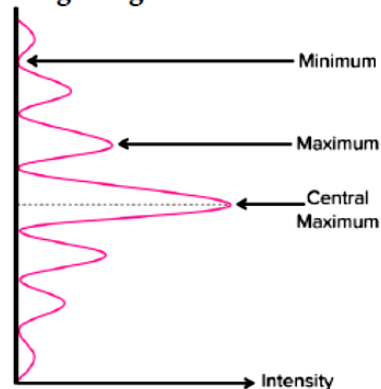
Where d = distance between successive slits =
N = number of slits per meter
θ = angle from horizontal equilibrium
n = order number
λ = wavelength
Intensity curve for diffraction grating:

Comparison between double slit and diffraction grating:

	double-slit	diffraction grating
pattern	closely spaced bright fringes on a dark background	widely spaced bright fringes on a dark background
features	less bright and sharp	brighter and sharper (more slits: more light pass through; narrower slits: more diffracted)
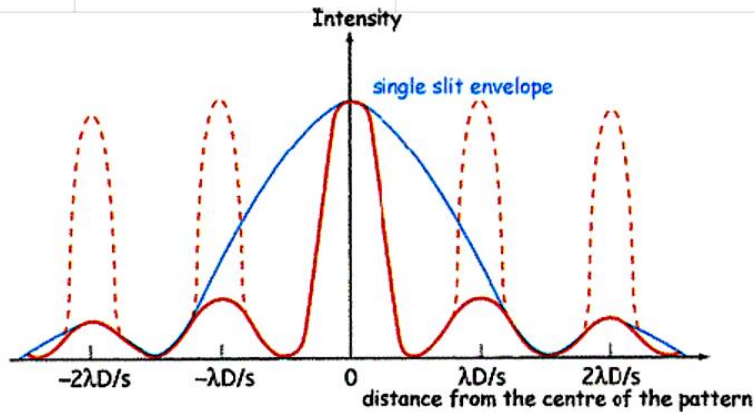
## C: Synthesising/absorbing information:
Complete your notes in the notebooks.
D: Practising:
Q1. Solve the following questions and practice from past papers.

1. A ripple tank and a barrier with a single gap are used to demonstrate the diffraction of surface ripples on water. Initially, the wavelength of the ripples is five times smaller than the gap in the barrier.
Which change increases the amount of diffraction observed?
A double the amplitude of the ripples
B double the width of the gap
C halve the frequency of the ripples
D halve the wavelength of the ripples
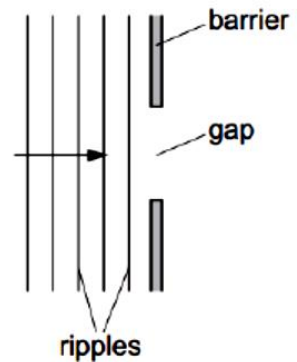
2. A beam of light from a laser is incident normally on a diffraction grating. The diagram shows only the second-order maxima that are produced. The grating has a line spacing of 1.0×10^{-6} m. The angle between the two second-order maxima is 110°. What is the wavelength of the light?
A 4.1×10^{-7} m
B 4.7×10^{-7} m
C 8.2×10^{-7} m
D 9.4×10^{-7} m
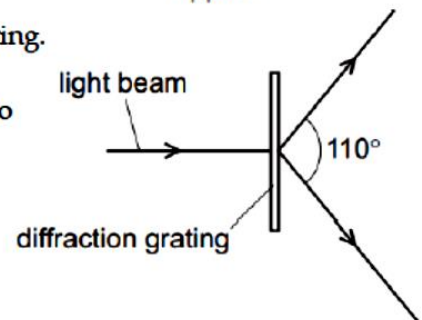
3. A continuous progressive water wave in a ripple tank passes through a gap in a barrier and diffracts. The width of the gap is greater than the wavelength of the wave. Which change causes the wave to spread over a larger angle as it passes through the gap?

A a small decrease in the wavelength of the wave   B a small decrease in the width of the gap

C a small increase in the frequency of the wave   D a small increase in the height of the barrier

4. Green light of wavelength 550 nm is incident normally on a diffraction grating and produces a diffraction pattern on a screen placed 3.5 m from the diffraction grating. The third-order maximum on the screen is a distance of 0.75 m from the zeroth-order (central) maximum.

What is the distance between two adjacent slits in the diffraction grating?

A 2.6×10^{-6} m

B 7.7×10^{-6} m

C 7.9×10^{-6} m

D 1.0×10^{-5} m
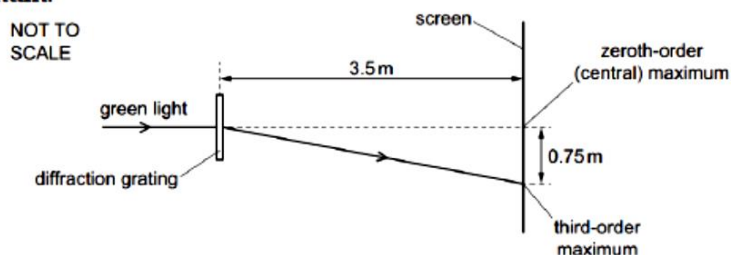
5. An experiment is set up to demonstrate the diffraction of water waves in a ripple tank. The waves pass through a gap of width w and some diffraction of the waves is observed. The wavelength of the waves is now doubled. What is the new gap width needed to cause the same amount of diffraction as before?

A 0.5w   B w

C 2w   D 4w

Q2. A beam of light of a single wavelength is incident normally on a diffraction grating, as illustrated in Fig. 2.2.
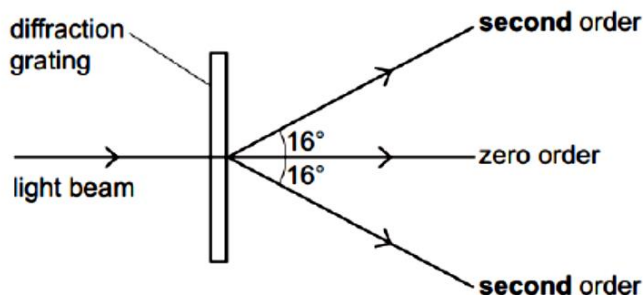

Fig. 2.2 does not show all of the emerging beams from the grating. The angle between the second-order emerging beam and the central zero-order beam is 16°.

The grating has a line spacing of 3.4×10^{-6} m.

(i) Calculate the wavelength of the light. [2]

(ii) Determine the highest order of emerging beam from the grating. [2]

Subject: Chemistry

Lesson 1-This lesson is about: the chemistry of aldehydes and ketones

You know that Aldehydes and ketones contain the carbonyl group, $>C=O$: in aldehydes, the carbonyl group is bonded to one other carbon atom and a hydrogen atom in ketones, the carbonyl group is bonded to two other carbon atoms.

The names of aldehydes are derived from the name of the alkane with the '-e' at the end replaced by '-al'. Similarly, ketones are named with the '-e' replaced by '-one'.

Carbonyl compounds are readily reduced by aqueous $NaBH_4$ or $LiAlH_4$ dissolved in dry ether: reduction of an aldehyde forms a primary alcohol reduction of a ketone produces a secondary alcohol. Aldehydes are readily oxidised under mild conditions to carboxylic acids. Ketones are not oxidised under mild conditions.

The polar nature of the carbonyl group in aldehydes and ketones enables them to undergo nucleophilic addition by reacting with the cyanide ions (CN^-) from HCN. The product is a 2-hydroxynitrile.

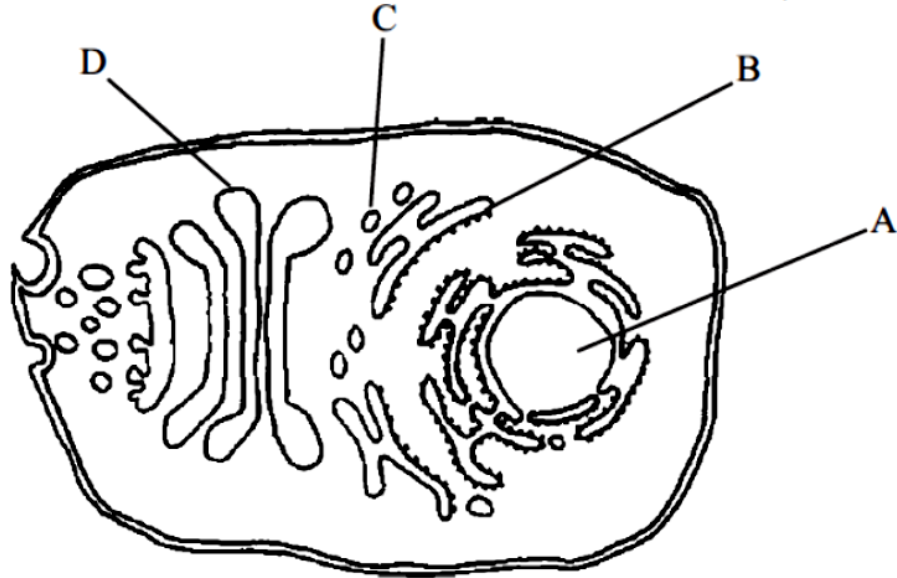Write answers of questions from the book exercise on page 515 (Q1-2) on your note book

Answer following questions.   **TOTAL [31]**

1. The diagram shows some of the cell structures involved in the secretion of an extracellular enzyme.

(a) Identify A, B, C, and D.

(b) A: .... B: .... C: .... D: ....

[4]

(b) Outline the role of each of the following in this process.
(i) A:

....

....

[2]

(ii) B:

....

....

[2]

(iii) C:

....

....

[2]

(iv) D:

....

....

2. The diagram shows a cell from the proximal (first) convoluted tubule in the nephron of the kidney.

(a) Label two features on the diagram that help the cell to take up glucose from the glomerular filtrate.

[2]

(b) Explain how the two features of the cell help in the uptake of glucose from the glomerular filtrate.
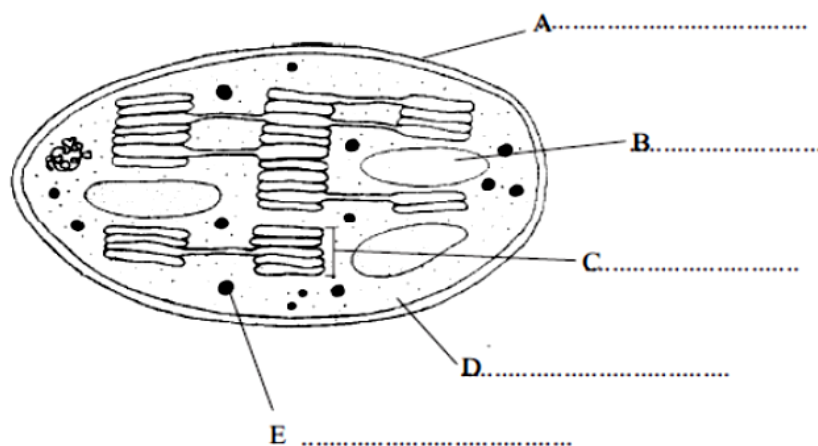
1. ....

....

....

[2]

2. ....

....

....

[2]

The diagram shows the structure of a chloroplast.

A..................................

B..........................

C..........................

D............................

E ....

(a) Name structures labelled A to E on the diagram.

[5]

(b) Describe where in the chloroplast:

(i) the light dependent reaction takes place.

....
[1]

(ii) the light independent reaction takes place.

....
[1]

(c) Describe three similarities in the structure of chloroplasts and mitochondria.

....

....

....
[3]

(d) Suggest why each of the following are present in both chloroplasts and mitochondria.
(i) phosphorylase enzymes.

....

....
[2]

(ii) ribosomes.

....
[1]

TOTAL /19

1. A curve is such that $\frac{dy}{dx} = 2x^2 - 5$. Given that the point (3, 8) lies on the curve, find the equation of the curve. [4]

2. A curve has equation $y = \frac{4}{\sqrt{x}}$.

    (i) The normal to the curve at the point (4, 2) meets the x-axis at P and the y-axis at Q. Find the length of PQ, correct to 3 significant figures. [6]

    (ii) Find the area of the region enclosed by the curve, the x-axis and the lines $x = 1$ and $x = 4$. [4]

    A curve is such that $\frac{dy}{dx} = \frac{16}{x^3}$, and (1, 4) is a point on the curve.

3.
    (i) Find the equation of the curve. [4]

    (ii) A line with gradient $-\frac{1}{2}$ is a normal to the curve. Find the equation of this normal, giving your answer in the form $ax + by = c$. [4]

    (iii) Find the area of the region enclosed by the curve, the x-axis and the lines $x = 1$ and $x = 2$. [4]

4. A curve is such that $\frac{dy}{dx} = \frac{4}{\sqrt{(6-2x)}}$, and $P(1, 8)$ is a point on the curve.

    (i) The normal to the curve at the point P meets the coordinate axes at Q and at R. Find the coordinates of the mid-point of QR. [5]

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

5.
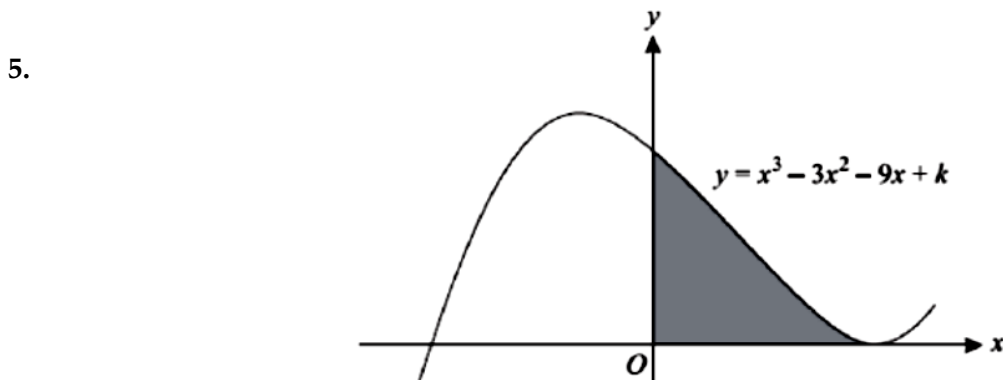
The diagram shows the curve $y = x^3 - 3x^2 - 9x + k$, where k is a constant. The curve has a minimum point on the x-axis.

    (i) Find the value of k. [4]

    (ii) Find the coordinates of the maximum point of the curve. [1]

    (iii) State the set of values of x for which $x^3 - 3x^2 - 9x + k$ is a decreasing function of x. [1]

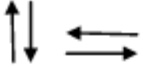   (iv) Find the area of the shaded region. [4]

9

Subject: Computer

Lesson: This lesson is about writing pseudocode from a flowchart.

Inquiry:
Can you describe the functions of various shapes used to draw a flowchart? There must be a matching programming construct (Selection, iteration etc.) for each of flowchart symbol, try to trace out the connection.

Information
To convert flowcharts to pseudocode, you must understand exactly what is described in the flowchart in order to translate it. Flowcharting is a tool for graphically representing the processes that will be performed by a program. In most cases these flowcharts use graphic symbols that represent decisions or processes and terminators and arrows to graphically represent what conditions initiate specific processes to be performed.

| Symbol	Name	Function
	Process	Indicates any type of internal operation inside the Processor or Memory
	input/output	Used for any Input / Output (I/O) operation. Indicates that the computer is to obtain data or output results
	Decision	Used to ask a question that can be answered in a binary format (Yes/No, True/False)
	Connector	Allows the flowchart to be drawn without intersecting lines or without a reverse flow.
	Predefined Process	Used to invoke a subroutine or an Interrupt program.
	Terminal	Indicates the starting or ending of the program, process, or interrupt program
	Flow Lines	Shows direction of flow.

Here are the steps describing how we can write a pseudocode form a given flowchart.
1. Locate the stating location of the chart
2. Write down pseudocode statement for each shape in flowchart
3. Write the pseudocode that is equivalent to the rectangular process boxes in your diagram. For example, a process box that assigns zero to an identifier Sum, translates to Sum ← 0
4. Write the pseudocode for the diamond-shaped decision boxes in your diagram. The decisions are replaced by If… Then… Else structure. The true or yes condition is stated in the IF portion of your pseudocode. The false or no condition is stated in the THEN portion of your pseudocode.
5. Write the pseudocode for the output, what your pseudocode is expected to do?

6. Combine all of your converted statements above and you have a flowchart that has been converted to pseudocode.

- For more information, please Read what your textbook says about the topic (pages 231 -233)
- Please watch the YouTube video (https://youtu.be/vOEN65nm4YU)
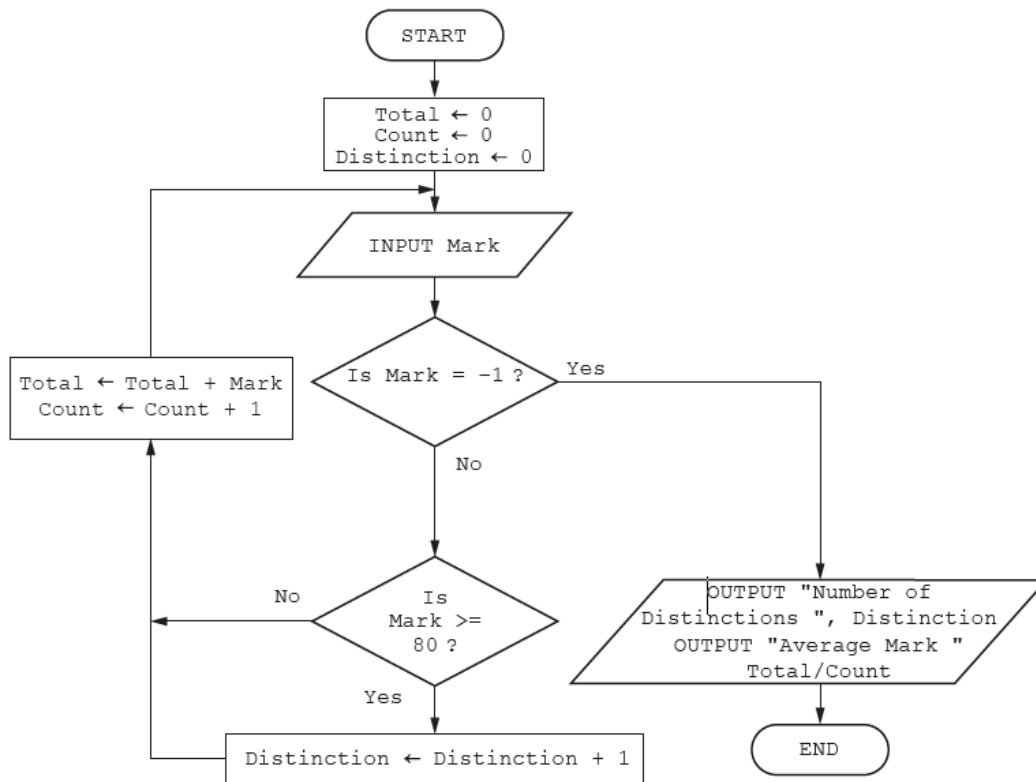
Practising:

Practice Question 1. Write down pseudocode for the flowing flowchart
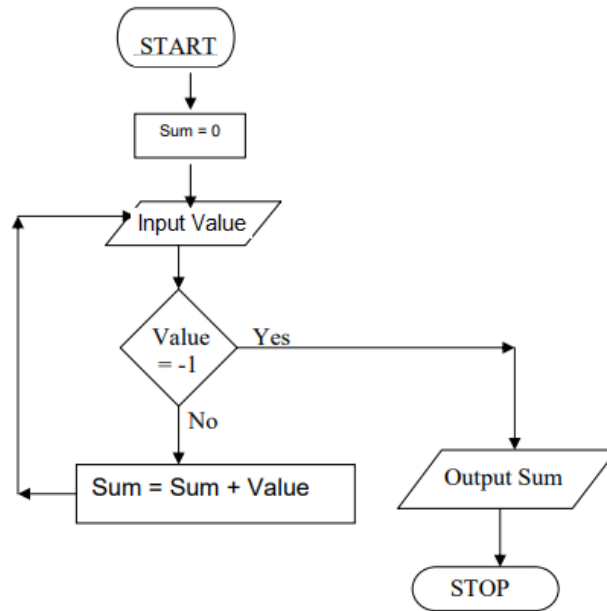
Practice Question 2. Write down pseudocode for given flowchart.
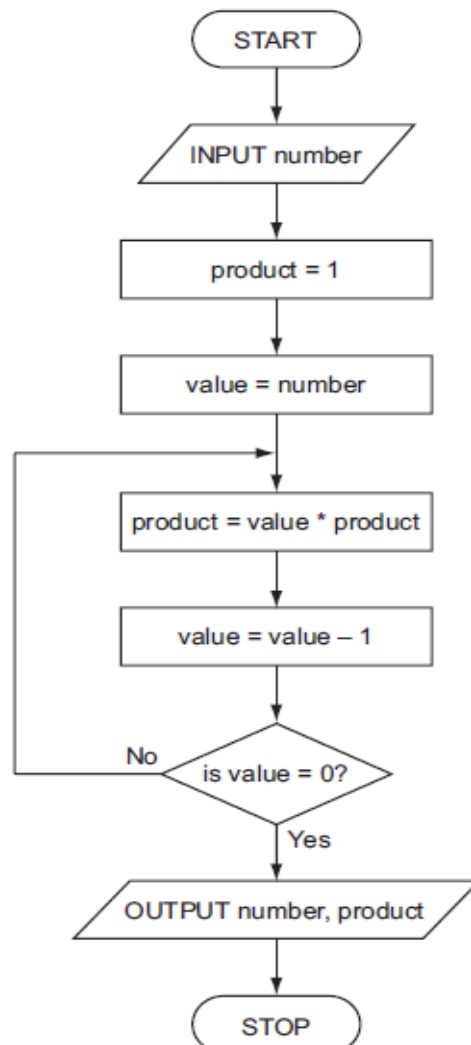
Practice Question 3. Write down pseudocode form given flowchart.

Inquiry

Full costing technique

Full costing allocates all costs to each product. If the business is only producing one type of product, then this is not a problem.

In this case, the stages in full costing are:

- ✔ Identify and add up all of the direct costs.
- ✔ Calculate the total overheads of the business for a given time period.
- ✔ Add the total direct costs of making the product.
- ✔ Calculate the average cost of producing each product by dividing total costs by output.

Assume

A pump manufacturer produces 5 000 pumps per year.

Total direct costs = $100 000

Total overhead costs = $50 000

Full cost of producing pumps = $150 000

Average (or unit) full cost per pump = $30

Comment

This is a straightforward calculation as there is just one product being made. The main problem arises when a business produces two or more products. How should indirect expenses then be divided up between the two (or more) products? The division of indirect costs is called an 'allocation of indirect costs'. The easiest way is to divide total overhead costs by the number of different products being produced. In the following example, a manufacturer produces both Product A and Product B.

Synthesis/ Absorption of Information

Heath Electronics (HT)

HT produces two products: a pump for central heating systems and an extractor fan. Both products pass through two process cost centres during their manufacture. Different equipment is used for each product. The direct labour and material costs have been identified and allocated to the two products (see Table 31.4). The management accountant has been asked to calculate the full cost of both products. This will allow the unit cost to be calculated as a basis for pricing decisions. In 2021, 50 000 pumps and 40 000 fans were produced.

	Pump ($000)	Fan ($000)
Machining and assembling department:		
Direct materials	100	130
Direct labou	170	50
Testing department:		
Direct labour	30	20
Total overheads of the business in 2021 ($000):		
Rent	60	
Electricity	20	
Administration	80	
Depreciation	40	
Total overheads	200	

Table 31.4

1 a Calculate the average direct cost of producing each product.

b Allocate total overhead costs in proportion to the direct costs incurred.

c Calculate the average (unit) full cost of each product.

2 Analyse **two** ways in which this cost information might be useful to HT's managers.

3 Discuss the uses and limitations of full costing.

Practice Questions

Exam style 6. (Page no: 529)

Subject: Accounting

Irrecoverable and Doubtful Debts

Inquiry

Do you know some times by all means there is no chance to recover form debtors? What may be the reasons behind this loss? And how this loss is considered in final accounts of any business? If there is a risk to be bad debts in future then how provisions are considered in final accounts.

Information

(i) With many businesses a large proportion, if not all, of the sales are on credit. The business is therefore taking the risk that some of the customers may never pay for the goods sold to them on credit. This is a normal business risk and such bad debts are a normal business expense. They must be charged to profit and loss as an expense when calculating the profit or loss for the period. The other thing that needs to be done is to remove the bad debt from the asset account. Usually, this will mean closing the debtor's account, but not always. When a debt is found to be 'bad', the asset as shown by the debt in the debtor's account is worthless. It must be eliminated from the account. This is done by crediting the debtor's account to cancel the asset and increasing the expense account of bad debts by debiting it there.

(ii) Sometimes, a debt written off in previous years is recovered. When this happens, we:

1 Reinstate the debt by making the following entries:
Dr Debtor's account
Cr Bad debts recovered account
2 When payment is received from the debtor in settlement of all or part of the debt:
Dr Cash/bank
Cr Debtor's account

(iii)   The accounting entries needed for the provision for doubtful debts are:

Year in which provision is *first* made: 1 Debit the profit and loss account with the amount of the provision (i.e. deduct it from gross profit as an expense). 2 Credit the *Provision for Doubtful Debts Account*.
If provision has increased as compared to previous year: 1 Debit Profit and Loss Account with the increase in the provision (i.e. deduct it from gross profit as an expense). 2 Credit the Provision for Doubtful Debts Account.
If provision has decreased as compared to previous year: 1 Debit Provision for Doubtful Debts Account. 2 Credit Profit and Loss Account (i.e. add it as a gain to gross profit).

(iv)   Read page no. 130 of your text book.

Practice

(i)   Solve a practice exercise no. 1 which is on page no. 131

Subject: Economics

Lesson is about benefits of free trade

Inquiry:

What are the advantages of free trade?
Can countries benefit from trade even if they do not export much?
What are the negative effects of free trade?
Why free trade is very important in comparative advantage?

Information: Benefits of free trade

These include the following:

- World output can be increased.
- Resources are allocated more efficiently.
- Consumers may have a wider range of products to choose from.
- This can contribute to a substantial increase in economic growth.
- It will lead to an improved standard of living and quality of life.
- Trading possibility curve

Trading possibility curve:

A trading possibility curve shows how an economy can benefit from specialising and trading. For example, a country may be able to produce a maximum of 50 million units of clothing or 100 million units of food. For every 1 unit of clothing it produces it gives up the opportunity to produce 2 units of food. Engaging in international trade may enable the country to specialise in clothing production and import three units of food for every unit of clothing it exports. In this case, trading will increase the total quantity of products the country can consume. If the country had initially produced 40 million units of clothing, the maximum output of food it could produce would be 20 million units.

If, however, it engages in international trade, it can specialize in clothing production making 50 million units of clothing. It can export 10 million units of clothing in exchange for 30 million units of imported food, enabling it to move from point A to point B and enjoy more products.

A reduction in trade barriers will bring about a greater degree of free trade and this process of trade liberalisation will lead to trade creation.

Trade creation:

This occurs when the removal of tariff s allows members to specialise in those products in which they have a comparative advantage. More expensive domestic products can be replaced by imports from another member country that are lower in price.

Please read what your textbook says about the benefits of trade

Please watch this brief YouTube video on benefits of trade

(https://www.youtube.com/watch?v=B6Qqk72HYNc)

Synthesising/absorbing the information

Write your own summary notes in your notes book based on the information you read in your textbook and what you saw on the youtube video.

Practising:
Explain two possible benefits of international trade for developing countries.

Subject: Law

Attempt data response question no 1 of May/June 2023 Paper 22.

Subject: Psychology

Chap No. 4 - Learning Approach
Page No. 148 - 149
Solve Exam style questions