SADIQ PUBLIC SCHOOL

Do the right, fear no man

Class: H2   Homework Worksheet

Friday, 9th February 2024

Subject: Physics

Solve the Q1 of paper 5

1 A student wishes to investigate projectile motion.

A small ball is rolled with velocity v along a horizontal surface. When the ball reaches the end of the horizontal surface, it falls and lands on a lower horizontal surface. The vertical displacement of the ball is p and the horizontal displacement of the ball is q, as shown in Fig 1.1.
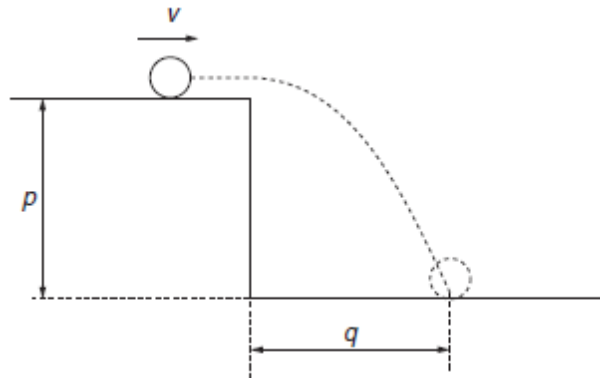

Fig. 1.1

It is suggested that

$$gq^2 = 2pv^2$$

where g is the acceleration of free fall.

Design a laboratory experiment to investigate how q is related to p and how v may be determined from the results. You should draw a diagram, on page 3, showing the arrangement of your equipment. In your account you should pay particular attention to

(a) the procedure to be followed,

(b) the measurements to be taken,

(c) the control of variables,

(d) the analysis of the data,

(e) the safety precautions to be taken.

[15]

Diagram

Subject: Chemistry

Lesson4- Thin Layer Chromatography

A: Inquiry

to determine the identity of the components of a mixture (usually by comparison with known compounds).3.to determine the amounts of the various components present in a mixture (usually by comparison with a standard).

B: Information:

All chromatographic techniques involve a stationary phase and a mobile phase. The components in a mixture are separated because of their differences in affinity for the stationary and mobile phases.

There are two basic phenomena that may be exploited to bring about separation of the components of a mixture: adsorption and partition.

The different components of the mixture separate from each other as they have different tendencies to be adsorbed onto the surface of the solid particles. The more polar the particles, the greater the tendancy they will have to be adsorbed on the stationary phase.

C. Practising

1- A student uses thin-layer chromatography (TLC) to analyses a mixture containing different metal cations. The student repeats the experiment using different solvents. Fig. 6.1 shows the chromatogram obtained by the student using water as a solvent.
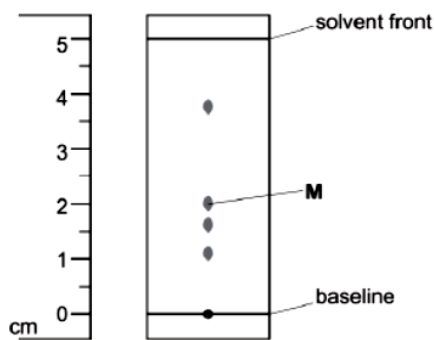
(a) (i) Suggest a compound that could be used as the stationary phase in this experiment.

.... [1]

(ii) Table 6.1 shows the Rf values for different metal cations when separated by TLC using water as a solvent.

cation	R_f value (water)
$Cd^{2+}(aq)$	0.40
$Co^{2+}(aq)$	0.77
$Cu^{2+}(aq)$	0.32
$Fe^{3+}(aq)$	0.12
$Hg^{2+}(aq)$	0.23
$Ni^{2+}(aq)$	0.75

Suggest the identity of the cation that causes the spot at Min Fig. 6.1. Explain your answer.

....

.... [1]

(b) The student repeats the experiment using butan-1-ol as a solvent. The metal cations do not travel as far up the TLC plate in this experiment. Suggest why the metal cations do not move as far up the TLC plate with butan-1-ol as a solvent.

....

.... [1]

(c) The student sprays the TLC plate in Fig. 6.1 with KSCN(aq).The colour of some of the spots changes, as some of the metal cations undergo a ligand exchange reaction.Identify the ligands involved in the ligand exchange reaction.

.... exchanges with ....

[1]

(d) A mixture of three different compounds, J, K and L, was analysed by thin layer chromatography

using a polar stationary phase and a non-polar mobile phase. The three compounds all have

similar molecular masses. The resulting chromatogram is shown.
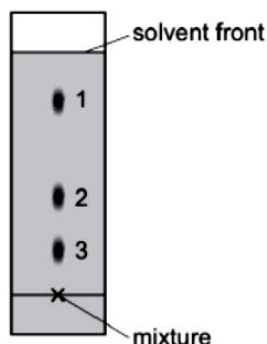
(i)   Identify which spot corresponds to each compound.

compound	spot
J CH_3COCO_2H	
K HO_2CCO_2H	
L $CH_3CH_2COCH_2CH_3$	

[1]

(ii) Explain your answers to (b)(i).

....

.... [1]

(iii) What is meant by the term Rf value?

....

.... [1]

Subject: Biology

Energy and respiration (Revision)

A) **Inquiry:**

Combustion of carbohydrates, like in a fireplace, is a reduction-oxidation reaction in which the carbon atom is oxidized and the oxygen atom is reduced, producing water and carbon dioxide. Oxidative phosphorylation and glycolysis are also reduction-oxidation reactions that produce the same products. Where do the cells of the body get energy from for carrying out activities?

B) **Information**

R.Q. Respiratory quotient

Definition

Is it ratio of volume or moles of CO_2 released to volume or moles of O_2 used in a fixed time by organism in respiration By calculating R.Q. value we can determine types of metabolism carried out by organism. It is possible to get a good idea of which respiratory substrate the cells in an organism are using by measuring the volume of oxygen it is taking in and the volume of carbon dioxide it is giving out It is also used to calculate B.M.R(Basal Metabolic Rate). If organism respires by using carbohydrate R.Q. will be: Carbohydrate R.Q=$\frac{CO_2}{O_2} = \frac{6}{6} = 1$,

Respiratory substrate	Respiratory quotient (RQ)
carbohydrate	1.0
lipid	0.7
protein	0.9

R.Q. decrease with increasing energy volume per unit mass of substance more energy means more C – H bonds and more $NADH^+$ generated more O_2 consumed during oxidative phosphorylation and decreasing the R.Q. value. In yeast / plant both anaerobic and aerobic respiration carried out and R.Q will be more than one.

How to calculate R.Q. value

Organisms respire and release CO_2, absorbed by KOH so meniscus will move upwards. This tube is graduated we directly note the volume of O_2 used Or it can be calculated by finding the diameter of tube and multiplying it with the distance moved (volume of Liquid in tube length πr^2). To calculate CO_2 released we can repeat experiment for same time without KOH. If the meniscus stays at the same position volume of CO_2 given off is equal to the calculate volume of O_2 used.If meniscus moves upwards then much lesser CO_2 is given of so that volume will be subtracted from the volume of O_2 calculated. If meniscus moves downwards means that much more CO_2 gave off so its volume will be added to volume of O_2.

Method

Record new positions of the manometer fluid at regular intervals for 30 minutes. When it nears the end of the scale on one side, restore it to its original position and note the new position of the syringe piston.Find the amount of oxygen absorbed by germinating seeds in a period of 30 minutes at 20 °C. This is $Vol1$. Remove the potassium hydroxide solution from both vessels and wash them out with water.

At 50°C manometer fluid travelled 47 mm in 50 s

Rate of respiration $= \frac{47}{50} = 0.94$ mm s^{-1}

At 30°C manometer fluid travelled 40 mm in 60 s

Rate of respiration $= \frac{40}{60} = 0.67$ mm s^{-1}

At 20°C manometer fluid travelled 21 mm in 70 s

Rate of respiration $= \frac{24}{70} = 0.34$ mm s^{-1}

Replace the basket containing seeds or invertebrates in vessel B, an equivalent volume of water in the other vessel and the bungs in both. Set up the respirometer a 20 °C again and record any increase or decrease in gas volume over the next 30 minutes. This is *Vol2*.

Now Calculate the volume of carbon dioxide produced.
The volume of oxygen absorbed is *Vol1*. This is recorded in the first part of the investigation. Vol2 is the volume of carbon dioxide produced minus the volume of oxygen absorbed. This is recorded in the second part of the investigation.
Therefore, *Vol1* + *Vol2* = the total volume of carbon dioxide produced.

$$RQ = \frac{Vol1 + Vol2}{Vol1}$$

RQ must be interpreted with care and, on occasion, may not really tell us very much. If an organism is respiring a mixture of compounds, the RQ that results will be the weighted average of the RQs of the mixture and will depend on the proportions of each substance involved.

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 respiration and its steps.

D) Practising. (Read your text book for detailed information)

Do practice of given question based on respiration.

(a) At the end of glycolysis in mammalian muscle tissue, pyruvate is formed. Pyruvate can be further metabolised along two different pathways, pathway 1 and pathway 2.

Fig. 6.1 outlines the two pathways.
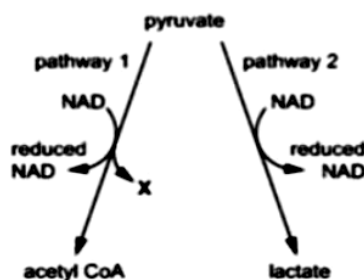
Fig. 6.1

(i) State the condition under which pyruvate would be metabolised along pathway 2.

.... [1]

(ii) Name compound X.

.... [1]

(iii) Name the two types of reaction that are involved in pathway 1.

....

.... [2]

:

6

(iv) Suggest a cell in a mammal that **cannot** carry out pathway 1.

Give a reason for your answer.

....

....

.... **[2]**

(v) ATP is synthesised during glycolysis.

Name the process by which ATP is synthesised.

.... **[1]**

Subject: Mathematics

Q.1   On a certain day in spring, the heights of 200 daffodils are measured, correct to the nearest centimetre. The frequency distribution is given below.

Height (cm)	4 – 10	11 – 15	16 – 20	21 – 25	26 – 30
Frequency	22	32	78	40	28

    (i) Draw a cumulative frequency graph to illustrate the data.   [4]

    (ii) 28% of these daffodils are of height h cm or more. Estimate h.   [2]

    (iii) You are given that the estimate of the mean height of these daffodils, calculated from the table, is 18.39 cm. Calculate an estimate of the standard deviation of the heights of these daffodils.   [3]

Q.2   A traffic camera measured the speeds, x kilometres per hour, of 8 cars travelling along a certain street, with the following results.

        62.7   59.6   64.2   61.5   68.3   66.9   62.0   62.3

    (i) Find $\Sigma(x - 62)$.   [1]

    (ii) Find $\Sigma(x - 62)^2$.   [1]

    (iii) Find the mean and variance of the speeds of the 8 cars.   [3]

Q.3   A random sample of 25 people recorded the number of glasses of water they drank in a particular week. The results are shown below.

        23   19   32   14   25
        22   26   36   45   42
        47   28   17   38   15
        46   18   26   22   41
        19   21   28   24   30

    (i) Draw a stem-and-leaf diagram to represent the data.   [3]

Q.4   The age at which a child first walked (to the nearest month) was recorded for 8 children. The results were as follows.

        12   11   16   19   10   12   12   13

Calculate the mean and standard deviation of the data.   [3]

Q.5   A survey was made of the number of people attending church services on one particular Sunday morning. A random sample of 500 churches was taken. The results are as follows.

Number of people attending	1–20	21–40	41–60	61–100	101–200	201–300
Number of churches	46	110	122	100	86	36

    (i) Draw a histogram on graph paper to represent these results.   [5]

    (ii) Find the probability that, in each of 3 churches chosen at random from the sample, the number of people attending was less than 61.   [2]

Subject: Computer

Lesson: This lesson is a continuation of "Object Oriented Paradigms". That aims to reinforce object oriented paradigms through past papers question solving activity.

Inquiry

Why do programmers today do not prefer traditional imperative programming style. Name the powerful features of Object Oriented Programming which have empowered programmer in this era of technology.

Information

Refer to Thursday, 8th February lesson as this lesson is a continuation of same concepts.

Synthesising/Absorbing the information

- Revise your book contents pages 501 - 521
- Watch youtube video: https://youtu.be/pTB0EiLXUC8
- Add on important aspect discussed into your revision notes.

Practising

Attempt the following questions based on "Object Oriented Paradigm".

Q. 1.

A computer game is being developed using object-oriented programming. The following image is a screenshot from the game.

There are scenery elements and animated elements. The player's character is one of the animated elements. Each game element has the attributes:

Attribute	Description	Example value
PositionX	The x coordinate of the game element.	92
PositionY	The y coordinate of the game element.	106
Width	The width of the game element.	150
Height	The height of the game element.	200
ImageFilename	The filename of the image file for the game element.	GameElementFrame1.png

Each game element has a method, GetDetails() that returns a string containing all the element's attributes. The player's character is one of a number of animated elements. All animated elements have the attributes:

Attribute	Description	Example value
AnimationFrames	An array of GameElement	
Direction	A string giving the direction the object is travelling in.	"Left"
Strength	A value for the strength that indicates the power of the object.	2000
Health	A value for the health that indicates the health of the object.	100

The player's character can either move left or right, or jump.

(a) Complete the following class diagram for the game.
You do not need to include any additional get or set methods. [3]

GameElement
PositionX: INTEGER PositionY: INTEGER Width: INTEGER Height: INTEGER ImageFilename: STRING
Constructor() GetDetails()

AnimatedElement
AnimationFrames: ARRAY OF GameElement ....
Constructor() AdjustHealth() AdjustStrength() DisplayAnimation()

Scenery
CauseDamage: BOOLEAN DamagePoints: INTEGER
Constructor() GiveDamagePoints()

Player
....

(b) Write **program code** to define the GameElement class. [6]

Programming language ....

Program code

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(c) The Scenery() class has two attributes, CauseDamage and DamagePoints.

If the attribute CauseDamage is TRUE, then the scenery element can cause damage.

The method GiveDamagePoints() checks whether the object can cause damage. If the object can cause damage, the method returns the integer value of the DamagePoints attribute.

Write **program code** for the Scenery class. [6]

Programming language ....

Program code

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(d) A new scenery object, GiftBox, is to be created.

(i) The attributes of GiftBox are as follows:

Attribute	Value
PositionX	150
PositionY	150
Width	50
Height	75
ImageFilename	"box.png"
CauseDamage	TRUE
DamagePoints	50

Write **program code** to create an instance of GiftBox.   [3]

Programming language ....

Program code

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(ii) An additional method, GetScenery(), returns all the attributes of the Scenery class.

Write **program code** for the GetScenery() method.

You should use the GetDetails() method that the Scenery class inherits from the GameElement class.

Programming language ....

[3]

Program code

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Q. 2.

X-Games is an international extreme sports competition.

A program will store and process data about the teams in the competition.

- Each team is made up of members.
- Members can be added and removed from each team.
- Each member has a first name, last name, date of birth and gender.
- Each member can be an official or a competitor.
- Each official has a job title and may be first-aid trained.
- Each competitor takes part in one sport.

The program is written using object-oriented programming.

The program can output the full name and date of birth of any member. For example, "Nadia Abad 16/05/1995"

An introduction about a team member can be output using their name. For example, "Hello, I'm Nadia Abad".

The program outputs a different version of the introduction for a competitor. This version includes the competitor's sport. For example, "Hello, I'm Sally Jones and my sport is Skateboard Park."

(a) Complete the following class diagram to show the attributes, methods and inheritance for the program. You do not need to write the get and set methods.

Member
FirstName : STRING
LastName : STRING
DateOfBirth : DATE
Gender : STRING
Constructor()
Introduction()
DisplayFullnameAndDateOfBirth()

Team
TeamName : STRING
TeamList : ARRAY OF Member
Constructor()
....
....

Competitor
Sport : STRING
Constructor()
Introduction()

Official
....
....
Constructor()
DisplayJobTitle()

[3]

(b) Write **program code** for the Member class. [5]

Programming language ....

Program code

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(c) Write **program code** for the Competitor class. [5]

Programming language ....

Program code

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(d) Omar Ellaboudy is an official at X-Games. He is first-aid trained and his job title is Judge. He is male and was born on 17/03/1993.

Write **program code** to create an instance of an object with the identifier BMXJudge. All attributes of the instance must be fully initialised.

Programming language .... [3]

Program code

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Q. 3.

A circus is made up of performers. There are three types of performer: clown, acrobat and aerial.

The following data are stored for each performer.

• First name

• Last name

• Secondary role (that can be edited)

• Stage name (that can be edited)

• Type of performer (PerfType)

The following statements apply to performers.

• An acrobat may or may not use fire in his or her act.

• An aerial performer can be one of two types: either catcher or flyer.

• Each clown has an item, such as a water-spraying flower or a unicycle.

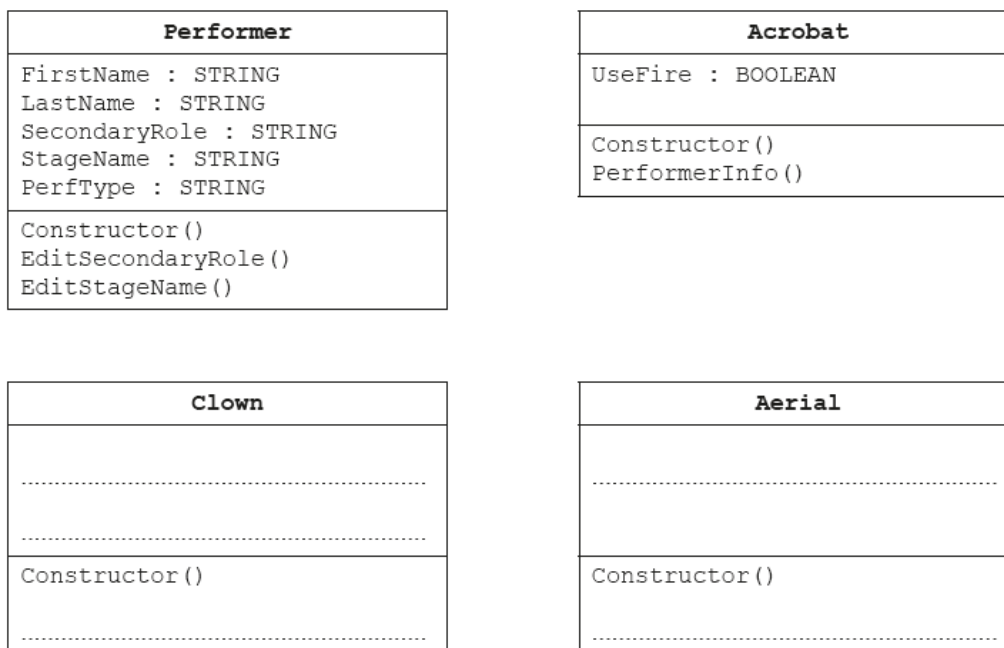• Each clown also has a musical instrument, such as a guitar or an oboe.

Each of the three types of performer has a method that will display all of the information about that performer in a specific format. For example:

> Sally Superstar (real name Sally Smith) is an acrobat. Fire is part of Sally Superstar's act. When not performing, Sally Superstar is a set changer.

(a) Complete the following class diagram to show the **attributes**, **methods** and **inheritance** for the program.

You do not need to write the get and set methods. [4]

Performer
FirstName : STRING LastName : STRING SecondaryRole : STRING StageName : STRING PerfType : STRING
Constructor() EditSecondaryRole() EditStageName()

Acrobat
UseFire : BOOLEAN
Constructor() PerformerInfo()

Clown
....
Constructor() ....

Aerial
....
Constructor() ....

(b) Write **program code** for the Performer class. [5]

Programming language ....

Program code

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(c) The program will display the acrobat information as follows:

Sally Superstar (real name Sally Smith) is an acrobat. Fire is part of Sally Superstar's act. When not performing, Sally Superstar is a set changer.

Write **program code** for the Acrobat class. [8]

Programming language ....

Program code

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(d) Information about a performer is as follows:

> Amazing Alex (real name Alex Tan) is an acrobat. Fire is part of Alex's act. When not performing, Amazing Alex is a popcorn seller.

(i) Write **program code** to create an instance of an object with the identifier Acrobat_1. [3]
All attributes of the instance should be fully initialised.

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(ii) Explain **inheritance** with reference to the circus example. [2]

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Q. 4.

A program is to be written using Object-Oriented Programming (OOP) for a shop that sells knitting yarn.
There are three types of yarn: acrylic, wool or mix.
The following data are stored for each type.

• Name
• Colour
• Batch code
• Weight
• Number of balls of yarn in stock (can be edited)
• Type of yarn

The following statements apply to yarn.
• Acrylic can be soft or not soft.
• Wool can be lamb, merino or alpaca.
• Mix contains a percentage of acrylic.

Each type of yarn has a method that will display all the information about the yarn.

(a) Complete this class inheritance diagram to show the **properties**, **methods** and **inheritance**.[5]

```
┌────────────────────────┐
│          Yarn          │
├────────────────────────┤
│ Name: STRING           │
│ Colour: STRING         │
│ BatchCode: STRING      │
│ Weight: INTEGER        │
│ NumberBalls: INTEGER   │
│ Type: STRING           │
├────────────────────────┤
│ Constructor()          │
│ EditNumberBalls()      │
│ YarnInfo()             │
└────────────────────────┘
```

```
┌────────────────────────┐    ┌────────────────────────┐    ┌────────────────────────┐
│        Acrylic         │    │          Wool          │    │          Mix           │
├────────────────────────┤    ├────────────────────────┤    ├────────────────────────┤
│                        │    │                        │    │ Percentage: INTEGER    │
│ ...................... │    │ ...................... │    ├────────────────────────┤
├────────────────────────┤    ├────────────────────────┤    │ Constructor()          │
│ Constructor()          │    │ Constructor()          │    │ YarnInfo()             │
│                        │    │                        │    └────────────────────────┘
│ ...................... │    │ ...................... │
└────────────────────────┘    └────────────────────────┘
```
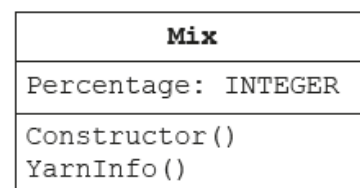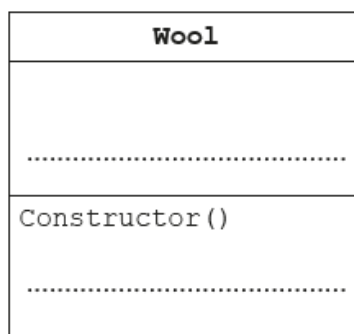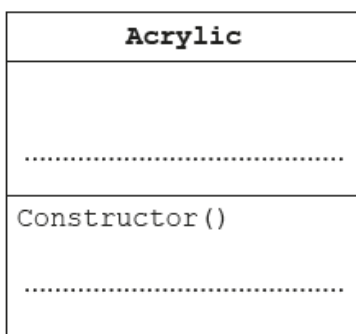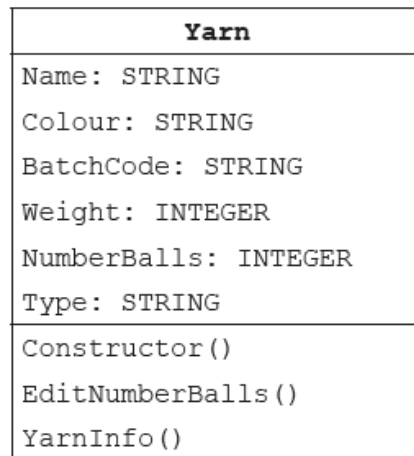
(b) Describe what is meant by the terms **properties**, **methods** and **inheritance**. [6]

Properties ....

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Methods ....

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Inheritance ....

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Q. 5.

(a) Define these Object-Oriented Programming (OOP) terms: [2]

Instance ....

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Polymorphism ....

....

(b) In OOP, a class contains attributes and methods.
Complete the pseudocode for the class Car to enable objects to be created. The class needs to include:
• string attributes to store the make, model, body type and fuel type
• an integer attribute to store the number of cars of that type built.

The attributes must be available only through the methods of the class.   [5]

```
CLASS ....................................

    PRIVATE Make : STRING

    PRIVATE ...............................................

    ...........................................................

    ...........................................................

    ...........................................................

    PUBLIC PROCEDURE New(CarMake : STRING, ............................................... ,

                        ...........................................)

        Make ← ...................................

        Model ← ...................................

        BodyType ← CarBodyType

        Fuel ← ""

        NumberBuilt ← 0

    ENDPROCEDURE

    GetFuel()

    GetNumberBuilt()

    ....................................                                    ---
```

Q. 6.

(a) Define these Object-Oriented Programming (OOP) terms: [3]

Constructor: …..

....

Getter:..

....

Setter:..

....

(b) A school has a program written using OOP to maintain its staff and student records. The object SubstituteTeacher allows the details of the school's substitute teachers to be stored. This includes their full name, telephone number and whether or not they are in school today. For example:

SubName	Sarah Jones
Telephone	01223658721
InSchool	TRUE

Complete the diagram for the object SubstituteTeacher, including appropriate properties and their getters and setters. [3]

SubstituteTeacher
SubName : STRING
....
InSchool : BOOLEAN
....
SetTelephone(Tel : STRING)
....
GetSubName()
....
....
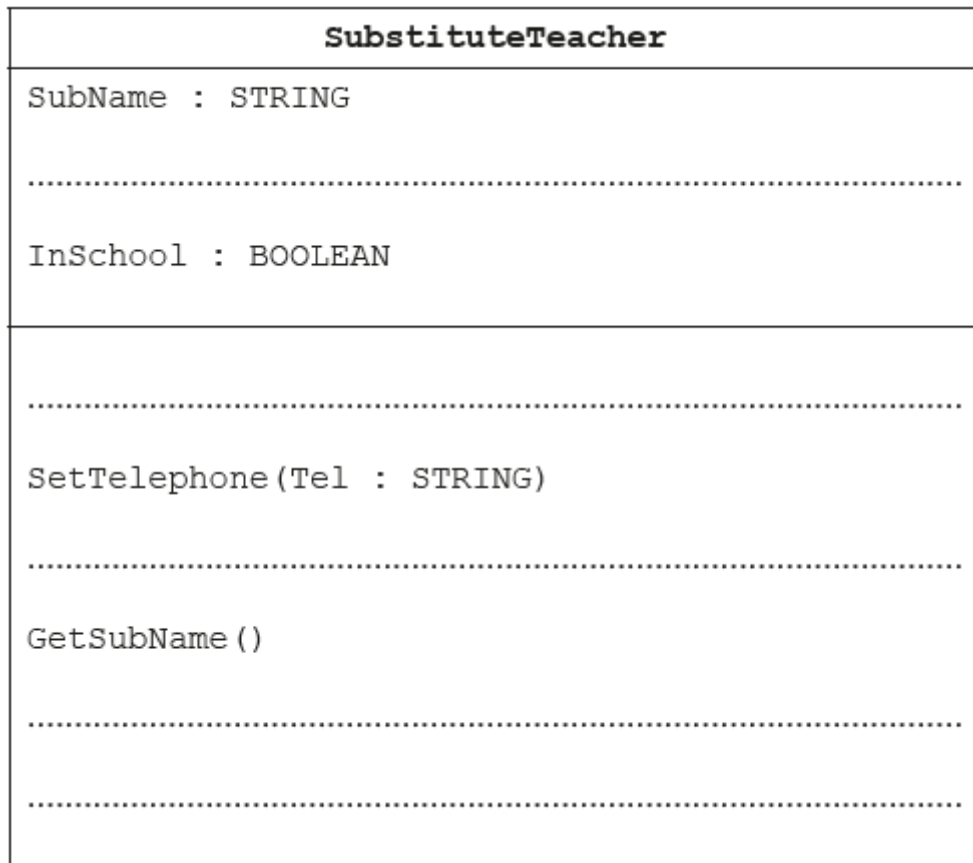
Subject: Business Studies

Topic: Analysis of published accounts

Reinforce the concept of gearing ratio through text book and lecture given in class and attempt following questions.

The Peoples' Pleasure Park (PPP) in Country X has a gearing ratio of 65%. The directors of this public limited company recently arranged increased borrowing to expand the facilities in the park. This was because they had forecast increased demand from major sporting events that were planned in Country X. Two of these have been cancelled because of fear of hurricanes in the area. PPP is left with a high level of debts and expanded facilities but no more customers. Profit is expected to be 50% of last year's level and net cash flow will be lower this year too.

Q1. Analyse the problems PPP will face as a result of its high gearing ratio.

Q2. Evaluate two methods the directors could use to improve the gearing ratio.

Subject: Accounting

<center>**Activity- Based Costing (ABC)**</center>

Inquiry

Students do you remember what is OAR?   How did you deal over/under absorption of overhead in a business? Cost calculation under total costing system had been arbitrary. ABC is a new system for exact calculation of cost as a whole and per unit as well. In this new system there is no concept of over/under absorption of FOH costs.

Information

(i)   This costing system is used in target costing, product costing, product line profitability analysis, customer profitability analysis, and service pricing. Activity-based costing is used to get a better grasp on costs, allowing companies to form a more appropriate pricing strategy.

The formula for activity-based costing is the cost pool total divided by cost driver, which yields the cost driver rate. The cost driver rate is used in activity-based costing to calculate the amount of overhead and indirect costs related to a particular activity.

(ii)   **Cost drivers** are activities undertaken in each department; they are activates that are part of the process of making a product

(iii)   **Cost pools** are accounts that collet the costs incurred by each activity

(iv)   Stages in using ABC system are:

- Record and classify all costs
- Identify the activities producing the overhead cost
- Identify cost drivers
- Apportion appropriate overheads to the cost drivers
- Calculate the cost driver rate
- Absorb both indirect and direct costs into the product or service

(v)   Read from your text book page No. 569-571 relating to ABC

Practice

Solve four latest questions from topical past papers relating to ABC

Assessment

Solve question no.5 from 9706/31/M/J/16

Subject: Economics

Transfer earnings and economic rent

Inquiry:

When we see the term "rent," most of us think of the rental price of an apartment or a house. But when economists talk about an economic rent, they mean the difference between what a factor of production earns and what it could earn in the next-best alternative. Economic rent is different from rent seeking.

What is the difference between transfers earnings and economic rent?

Information: Transfer earnings and economic rent

Earnings of workers can be split into two elements, i.e. transfer earnings, and economic rent. Transfer earnings: the amount that is earned by a factor of production in its best alternative use. This is the minimum payment necessary to keep labour in its present use. This is shown by the area under the labour supply curve.
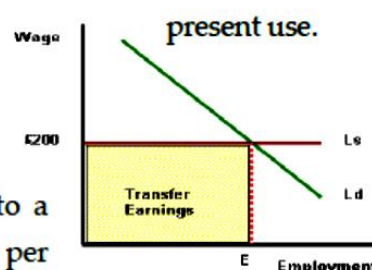
In the diagram above there is a perfectly elastic supply curve to a particular labour market. The ruling equilibrium wage is at £200 per week. The wage that workers receive is equal to the minimum they are prepared to supply their labour at. Thus the entire factor earnings are transfer earnings.

Economic rent: a payment made to a factor of production above that which is necessary to keep it in its present use.

Any payment to labour which is over and above transfer earnings.

For an upward sloping labour supply curve, total factor earnings comprise transfer earnings and economic rent. This is shown in the diagram below.

The market equilibrium wage is £250 per week where labour demand equals labour supply. Some of this is economic rent - the area above the labour supply curve for the occupation and below the market equilibrium wage. The more inelastic the labour supply, the greater the proportion of total earnings that is accredited as economic rent to the factor of production labour.
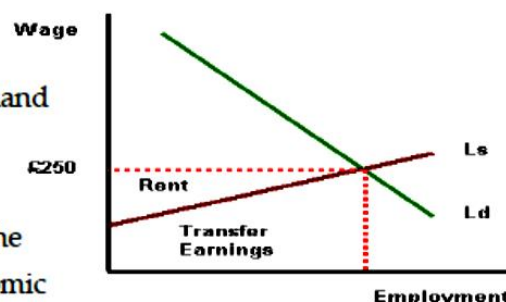
The amount of economic rent that a worker is able to obtain is limited by the fact that there is not usually a high level of mobility of labour; in fact, in many labour markets, there is a high degree of immobility of labour.

Economic rent will be greater the more inelastic the supply curve.

Exceptional talent

Exceptional talent such as the legendary squash player Jahangir Khan is scarce and is unique. The supply curve of such talented individuals is completely inelastic and the earnings consist entirely of economic rent. Transfer earnings will be zero because the talent will be supplied whether the payment received is zero or infinity.

Unskilled workers

Unskilled workers are usually available in abundant supply. Employers can usually hire many workers at wage W. In such cases supply curve is completely elastic and the earnings consist entirely of transfer earnings.
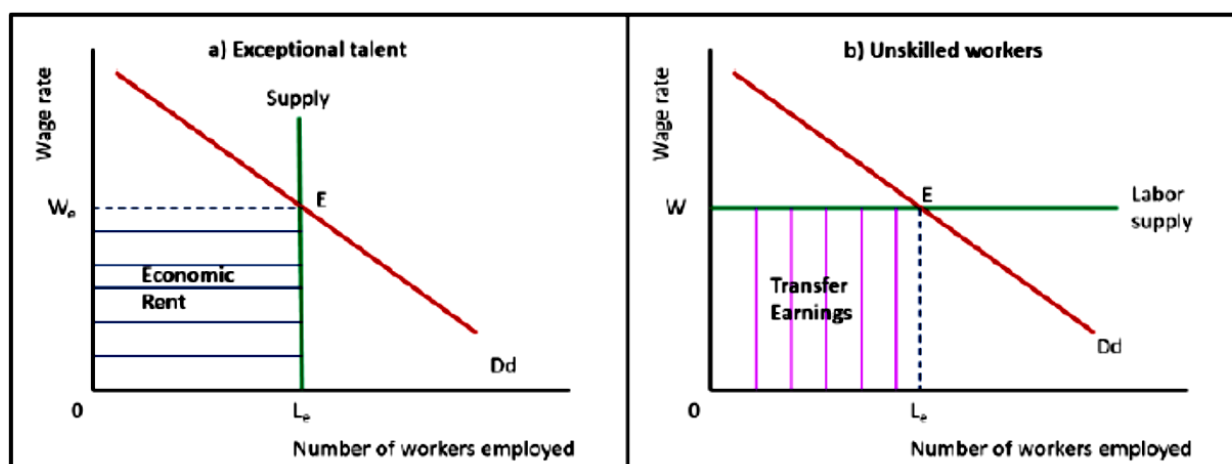
Please read what your textbook says about Transfer earnings and economic rent.

Please watch this brief YouTube video on transfer earnings and economic rent
(https://www.youtube.com/watch?v=cQgHaeOwTlc)

Synthesising/absorbing the information:
Write your own summary notes in your notebook based on the information you read in your textbook and what you saw on the youtube video.
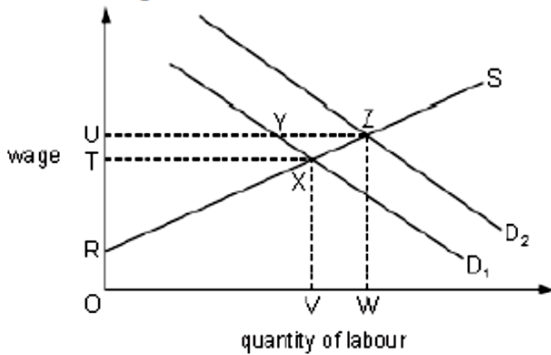
Practising:

MCQs

Choose the best option

1 An actor is paid $100 000 a year. The next best paid job he could get is as a lecturer at $60 000 a year.
What are his transfer earnings and his economic rent?

	transfer earnings	economic rent
A	$60 000	$40 000
B	$60 000	zero
C	$40 000	$60 000
D	$40 000	zero

2 In the diagram $D1$ and S are the initial demand and supply curves for building workers.

If the demand for building workers increases to $D2$ by how much does the economic rent earned by building workers rise?

A RZU   B TXZU   C VWZX   D XZY

Subject: Law

 Answer scenario question no. 1 of May/June 2023 paper 32.