QUESTION PAPER -2020

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SCIENCE AND TECHNOLOGY PAPER - 1

[Time : 2 hours] **[Max. Marks : 40]**

Note:

(i) All questions are compulsory.

(ii) Use of a calculator is not allowed.

(iii) The numbers to the right of the questions indicate full marks.

(iv) In case of MCQs (Q. No. l(A)) only the first attempt will be evaluated and will be given credit.

(v) For each MCQ, the correct alternative (A), (B), (C), (D) with sub-question number is to be written as answer.

For Eg : (i) (A), (ii) (B), (iii) (C)

(vi) Scientifically correct, labelled diagrams should be drawn wherever necessary.

Q. 1. (A) Write the correct alternative: **[5]**

(i) According to Mendeleev's periodic law, properties of elements are periodic function of their .....

(A) Atomic number **(B)** Atomic masses

(C) Densities **(D)** Boiling points

Answer: (B) Atomic masses.

(ii) The vapour content in the air is measured using a physical quantity called .....

(A) Absolute humidity **(B)** Relative humidity

(C) Dew point **(D)** Humidity

Answer: (A) Absolute humidity

(iii) For the normal human eye, the near point is at ..... cm.

(A) 10 **(B)** 20 **(C)** 25 **(D)** 30

Answer: (C) 25

(iv) The astronomical object closest to us is ..... is our galaxy.

(A) Mars **(B)** Venus

(C) Jupiter **(D)** Moon

Answer: (D) moon

(v) In the Wilfley table method, the particles of gangue are separated by ..... separation method.

(A) Magnetic **(B)** Froth floatation
(C) Hydraulic **(D)** Gravitational

Answer: (D) Gravitational

(B) Answer the following : **[5]**

(i) Find the odd one out : Voltmeter, Ammeter, Thermometer, Galvanometer.

Answer: Thermometer is odd.

(ii) Complete the correlation: Alkene : C = C : : Alkyne : .....

Answer: Alkene: C = C : : Alkyne : C ≡ C

(iii) State true or false : The frequency of AC is 50 Hz.

Answer: True

(iv) Match the Columns:

Column 'A'	Column 'B'
The wavelength of red light	(a) 600 nm
	(b) 700 nm
	(c) 500 nm

Answer: The wavelength of red light is (b) 700 nm

(v) Name the first artificial satellite sent by Russia in space.

Answer: Sputnik.

Q. 2. (A) Give scientific reasons (any two): **[4]**

(i) The weight of an object changes from place to place though its mass is constant.* (ii) Stars twinkle but we do not see the twinkling of planets. (iii) Elements belonging to the same group have the same valency.

Answer: **(A)**

(i) Answer is not given due to reduced syllabus.

(ii) Stars twinkle , but we do not see the twinkling of planets.

(1) Due to the motion of atmospheric air, changing air density and temperature, the apparent position of the star keeps changing a bit. Thus, the refractive · index of air keeps on changing continuously. So, the positions and brightness of the star keep changing continuously and hence the star appears to be twinkling.

(2) But planets are much closer to us as compared to stars. So, they do not appear as point sources. They appear as a collection of point sources. Due to the changes in atmospheric refractive index, the position as well as the brightness of individual point source change. But the average position and total average brightness remains unchanged. Hence, planets do not twinkle.

(iii) Elements belonging to the same group have the same valency.

(1) Valency of an element is defined as the number of electrons present in the outermost shell of its atoms, i.e. valence electrons.

(2) For all the elements in the same group, the number of electrons in the outermost shell are same. **(3)** Hence, the elements belonging to the same group have the same valency.

(B) Answer the following (any three): [6]

(i) How much heat energy is necessary to raise the temperature of 5 kg of water from 20°C to 100°C?

Answer: **Given data :** Mass of water (m) = 5 kg.

Change in temperature (ΔT) = 100 - 20 = 80°C c = 1 kcal/kg° C.

Calculation :

Energy to be supplied to water = Energy gained by water

= Mass of water × specific heat of water x Change in temperature of water

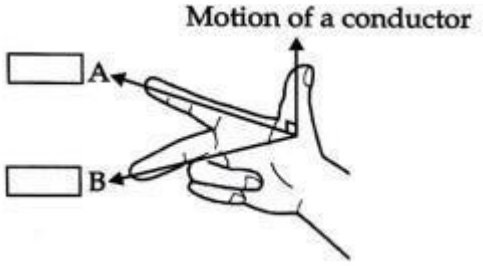
= m × c × ΔT

= 5 × 180 = 400

kcal.

∴ Heat energy necessary to raise the temperature of water = 400 kcal.

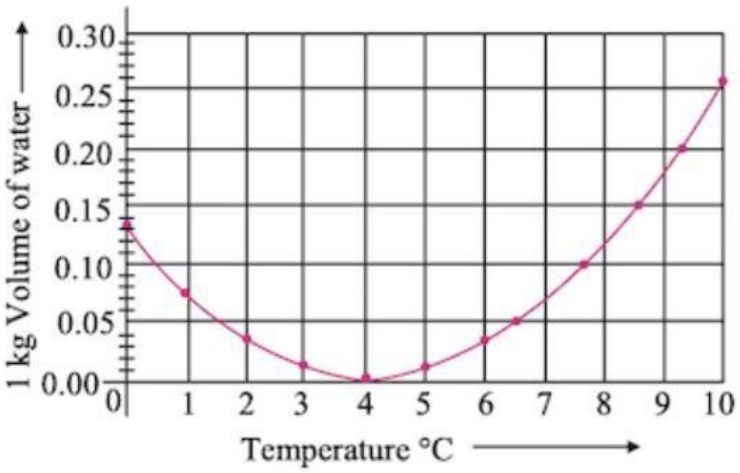
(ii) Observe the given figure of Fleming's Right Hand Rule and write the labels of A and B correctly.



Answer: (A) Direction of the magnetic field.

(B) Direction of the induced current.

(iii) Observe the given graph and answer the following questions:



(a) Name the process represented in the figure.

(b) At what temperature does this process take place?

Answer:

(a) The process represented in figure is Anomalous behavior of water. (b) This process takes place from $4°C\ to\ 0°C$.

(iv) Complete the given chemical reaction :

CuSO_4 (aq) + Fe (s) ..... + ...

Name the type of the reaction.

Answer: (1) $CuSO_4(aq) + Fe(S) \rightarrow FeSO_4(aq) + Cu(s)$

(2) The reaction is displacement reaction.

(v) Write a short note on Alloying.

Answer:

(1) An alloy is the homogenous mixture formed by mixing a metal with other metals or non-metals in a certain proportion and the process of making an alloy is called alloying.

(2) The main intension behind the alloying is to decrease the intensity of corrosion of metals.

(3) For example: Bronze is an alloy made from 90% copper and 10% tin. Statues made up of bronze are not affected by sun and rain.

(4) Stainless steel is an alloy formed from 74% iron, 18% chromium and 8% carbon.

Stainless steel does not get stains with air or water and also it does not rust. (5) In recent times, for mining coins, various types of alloys are used.

Q. 3. Answer the following (any five): [15]

(i) An element has its electronic configuration as 2, 8, 2. Now answer the following questions:

(a) What is the atomic number of this element?

(b) What is the group of this element?

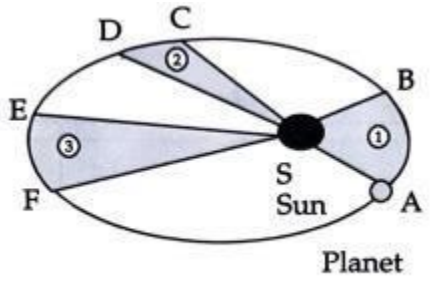
(c) To which period does this element belong?

Answer:

(a) Atomic number of the element with electronic configuration 2, 8, 2 is 12. (The element is Magnesium).

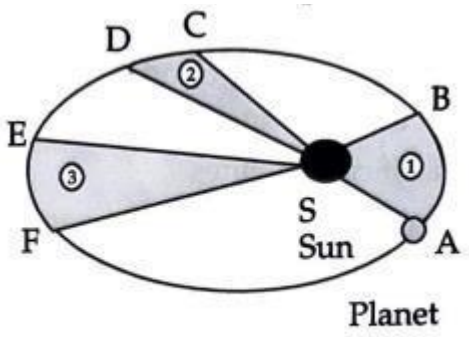
(b) Number of electrons in the outermost shell is 2. So, the element belongs Group 2. (c) The element has 3 shells in its electronic configuration. Hence, it belongs to period 3.

(ii) Observe the given figure showing the orbit of a planet moving around the Sun and write the three laws related to it:



The orbit of a planet moving around the Sun

Answer: The laws related to the given figure are Kepler's laws.



The orbit of a planet moving around the Sun

(1) Kepler's first law : The orbit of a planet is an ellipse with the sun at one of the foci.The given figure shows an elliptical orbit of a planet revolving around the sun. In the figure sun.

In the figure S indicates the position of the sun.

(2) Kepler's second law : The line joining the planet and the sun sweeps equal areas in equal intervals of time.

In the figure AB and CD are the distances covered by the planet in equal time. The straight lines AS and CS sweep equal area in equal interval of time. That is, area ASB and area CSD are equal.

(3) Kepler's third law: The square of its period of revolution around the sun is directly proportional to the cube of the mean distance of a planet from the sun. If r is the mean distance of the planet from the sun and T is its period of revolution then.

$$T^2 \alpha r^3$$

$$\therefore \quad \frac{T^2}{r^3} = constant$$

(iii) Read the given passage and answer the following questions:

The home electrical connection consists of 'live', 'neutral' and 'earth' wires. The 'live' and the 'neutral' wires have potential difference of 220 V. The 'earth' is connected to ground. Due to a fault in the equipment or if the plastic coating on the 'live' and the 'neutral' wires gives a way

the two wires come in contact with each other and a large current flows through it producing heat. If any inflammable material (such as wood, cloth, plastic, etc.) exists around that place it can catch fire. Therefore, a fuse wire is used as a precautionary measure.

(a) Name the two wires having potential difference of 220 V.
(b) What is short circuit?
(c) Write the function of a fuse.

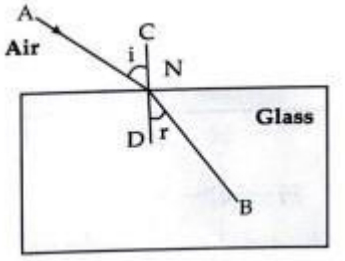
Answer:

(a) The 'live' and the 'neutral' wires have potential difference of 220 V.

(b) Due to a fault in the equipment or if the plastic coating on the 'live' and the 'neutral' wires gives away, then the two wires come in contact with each other and a large current flows circuit through it producing heat. This is called as short circuit. If any inflammable material (such as wood, cloth, plastic, etc.) exists around that place, it can catch fire.

(c) Fuse wire is used as precautionary measure. As soon as high current flows in a circuit, the fuse wire melts and breaks the circuit and any mishap is avoided.

(iv) Observe the given figure and answer the following questions:
(a) Name the process represented by the figure.
(b) State the two laws related to the process.



Answer:

(a) The given figure represent refraction.

(b) Laws of refraction :

(1) Incident ray and the refracted ray at the point of incidence N are on the opposite sides of the normal to the surface of the slab at that point i.e. CD, and the three the incident ray, refracted ray and the normal are in the same plane.

(2) For a given pair of media (here air and glass), and for a given color of light, the ratio of sine of angle of incidence (i) to the sine of angle of refraction (r) is constant.

(v) What is an artificial satellite? Name any two types of artificial satellite and state their functions.

Answer:

(l) If a manmade object revolves around the earth or any other planet in a fixed orbit, it is called an artificial satellite.

(2) The two types of artificial satellites.

(a) Weather satellite: Its function is study and prediction of weather. **(b)** Broadcast satellite: Its function is to telecast television programs.

(vi) Answer the following questions :

(a) Define Hydrocarbons.

(b) Name the types of Hydrocarbons.

(c) Name two carbon compounds used in day-to-day life.

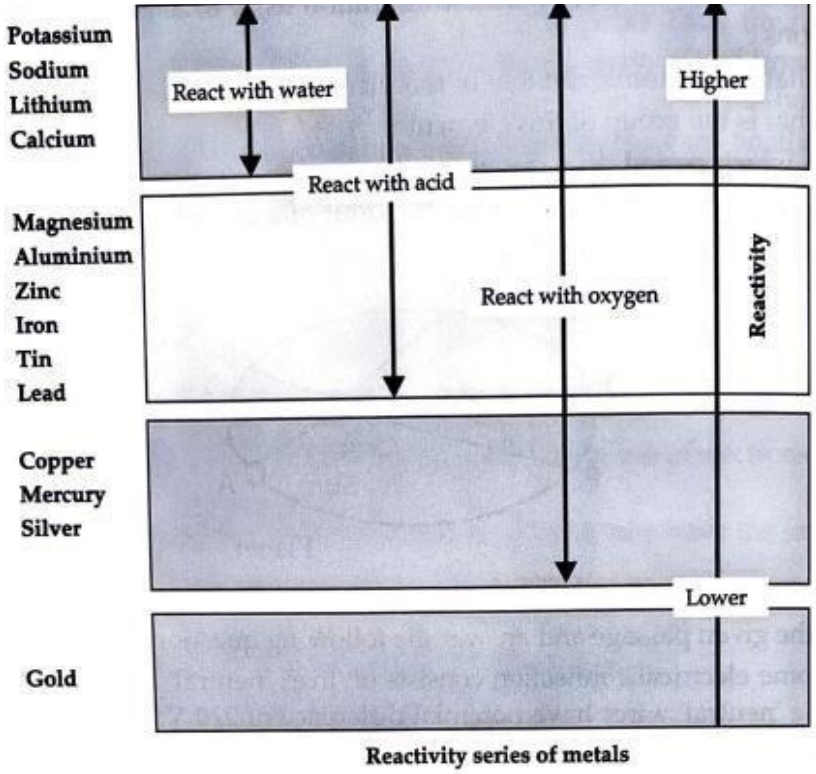
Answer:

(a) The compounds which contain carbon and hydrogen as the only two elements are called hydrocarbons.

(b) Types of hydrocarbons are saturated hydrocarbons and unsaturated hydrocarbons. Unsaturated hydrocarbons have double or triple bond between the carbon atoms unlike the saturated hydrocarbons in which all hydrogen atoms and carbon atoms are bonded together with single bonds. Both these types are further classified as straight chain hydrocarbons, branched chain hydrocarbons and cyclic hydrocarbons.

(c) -Polythene $[(CH_2 = CH_2)_n]$ which is used in production of carry bags. - Polyvinyl chloride (PVC) which is used in manufacture of PVC pipes

(vii) Observe the given figure of reactivity series of metals and answer the following:



Reactivity series of metals

(a) Name two metals which react with water.

(b) Name two moderately reactive metals.

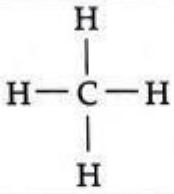
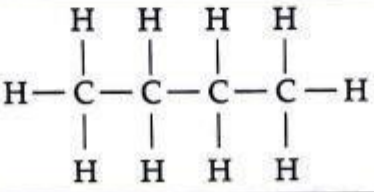
(c) Name the most highly reactive metal and the most less reactive metal.

Answer:

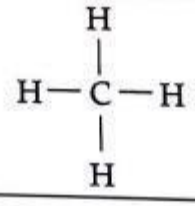
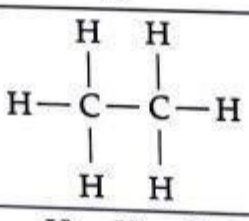
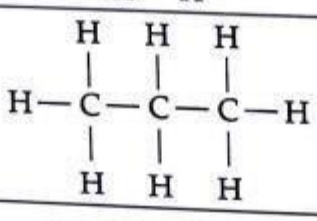
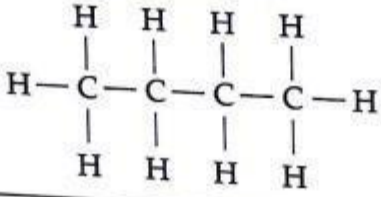
(a) Sodium and calcium react with water.

(b) Aluminium and zinc are the moderately reactive metals. **(c)** The most highly reactive metal is Potassium and the most less reactive metal is Gold.

(viii) Complete the following table :

Straight chain of Carbon compounds	Structural formula	Molecular formula	Name
C		CH_4	Methane
C—C	.....	.....	Ethane
C—C—C	.....	C_3H_8	.....
C—C—C—C		.....	.....

Answer:

Straight chain of Carbon compounds	Structural formula	Molecular formula	Name
C		CH_4	Methane
C—C		C_2H_6	Ethane
C—C—C		C_3H_8	Propane
C—C—C—C		C_4H_{10}	Butane

Q. 4. Answer any one of the following : **[5]**

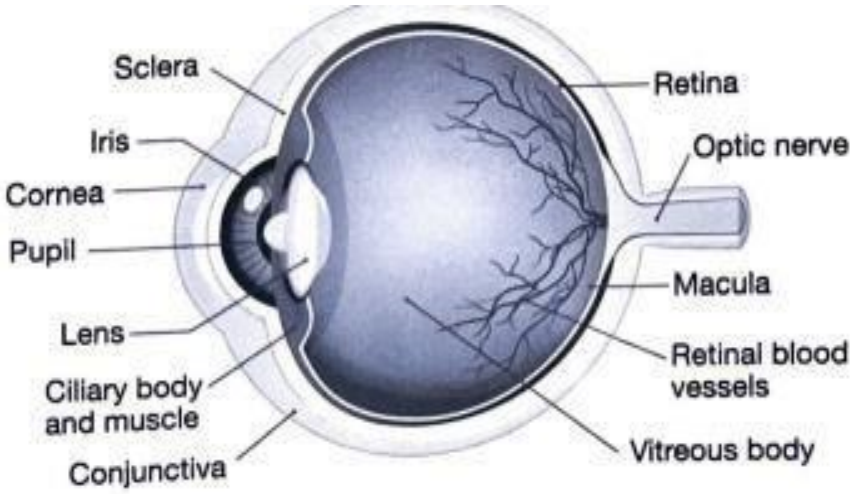
(i) Draw a scientifically correct labelled diagram of a human eye and answer the questions based on it:

(a) Name the type of lens in the human eye.

(b) Name the screen at which the maximum amount of incident light is refracted? (c) State the nature of the image formed of the object on the screen inside the eye.

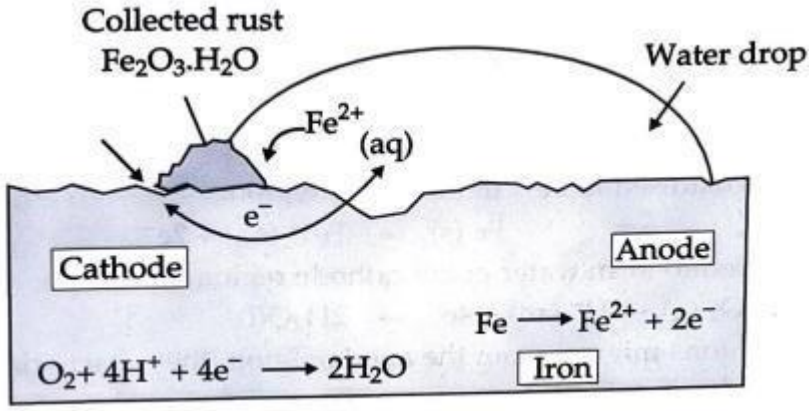
Answer

(i)



(a) Lens in the human eye is double convex transparent crystalline lens.
(b) Maximum amount of incident light is refracted inside the eye at the outer surface of the cornea.
(c) The image of the object formed on the screen inside the eye is real and inverted.

(ii) Observe the following picture and answer the following questions :



(a) What is a rust ?
(b) Write the chemical formula of rust.
(c) Write the reaction of oxidation of iron at anode.
(d) Write the reaction of oxidation of iron at cathode. **(e)** What is corrosion?

(ii)

(a) A certain type of reddish coloured solid layer collects on the metallic surface. This layer is called rust.
(b) Chemical formula of rust is $Fe_2O_3.H_2O$
(c) Iron (Fe) is oxidised to Fe^{2+} in the anode region.

$$Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$$

(d) O_2 is reduced to form water in the cathode region.

$$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(I)$$

When Fe^{2+} ions migrate from the anode region, they react with water and further get oxidized to form Fe^{3+} ions.

(e) Due to various components of atmosphere, oxidation of metals takes place, consequently resulting in their damage. This is called corrosion.

SCIENCE AND TECHNOLOGY PAPER - 2

[Time : 2 hours] **[Max. Marks : 40]**

Note:

(i) All questions are compulsory.

(ii) Use of a calculator is not allowed.

(iii) The numbers to the right of the questions indicate full marks.

(iv) In case of MCQs (Q. No. l(A)) only the first attempt will be evaluated and will be given credit.

(v) For each MCQ, the correct alternative (A), (B), (C), (D) with sub-question number is to be written as answer.

For Eg : (i) (A), (ii) (B), (iii) (C)

(vi) Scientifically correct, labelled diagrams should be drawn wherever necessary.

Q.1. (A) Choose the correct option and write its number for the following questions : [5]

(i) Transfer of information from molecule of DNA tom.RNA is called___process.

(A) Transcription
(B) Translation
(C) Translocation (D) Mutation

Answer: (A) Transcription

(ii) Body breaks up into several fragments and each fragment starts to live as a new individual. This is._____type of reproduction.

(A) Budding
(B) Fragmentation
(C) Regeneration
(D) Binary fission

Answer: (B) Fragmentation

(iii) Incomplete combustion of fuels leads to formation of. _____

(A) Carbon monoxide
(B) Carbon dioxide
(C) Chloroflurocarbon
(D) Hydrogen sulphide

Answer: (A) Carbon monoxide

(iv) The spindle fibres start appearing from._____stage of karyokinesis.

(A) Prophase

(B) Metaphase
(C) Anaphase
(D) Telophase

Answer: (B) Metaphase

(v) Salts which can be used as supplement of calcium and iron are obtained from_____.
(A) Carbonic acid
(B) Acetic acid
(C) Citric acid
(D) Gluconic acid

Answer: (D) Gluconic acid

(B) Solve the following questions : [5]

(i) Find odd one out :

Drying, Salting, Cooking, Soaking with sugar.

Answer: Cooking

(ii) Write the correct co-relation :

Annelida : Earthworm : : Platyhelminthes : _____

Answer: Planaria

(iii) State whether True/False :

Tobacco containing substances cannot cause cancer of mouth and lungs.

Answer: False

(iv) Write function of testes. Answer: Function of testes is to produce sperms and male hormone-testosterone.

(v) I am connecting link between Reptilia and mammals. What is my name? Answer: Duck-Billed Platypus.

Q. 2. (A) Give scientific reasons. (Any two): **[4]**

(i) Indians should follow family planning for controlling the population.

(ii) We feel exhausted after exercising.

(iii) Hydroelectric energy, solar energy and wind energy are called renewable energies. Answer:

(i) In India population is increasing tremendously. Today Indian population is more than 130 crores. This population explosion causes stress on natural resources.

The available natural resources are unable to complete the increasing demands of the increasing population. Also the increasing population causes lack of education

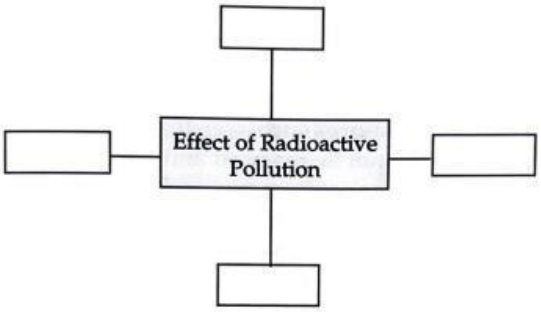
unemployment, poverty, crime, poverty, decreasing per capita income and increasing loan, etc. This worse condition can be improved only by controlling population. Hence, Indians should follow family planning for controlling the Population.

(ii) When we perform heavy exercises, we feel shortage of oxygen. In such situation, our muscles and other tissues perform anaerobic respiration. In this process lactic acid is formed, and also the molecules of ATP produced in oxidation of food are much less. So there is accumulation of lactic acid in our body and less energy is produced in our body. Due to this we feel exhausted after exercising.

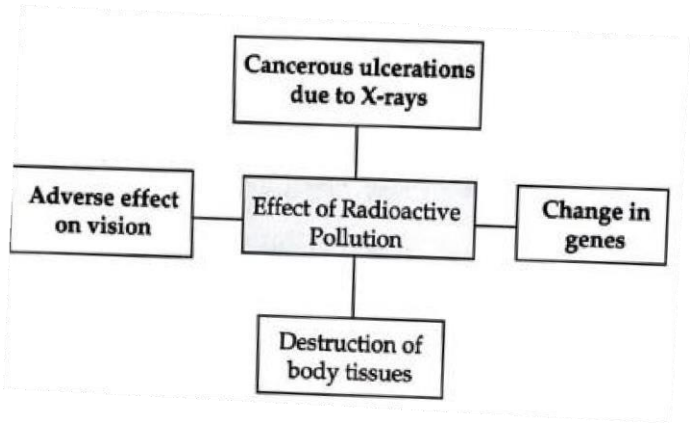
(iii) Conventional energy sources such as coal, natural gas and fossil fuels are limited on the earth. They cannot be renewed and so in future, they will get exhausted. But solar energy, hydroelectric energy and wind energy are obtained from solar radiations, flowing water and flowing wind respectively. Sun, water reservoirs and wind are the inexhaustible and sustainable resources. They will not be finished. Thus, hydroelectric energy, solar energy and wind energy can be replenished and so they are called renewable.

Q2. (B) Solve the following questions. (Any three) : **[6]**

(i) Complete the following chart :



Answer:



(ii) **Distinguish between Aves and Mammalia.**

Answer:

Aves	Mammalia
1. These are adopted for aerial mode of life.	1. These are adapted for terrestrial life.
2. Body is spindle shaped and it is divided into head, neck and trunk.	2. Body is not spindle shaped and it is divided into head, neck, trunk and tail.
3. They have two pairs of limbs and forelimbs are modified to form wings.	3. They have two pairs of limbs, which are adapted for walking and run· ning on the ground.
4. Exoskeleton is in the form of feathers.	4. Exoskeleton is in the form of hair, wool or fun.
5. Jaws are modified into a beak	
6. These are oviparous. They hatch the eggs into nest lings.	6.These are viviparous. They give birth to live young ones.

(iii) **By observing given picture, write any two effects of this disaster:**

Answer: The given picture shows the railway accident. The worst effects of this disaster are:

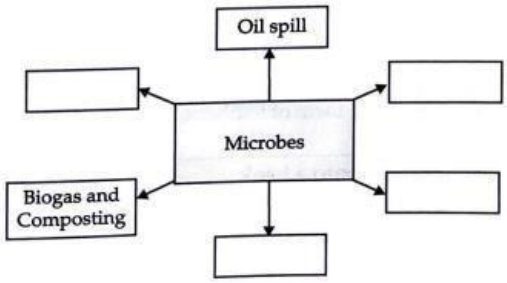
1. **Loss of life:** In railway accidents hundreds of people die and too many are injured also.
2. **Economic loss:** The repairing and maintenance of railways result into economic pressure on government and public also.

(iv) Explain four ways to minimize stress:

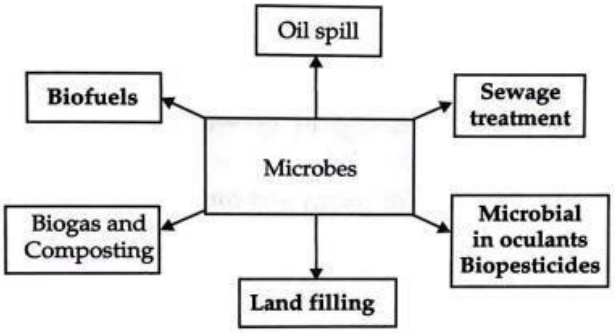
Answer:

1. One should express his feelings with their near and dear ones, or he should note down his feelings in a diary.
2. One should learn Yoga and Meditation. Also, he should perform physical exercise daily.
3. One should inculcate good hobbies like reading, drawing, cooking, dancing, photography etc., in his routine.
4. We should listen and also learn the music, because music reduces the mental stress and it teaches us how to enjoy the life.

(v) Complete the following conceptual picture:



Answer:



Q. 3. Solve the following questions. (Any five) : [15]

(i) Explain the importance of Anatomical evidences with examples.

Answer:

1. The structure and anatomy of different animal groups show certain similarities.

For example, human hand, cat's foreleg, flipper of whale and patagium of bat, Etc., are similar in their internal anatomy.

2. External morphology of those organs does not show any similarity. Also the use of These organs is also different in different animals.
3. But there is similarity in structure of bones and bony joints in organs of each of these animals.
4. This similarity indicates that those animals many ave a common ancestor.
5. Thus, the anatomical evidence tries to prove the process of evolution.

(ii) What will you do? Why?

(a) Child of your neighbor is addicted to tobacco chewing.
(b) Your friend has developed the hobby of snapping selfies.
(c) Your sister has become incommunicative. She prefers to remain alone.

Answer:

(a) I will explain the bad effects of tobacco chewing to that child. I will convince him How tobacco causes cancer of mouth by showing him different videos and Photographs. Also, I will inform his parents about his habit of tobacco chewing. I Will try my best to make him free from his addiction.

(b) The person who has the hobby of snapping selfies is always thinking of himself Only. I will try to find out the reason behind his self-centeredness. I will try to motivate him to do some other good things so that his habit of snapping selfies will be lessened.

(c) I will take my sister in confidence, and I will try to find out the reason behind the lack of communication of her. I will speak with her on various interesting topics and will always stay with her. I will invite her friends at home so that she will mix with them. Also, i will encourage her to pursue her hobbies and will try my best to make her happy.

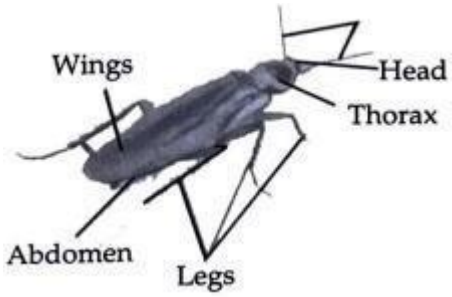
(iii) Which precautions are necessary for proper decomposition of domestic waste?

Answer:

For proper decomposition of domestic waste, decomposable and non-decomposable garbage i. e., wet and dry garbage should be properly separated. Wet garbage can be used to make compost at home. Non-decomposable garbage i.e., plastic, broken metallic things, pieces of glass, bottles of medicines, E-waste, etc., should be stored separately, so that this dry garbage can be sent for re-cycling and re-use. If wet and dry garbage are mixed together then it becomes very difficult to decompose the waste. So non-decomposable waste material should be strictly kept aside. Thus these are the

precautions which are necessary for proper decomposition of domestic waste.

(iv) Observe the following diagram. Write the answers of the following.



(a) To which phylum does the animal included in the diagram belong ?
(b) What is the exoskeleton made up ?
(c) What is the symmetry?

Answer:

(a) Cockroach is shown in the diagram. It belongs to phylum Arthropoda.
(b) The exoskeleton is made up of chitin.
(c) Body of cockroach shows bilateral symmetry.

(v) Explain the following concepts in short:

(a) Surrogacy

(b) In Vitro Fertilization (IVF)

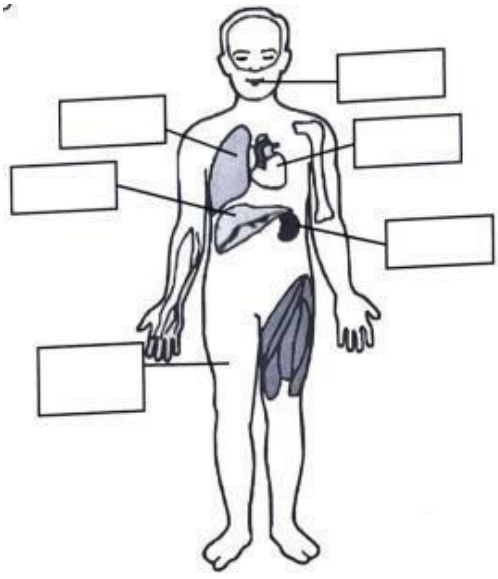
(c) Sperm Bank Answer:

(a) Surrogacy: Some women have problems in implantation of embryo in uterus. For such women surrogacy is the remedial technique. In this technique oocyte is collected from the ovary of the woman having problem in implantation in uterus. That oocyte is fertilized in test-tube with the help of sperms collected from her husband. The embryo formed from such fertilization is implanted in the uterus of some other woman having normal uterus. Such a woman in whose uterus the embryo is implanted, is called as surrogate mother and this entire procedure is termed as surrogacy.

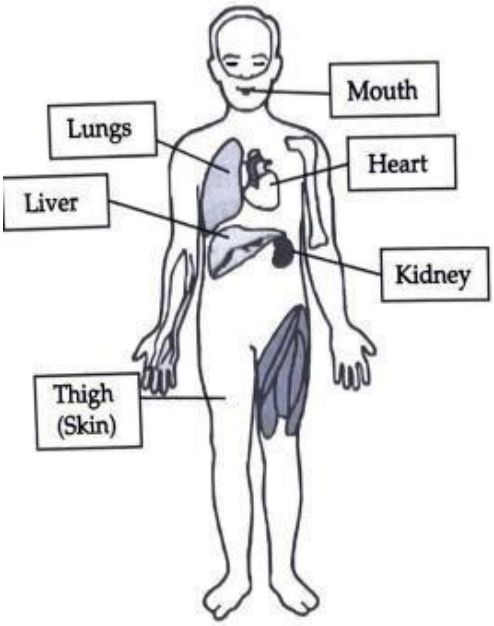
(b) In Vitro Fertilization (IVF): In this technique fertilization is brought about in the test ttube and the embryo formed is implanted in uterus of woman at appropriate time. This technique is used for having the child in case of those childless couples who have problems like less sperm count, obstacles in oviduct etc.

(c) Sperm Bank: Semen ejaculated by the desired men is collected after their thorough physical and mental check-up and is sotred in the sperm bank. As per the wish of needful couple, oocyte of woman of the concerned couple is fertilized by IVF technique using the semen from sperm bank. Resultant embryo is implanted in the uterus of same woman.

(vi) Label the body organization of human in the following figure:



Answer:



(vii) Make a table based on forms of energy and corresponding devices :

	Forms of Energy	**Devices**
(a)	**Electric**	_____
(b)	**Mechanical**	**Sewing machine, Bicycle**
(c)	**Thermal**	_____
(d)	_____	**Solar cooker, Solar heater**

Answer:

Forms of Energy	Devices
(a) Electric	Tube light, fan, Refrigerator, Microwave oven, etc.
(b) Mechanical	Sewing machine, Bicycle
(c) Thermal	Chulha, Furnace, Steam engine.
(d) Solar	Solar cooker, Solar heater

(viii) Complete the paragraph using proper words :

(Mechanical, Rhizobium, Aquatic, Toxic, CO_2, Nitrogen, Pseudomonas, Amoeba, Bacteria, Hydrocarbons)

Spilling of petroleum oil occurs in ocean due to various reasons. This oil may prove fatal and toxic to_____organisms. It is not easy to remove the oil layer from surface of water by _____method. However, bacteria like _____spp and Alcanivorax borkumensis have the ability to destroy the pyridines and other chemicals. Hence, these bacterias are used to clear the oil spills, These are called hydrocarbonoclastic bacteria (HCB). HCB decompose the ____ and bring about the reaction of carbon with oxygen____and water is formed in this process.

Answer:

Spilling of petroleum oil occurs in ocean due to various reasons. This oil may prove fatal and toxic to **aquatic** organisms. It is not easy to remove the oil layer from surface of water by **mechanical** method. However, bacteria like **Pseudomonas** spp. and Alcanivorax borkumensis have the ability to destroy the pyridines and other chemicals. Hence, these bacteria are used to clear the oil spills. These are called hydrocarbonoclastic bacteria (HCB). HCB decompose the **hydrocarbons** and bring about the reaction of carbon with oxygen. CO_2 and water is formed in this process.

Q. 4. Solve the following questions. (Any one) : [5]

(i) Attempts at various levels are performed for conserving environment. Which role would you like to perform. Give two actions each :

(a) Prevention
(b) Control
(c) Production
(d) Awareness
(e) Conservation

Answer:

(a) **Prevention: 1**. Preventing possible harms.
2. Designing new plans, (b) **Control**:
1. Stopping the harmful activities.
2. Changing the mindset

(c) **Production:** 1. Revival of harmed factors of environment.
2. Attempting innovation

(d) **Awareness:** 1. Education,
2. Guidance

(e) **Conservation:** 1. Conserving the available resources.
2. Using the available pool of resources in sustainable manner.

(ii) (a) What is Biotechnology?

(b) Give one use of Biotechnology.

(c) Give one commercial use of Biotechnology.

(d) Write two bacterial examples of biofertilizer. (e) Write two names of crops genetically developed.

Answer:

(a) The techniques of brining about improvements in living organisms by artificial genetic changes and by hybridization for the welfare of human beings is called Biotechnology.

(b) Due to development of fast fruit setting varieties due to biotechnology, yield per annum has been increased.

(c) Animal husbandry: Two main methods as artificial insemination and embryo transfer are used in animal husbandry. It helps to improve both, the quantity and quality of animal products. E.g. Milk, meat, wool etc. Similarly animals with move strength have been developed for hard work. This is one of the commercial use of Biotechnology.

(d) Rhizobium and Azotobacter.

(e) BT cotton and Golden rice.

SSC **MARCH 2020**

MATHEMATICS
ALGEBRA – PART I

Time allowed: 2 hours **Maximum marks: 40**

General Instructions:

(i) All questions are compulsory.
(ii) Use of calculator is not allowed.
(iii) The numbers to the right of the questions indicate full marks.
(iv) In case MCQ's Q. No. 1(A) only the first attempt will be evaluated and will be given credit.
(v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with sub question number is:

1. (A) For every sub question 4 alternative answers are given. Choose the correct answer and write the alphabet of it: **[4]**

(i) In the formal of GSTIN there are _____alpha-numerals.
(A) 15 (B) 10 (C) 16 (D) 9

Answer: Answer is not given due to change in reduced syllabus.

(ii) From the following equations, which one is the quadratic equation?
(A) $5 - 3 = x^2$ (B) $x(x + 5) = 4$ (C) $n - 1 = 2n$ (D) $\frac{1}{2}(x + 2) = x$ x x

Answer: (B) $x(x + 5) = 4$

(iii) For simultaneous equations in variables x and y, if $D_x = 49, D_y = -63, D = 7$, then what is the value of x?
(A) 7 (B) -7 (C) $\frac{1}{7}$ (D) $-\frac{1}{7}$

Answer: (A) 7

(iv) If if $n(A) = 2, P(A) = \frac{1}{\_}$, then $n(S)$ =?
(A) $\frac{5}{\frac{2}{5}}$ (B) $\frac{5}{2}$ (C) 10 (D) $\frac{1}{3}$

Answer: (C) 10

1. (B) Solve the following sub questions: **[4]**

(i) Find second and third term of an A. P. whose first term is -2 and common difference is -2.

Answer: Given,
First term, $a = -2$
Common difference, $d = -2$
We know that Second term $= a + d$
$= -2 + (-2)$
$= -4$
And Third Term $= a + 2d = -2 + 2(-2)$
$= -2 - 4$
$= -6$
∴ Second term is -4 and third term is -6.

(ii) Pawan Medicals supplies medicines. On some medicines the rate of GST is 12%, then what is the rate of CGST and SGST?

Answer: Answer is not given due to the change in reduced syllabus.

(iii) Find the values of a and b from the quadratic equation $2x^2 - 5x + 7 = 0$.

Answer: The given quadratic equation is
$2x^2 - 5x + 7 = 0$.
Comparing the given quadratic equation with
$ax^2 + bx + c = 0$
∴ The Values of $a = 2$ and $b = -5$

(iv) If $15x + 17y = 21$ and $17x + 15y = 11$, then find the value of $x + y$.

Answer: The given equations are
$15x + 17y = 21$ ... . (1)
$17x + 15y = 11$ ... . (2)
Adding equations (1) and (2)
$15x + 17y = 21$
$+17x + 15y = 11$

$32x + 32y = 32$
Dividing both sides by 32, we get $x + y = 1$

2. (A) Complete and write any two activities from the following: **[4]**

(i) Complete the following table to draw the graph of $2x - 6y = 3$:

X	-5	

Y	□	0
(x, y)	□	□

Solution:

X	-5	$\frac{3}{2}$
Y	$-\frac{13}{6}$	0
(x, y)	$-5, -\frac{13}{6}$	$\frac{3}{2}, 0$

(ii) First term and common difference of an A.P. are 6 and 3 respectively. Find S_{27}.

Solution:

First term $= a = 6$, common difference $= d = 3$, $S_{27} = ?$

$S_{27} = ?$

$S_n = \frac{n}{2}[\_\_\_\_\_ + (n-1)d]$ – Formula

$S^{27} = \frac{27}{2}[12 + (27-1)\_\_\_\_\_]$

$= \frac{27}{2} \times [\_\_\_\_\_]$

$= 27 \times 45$

$\therefore S_{27} = \_\_\_\_\_$

Solution:

First term $= a = 6$, common difference $= d = 3$,

$S_{27} = ?$

$S_n = \frac{n}{2}[2a + (n-1)d]$ – Formula

$S_{27} = \frac{27}{2}[12 + (27-1)3]$

$= \frac{27}{2} \times [90]$

$= 27 \times 45$ $S_{27} = 1215$

(iii) A Card is drawn from a well shuffled pack of 52 playing cards. Find the probability of the event, the card drawn is a red card.

Solution:

Suppose 'S' is sample space.

$\therefore n(S) = 52$

Event A: Card drawn is a red Card.

$\therefore$ Total Red Cards = ____ hearts + 13 diamonds

$\therefore n(A) =$ _____

$\therefore p(A) = \frac{n(A)}{n(S)}$ – Formula

$\therefore p(A) = \frac{26}{52}$

$\therefore p(A) =$ _____

Solution:

Suppose 'S' is sample space.

$\therefore n(S) = 52$

Event A: Card drawn is a red Card.

$\therefore$ Total Red Cards = 13 hearts + 13 diamonds

$\therefore n(A) = 26$

$\therefore p(A) = \frac{n(A)}{n(S)}$ – Formula

$\therefore p(A) = \frac{26}{52}$

$\therefore p(A) = \frac{1}{2}$

2. (B) Solve any four sub questions from the following: **[4]**

(i) Find the value of the determinant:

$$\begin{vmatrix} \frac{7}{5} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix}$$

Solution:

$$\begin{vmatrix} \frac{7}{5} & \frac{5}{3} \\ \frac{3}{2} & \frac{1}{2} \end{vmatrix} = \frac{7}{10} - \frac{5}{2}$$

$$= \frac{7-5(5)}{10}$$

$$= \frac{-18}{10}$$

$$= \frac{-9}{5}$$

(ii) Solve the quadratic equation by factorisation method: $x^2 - 15x + 54 = 0$.

Solution: The given quadratic equation is

$x^2 - 15x + 54 = 0.$

$\Rightarrow x^2 - x - 6x + 54 = 0$

$\Rightarrow x(x-9) - 6(x-9) = 0$

$\Rightarrow (x-9)(x-6) = 0$

$\Rightarrow (x-9) = 0$ or $((x-6) = 0$

$\therefore x = 9$ or $x = 6$

$\therefore$ 9 and6 are the roots of the given quadratic equation.

(iii) Decide whether the following sequence is an A.P. if so, find the 20^{th} term of the progression:

-12, -5, 2, 9, 16, 23, 30, …….

Solution: Here $a = t_1 =$ first term $= -12, t_2 = -5$,

Common difference $= d = t_2 - t_1$

$d = -5 - (-12)$

$\therefore = -5 + 12$ We know that, $t_n = a + (n-1)d$

$d = 7$ Here, $n = 20, a = -12, d = 7$

$t_{20} = -12 + (20-1)7$

$= -12 + 133$ $t_{20} = 121 \therefore 20^{th}$ term of the progression is 121.

(iv) A two-digit number is formed with digits 2, 3, 5, 7, 9 without repetition. What is the probability that the number formed is an odd number?

Solution: Simple space S: to form two-digit number from $2, 3, 5, 7, 9$

$\therefore S = [23, 25, 27, 29, 32, 35, 37, 39, 52, 53, 27, 59, 72, 73, 75, 79, 92, 93, 95, 97]$

$\therefore n(S) = 20$

Event A: Number formed is an even number are such that whose unit place is $0, 2, 4, 6,$ 8. One of these numbers should be in even number.

In the given numbers $2, 3, 5, 7, 9$ only 2 is the even number whose unit place is 2.

$\therefore$ Sample space of even numbers $= [32, 52, 72, 92]$

$\therefore n(\text{Even numbers}) = 4$

$\therefore n(\text{Odd numbers}) = n(S) - 4$

$= 20 - 4$

$= 16$

$\therefore n(A) = 16$

$p(A) = \frac{n(A)}{n(S)}$

$= \frac{16}{20} = \frac{4}{5}$

(v) If $L = 10, f_1 = 70, f_0 = 58, f_2 = 42, h = 2$, then find the mode by using formula.

Solution: Answer is not given due to the change in reduced syllabus.

3. (A) Complete and write any one activity from the following: **[3]**

(i)

Age group (in years)	No. of persons	Measure of Central Angle
$20-25$	80	$\frac{80}{200} \times 360° = 144°$
$25-30$	60	$\frac{60}{200} \times 360° = 108°$
$30-35$	35	$\frac{35}{200} \times 360° = 63°$
$35-40$	25	$\frac{25}{200} \times 360° = 45°$
Total	200	

Solution: Answer is not given due to the change in reduced syllabus.

(ii) Shri Shantilal has purchased 150 shares of EV ₹100, for MV of ₹120, company has paid dividend at 7%, then to find the rate of return on his investment, complete the following activity:

Solution: Answer is not given due to change in reduced syllabus.

3. (B) Attempt any two sub questions from the following: **[6]**

(i) A balloon vendor has 2 red, 3 blue and 4 green balloons. He wants to choose one of them at random to give it to Pranali. What is the probability of the event that Pranali gets:
1. a red balloon. **2. a blue balloon.**

Solution: Available balloons are 2 red, 3 blue and 4 green.
Sample space S: one balloon to be choose on random basis,
$\therefore n(S) = 2 + 3 + 4 = 9$

1. Event A: Probability that a red balloon is chosen.
$\therefore n(A) = 2$
$\therefore p(A) = \frac{n(A)}{n(S)}$
$p(A) = \frac{2}{9}$

2. Event B: Probability that a blue balloon is chosen.
$\therefore n(B) = 3$
$\therefore p(B) = \frac{n(B)}{n(S)}$

$\frac{3}{9} = \frac{1}{3}$

$\therefore \quad p(B) = \frac{1}{3}$

Probability that a red balloon is chosen is $\frac{2}{9}$ and probability that a blue balloon is chosen is $\frac{1}{3}$.

(ii) The denominator of fraction is 4 more than twice its numerator. Denominator becomes 12 times the numerator, if both the numerator and the denominator are reduced by 6, find the fraction.

Solution: Suppose numerator is x, then denominator will be $2x + 4$

$\therefore$ Fraction is $\frac{x}{2x+4}$

According to the given information we can write,

$\frac{x-6}{(2x+4)-6} = \frac{1}{12}$

$\frac{x-6}{2x-2} = \frac{1}{12}$

$\therefore 12(x-6) = 2x-2$

$\therefore 12x - 72 = 2x - 2$

$\therefore 12x - 2x - 72 + 2 = 0$

$\therefore 10x - 70 = 0$

$\therefore x = \frac{70}{10} = 7$

$\therefore \quad x = 7$

But fractions $\frac{7}{2x+4} = \frac{x}{2(7)+4}$

$= \frac{7}{14+4} = \frac{7}{18}$

$\therefore$ The faction is $\frac{7}{18}$.

(iii) A milk center sold milk to 50 customers. The table below gives the number of customers and the milk they purchased. Find the mean of the milk sold by direct method:

Milk sold (liter)	No. of customers
1 – 2	17
2 – 3	13
3 – 4	10
4 – 5	7
5 – 6	3

Solution: Answer is not given due to the change in reduced syllabus.

(iv) In an A.P. sum of three consecutive terms is 27 and their products is 504. Find the terms. (Assume that three consecutive terms in an A.P. are a − d, a, a + d.)

Solution:

Assume that the three consecutive terms are $a - d, a,$ and $a + d$

According to first condition,

$\therefore \quad (a - d) + a + (a + d) = 27$

$\therefore \quad 3a = 27$

$\therefore \quad a = 9$

According to second condition,

$(a - d)(a)(a + d) = 504$

Putting the value of a = 9 in above equation, we get

$\therefore \quad (9 - d)(9)(9 + d) = 504$

$\therefore \quad (9^2 - d^2) \times 9 = 504$

$\therefore \quad (81 - d^2) = 56$

$\therefore \quad 81 - d^2 = 56$

$\therefore \quad d^2 = 81 - 56$

$\therefore \quad d^2 = 25$

$\therefore \quad d = 5$

$\therefore$ First term $= a - d = (9 - 5) = 4$

Second term $= a = 9$

Third term $= a + d = 9 + 5 = 14$

$\therefore$ the three terms are $4, 9, 14$.

4. Attempt any two sub questions from the following: **[8]**

(i) Represent the following data by histogram :

Price of Sugar (per kg in ₹)	Number of weeks
18 − 20	4
20 − 22	8
22 − 24	22
24 − 26	12
26 − 28	6
28 − 30	8

Solution: Answer is not given due to the change in reduced syllabus.

(ii) One person borrows ₹4, 000 and agrees to repay with a total interest of ₹500 in 10 installments. Each installment being less than the preceding installment by ₹10. What should be the first and the last installments?

Solution: Number of installments, n = 10

Let the first installment be ₹A

As per the given data each further installment is less than the preceding one by ₹10. ∴ These installments are in A.P. ∴ First term $= a$

And common difference, $d = -10$

Here the negative sign indicates that the next term of A.P. is less than that the preceding term.

∴ Repayment of loan is a below:

∴ $S_n =$ Loan + Total interest

∴ $S_n = 4000 + 500$

∴ $S_n = 4500$

Here $n = 10$

We know that, $S_n = \frac{n}{2}[2a + (n-1)d]$

$\therefore 4500 = \frac{10}{2}[2a + (10-1)(-10)]$

$\therefore 4500 = 5[2a - 90]$

$\therefore 4500 = 10a - 450$

$\therefore 10a = 4500 + 450$

$\therefore a = \frac{4950}{10} = 495$

∴ first installment $= a = ₹495$

The last installment is the 10^{th} installment.

$\therefore n = 10$

We know that, $a_n = a + (n-1)d$

Here $n = 10, a = 495, d = -10$

$\therefore a_{10} = 495 + (10-1)(-10) = 495 - 90$

$a_{10} = 405$

Last installment $= a_{10} = ₹405$.

∴ First installment is ₹495 and the last installment is ₹405.

(iii) The sum of the areas of two squares is 400 sq.m. if the difference between their perimeters is 16 m, find the sides of two square.

Solution: Let the side of first square be x meter and the side of second square be y meter

As per the first given condition,

$\therefore x^2 + Y^2 = 400$ …. (i)

As per the second given condition,

$4x - 4y = 16$

$\therefore x - y = 4$

$\therefore x = y + 4$ …(ii)

Put the value of x = y + 4 in equation (i), we get

$\therefore (y+4)^2 + y^2 = 400$

$\therefore y^2 + 8y + 16 + y^2 = 400$

$\therefore 2y^2 + 8y + 16 - 400 = 0$

$\therefore 2y^2 + 8y - 384 = 0$

Dividing both sides by 2 we get

$y^2 + 4y - 192 = 0$

$y = {}^2 + 16y - 12y12y - 12 \quad 0 \therefore$

$y(y+16) - \quad (y+16)(y - \quad) = 0 \quad \therefore$

$(y+16) = \therefore 0 \quad \therefore$

$y = -16 \quad \therefore -\therefore 12$

$y = 12 \quad \therefore$

12

or

12

or

But side of square is never negative.

$\therefore y \neq -16$

$\therefore y = 12$

Putting the value of y=12 in equation (ii), we get x

$= 12 + 4 = 16$

∴Side of first square, $x = 16$ m and side of second square, $y = 12$m.

5. Attempt any one sub question from the following: **[3]**

(i) Convert the following equations into simultaneous equations and solve:

$\frac{1}{x} - \frac{1}{y} = 4, \quad \frac{1}{y} + \frac{1}{x} = \frac{1}{\sqrt{xy}}$

Solution: Answer is not given due to the change in reduced syllabus.

(ii) A dealer sells a toy for ₹24 and gains as much percent as the cost price of the toy. Find the cost price of the toy.

Solution: Selling price of the toy = ₹24

Let the cost price of the toy be ₹X

Gain% = x% (Given)

$$\text{Gain\%} = \left(\frac{\text{Selling price} - \text{Cost price}}{\text{Cost Price}}\right) \times 100$$

$$\therefore x = \left(\frac{24 - x}{x}\right) \times 100$$

$$\therefore x^2 = 2400 - 100x$$

$$\therefore x^2 + 100x - 2400 = 0$$

$$\therefore x^2 + 120x - 20x - 2400 = 0$$

$$\therefore x(x + 120) - 20(x + 120) = 0$$

$$\therefore (x + 120)(x - 20) = 0$$

$$\therefore x + 120 = 0 \quad \text{or} \quad (x - 20) = 0$$

$\therefore x = -120$ or $x = 20$

$x \neq -120$, because cost cannot be negative

$\therefore x = 20$

$\therefore$ Cost price = ₹20

$\therefore$ The cost price of the toy is ₹20

SSC **MARCH 2020**

MATHEMATICS
GEOMETRY – PART II

Time allowed: 2 hours **Maximum marks: 40**

General Instructions:

(i) All questions are compulsory.
(ii) Use of calculator is not allowed.
(iii) The numbers to the right of the questions indicate full marks.
(iv) In case MCQ's Q. No. 1(A) only the first attempt will be evaluated and will be given credit.
(v) For every MCQ, the correct alternative (A), (B), (C) or (D) of answers with sub question number is:

1. (A) Four alternative answer are given for every sub – question. Select the correct alternative and write the alphabet of that answer: **[4]**

(i) Out of the following which is the Pythagorean triple?

(A) $(1, 5, 10)$ **(B) $(3, 4, 5)$** **(C) $(2, 2, 2)$** **(D) $(5, 5, 2)$**

Answer: (B) (3, 4, 5)

(ii)Two circles of radii 5.5 cm and 3.3 cm respectively touch each other externally. What is the distance between their centres?

(A) 4.4 cm **(B) 2.2 cm** **(C) 8.8 cm** **(D)8.9 cm**

Answer: (C) 8.8 cm

(iii) Distance of point (-3, 4) from the origin is _____.

(A) 7 **(B) 1** **(C) -5** **(D) 5**

Answer: (D) 5

(iv) Find the volume of a cube of side 3 cm: *

(A) 27 cm^3 **(B) 9 cm^3** **(C) 81 cm^3** **(D) 3 cm^3**

Answer: Answer is not given due to the change in reduced syllabus.

(B) Solve the following questions: **[4]**

(i) The ratio of corresponding sides of similar triangles is $3 : 5$, then find the ratio of their areas.

Answer: Ratio of areas of similar triangles =

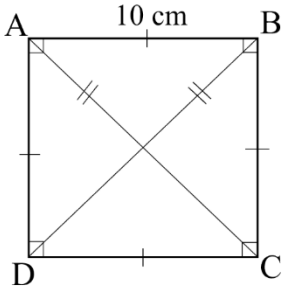
(Ratio of corresponding sides of similar triangles)^2

$= \frac{3}{5}^2$

Ratio of their areas $= \frac{9}{25}$

(ii) Find the diagonal of a square whose side is 10 cm.

Answer: Let □ ABCD is a square $l(AB) = l(BC) = l(CD) = l(AD) =$ 10 cm



In ΔaBC, (Given)

$AC^2 = AB^2 + BC^2$

(Pythagoras theorem)

$\therefore$ $AC^2 = AB^2 + AB^2$ ($\because AB = BC$)

$\therefore$ $AC^2 = 2AB^2$

$\therefore$ $AC = \sqrt{2}\ AB$

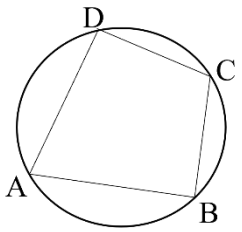
$= \sqrt{2}\,(10)$ cm ($AB = 10$cm)

$\therefore$ $AC = 10 \times 1.414 = 14.14$ cm

$\therefore$ Diagonal of the square $AC = 14.14$ cm

(iii) □ ABCD is cyclic. If $\angle B = 110$, then find measure of $\angle D$.

Answer: □ ABCD is cyclic



$\therefore$ $m\angle B + m\angle D = 180^\circ$

$\therefore$ $110^\circ + m\angle D = 180^\circ$

(Given, $m\angle B = 110^\circ$)

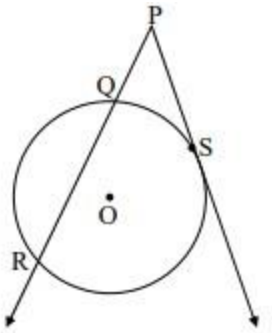
$\therefore$ $m\angle D = 180^\circ - 110^\circ$

$m\angle D = 70^\circ$

(iv) Find the slope of the line passing through the points A $(2, 3)$ and B $(4, 7)$.*

Answer: Answer is not given due to the change is reduced syllabus.

2. (A) Complete and write the following activities (Any two): [4]



(i) In the figure given, 'O' is the centre of the circle, seg PS is a tangent segment and S is the point of contact. Line PR is a secant. If PQ = 3. 6, QR = 6. 4, find PS.*

Answer: Answer is not given due to the change is reduced syllabus.

(ii) If $\sec\theta = \frac{25}{7}$, find the value of $\tan\theta$.

Solution: $1 + \tan^2\theta = \sec^2\theta$

$\therefore 1 + \tan^2\theta = \left(\frac{25}{7}\right)^{\square}$

$\therefore \tan^2\theta = \frac{625}{49}$ $\square$

$= \frac{625-49}{4}$ $\square$

$= \frac{\square}{49}$

$\tan\theta = \frac{\square}{7}$ …… (by taking square roots)

Answer: $1 + \tan^2\theta = \sec^2\theta$

$\therefore \quad 1 + \tan^2\theta = \left(\frac{25}{7}\right)^{\boxed{2}}$

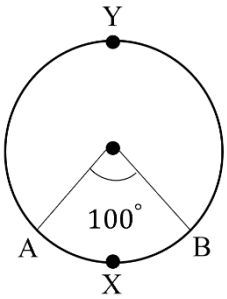
$\therefore \tan^2\theta = \frac{625}{49} - \boxed{1}$

$\frac{625-49}{49} = \frac{576}{49}$

$\tan\theta = \frac{24}{7}$ …. by taking square roots

(iii) In the figure given, O is the centre of the circle. Using given information complete the following table:*

Type of arc	Name of the arc	Measure of the arc
Minor arc	☐	☐
Major arc	☐	☐



Answer:

Type of arc	Name of the arc	Measure of the arc
Minor arc	**Arc AXB**	**100°**
Major arc	**Arc AYB**	**260°**

(B) Solve the following sub – questions (Any four): [8]

(i) In ΔPQR, NM ∥ RQ. If PM = 15, MQ = 10, NR = 8, then find PN.

Answer: Given NM ∥ RQ

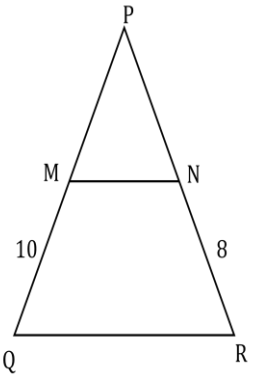
∴ $\frac{PN}{NR} = \frac{PM}{MQ}$ (Basic proportionality theorem) …(i)

But PM = 15, MQ = 10, NR = 8 (Given)

∴ Equation (i) becomes,

$\frac{PN}{8} = \frac{15}{10}$

$\therefore PN = \frac{15}{10} \times 8 = \frac{15 \times 4}{5} = 3 \times 4$

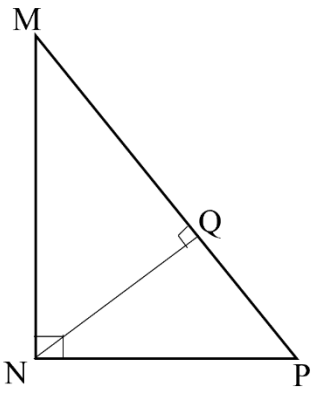


∴ PN = 12 Unit

(ii) In ΔMNP, ∠MNP = 90° seg NQ ⊥ seg MP. If MQ = 9, QP = 4, then find NQ.

Answer: In ΔMNP, ∠MNP = 90°, seg NQ ⊥ seg MP

∴ According to right angled triangle geometric mean sub theorem



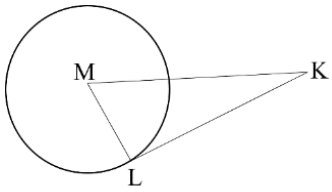
$NQ^2 = MQ \times QP$

$= 9 \times 4 = 36$

∴ $NQ = \sqrt{36}$

$= 6$ unit

(iii) In the figure given above, M is the centre of the circle and seg KL is a tangent segment. L is a point of contact. If MK = 12, KL = $6\sqrt{3}$, then find the radius of the circle.



Answer: In given figure,

radius ML ⊥ tangent Segment KL … (Tangent theorem)

∴ m∠MLK = 90°

In right – angled Δ MLK

$MK^2 = ML^2 + LK^2$ (According to Pythagoras theorem)

∴ $(12)^2 = ML^2 + (6\sqrt{3})^2$

∴ $144 = ML^2 + 108$

∴ $ML^2 = 144 - 108 = 36$

∴ ML = 6

∴ Radius ML = 6 unit

(iv) Find the co-ordinate of midpoint of the segment joining the points (22, 20) and (0, 16).

Answer: Given points are (22, 20) and (0, 16)

Let, $x_1 = 22, x_2 = 0, y_1 = 20, y_2 = 16$

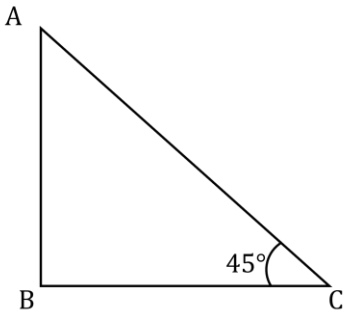
We know, Midpoint $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{22+0}{2}, \frac{20+16}{2}\right)$

$= \left(\frac{22}{2}, \frac{36}{2}\right)$

$= (11, 18)$

(v) A person is standing at a distance of 80 metres from a Church and looking at its top. The angle of elevation is of 45. Find the height of the Church. * Answer:



Let, AB be the height of the church.

$\angle ACB = 45°, BC = 80$ m

In right angled $\triangle$ ABC, we have,

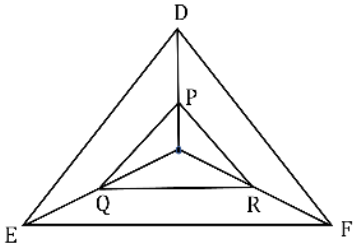
$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{AB}{80}$

$\Rightarrow AB = 80$ m

3. (A) Complete and write the following activities (Any one): [3]

(i) In the given figure, X is any point in the interior of the triangle. Point X is joined to the vertices of triangle. seg PQ ∥ seg DE, seg QR ∥ seg EF. Complete the activity and prove that seg PR ∥ seg DF.



Proof: In ΔXDE

PQ ∥ DE ….. (Given)

∴ $\frac{XP}{PD} = \frac{\square}{\square}$ ….. (Basic propatianality theorem) …. (i)

∴ $\frac{XP}{PD} = \frac{\square}{\square}$ …. [From (i) and (ii)]

∴ Seg PR ∥ seg DF … (By converse of basic proportionality throrem)

Answer: In ΔXEF

QR ∥ EF …. (Given)

∴ $\frac{XQ}{QE} = \frac{XR}{RF}$ …. (Basic proportionality theorem) …. (ii)

∴ $\frac{XP}{PD} = \frac{XR}{RF}$ …. [From (i) and (ii)]

∴ Seg PR ∥ seg DF … (By converse of basic proportionality throrem)

(ii) If A (6, 1), B (8, 2), C (9, 4) and D (7, 3) are the vertices of □ ABCD, show that □ ABCD is a parallelogram. *

Answer: Given A (6, 1), B (8, 2), C (9, 4) and D (7, 3)

$$AB = \sqrt{(8-6)^2 + (2-1)^2} \quad [\because \text{Distance} = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}]$$
$$= \sqrt{2^2 + 1^2} = \sqrt{5}$$

$$BC = \sqrt{(9-8)^2 + (4-2)^2}$$
$$= \sqrt{1^2 + 2^2} = \sqrt{5}$$

$$CD = \sqrt{(7-9)^2 + (3-4)^2}$$
$$= \sqrt{2^2 + (-1)^2} = \sqrt{5}$$

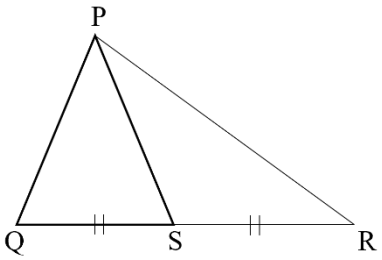
$$DA = \sqrt{(7-6)^2 + (3-1)^2}$$
$$= \sqrt{1^2 + (2)^2} = \sqrt{5}$$

$\therefore AB = BC = CA = DA$

Hence, ABCD is a parallelogram.

(B) Solve the following sub – questions (Any two): **[8]**

(i) If ΔPQR, point S is the mid – point of side QR. If PQ = 11, PR = 17, PS = 13, find QR.



Answer: In ΔPQR, point S is the mid – point of side QR.

∴ Segment PS is median of ΔPQR

According to Apollonius's theorem

$$PQ^2 + PR^2 = 2PS^2 + 2QS^2$$

As per given values,

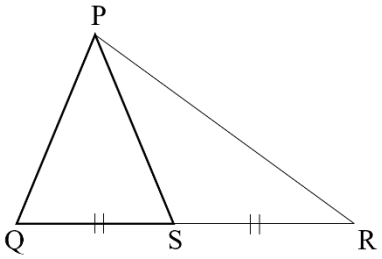
$\therefore (11)^2 + (17)^2 = 2(13)^2 + 2QS^2$

$\therefore 121 + 289 = 2(169) + 2QS^2$

$\therefore 410 = 338 + 2QS^2$

$\therefore 2QS^2 = 410 - 338 = 72$

$\therefore QS^2 = \frac{72}{2} = 36$



$\therefore$ QS = 6 unit …. (i)

We know, point S is the mid – point of side QR

$\therefore$ 2QS = QR ($\because$ QS = SR)

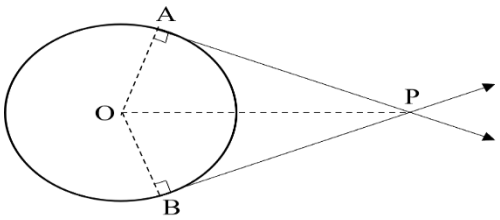
$\therefore$ QR = 2 × (6) [From equation (i)]

$\therefore$ QR = 12 unit

$\therefore$ Length of side QR is 12 unit.

(ii) Prove that, tangent segments drawn from an external point to the circle are congruent.

Answer: Point O is the centre of the circle and point P is external to the circle. Segment PA and segment PB are tangent segments to the circle. Point A and point B are touch points of the tangent segments.



Prove: PA ≅ PB

Construction: Draw OA, OB and OP.

Proof: $\because$ Each tangent of a circle is perpendicular to the radius drawn through the point of contact …. (Theorem)

$\therefore$ Radius OA ⊥ AP and, Radius OB ⊥ BP …..(i)

$\therefore$ m∠PAO = 90° and m∠PBO = 90°

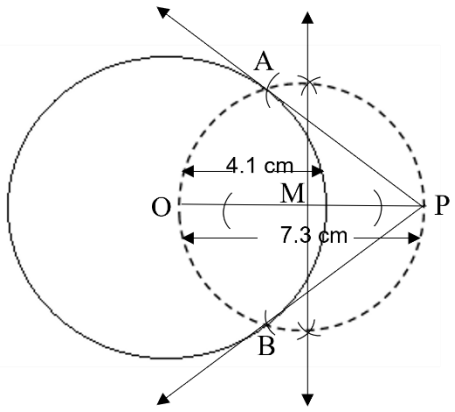
∴ ΔPAO and ΔPBO are right – angled triangles.
Now in ΔPAO and ΔPBO,

$OA = OB$ (∵ Radius of same circle)
∠PAO = ∠PBO [Using (i)]
Hypotenuse OP = Hypotenuse OP (∵ common side)
∴ $\Delta PAO \cong \Delta PBO$ (RHS conguruency criterion)
∴ line PA ≅ line PB (∵ corresponding sides of Congruent triangles)

Line PA and line PB are tangent. **Hence proved.**

(iii) Draw a circle with radius 4. 1 cm. Construct tangents to the circle from a point at a distance 7. 3 cm from the centre.

Answer:
Steps of construction:
Step 1: Draw a circle of radius 4.1 cm with centre O.
Step 2: Take a point P in the exterior of the circle such that OP = 7.3 cm
Step 3: Draw segment OP, draw perpendicular bisector of segment OP to get its midpoint M. Step 4: Draw a circle with radius OM and centre M.



Step 5: Name the point of intersection of the two circles as A and B.
Step 6: Join PA and PB.
Thus, PA and PB are required tangents.

(iv) A metal cuboid of measures 16cm 11cm 10cm was melted to make coins. How many coins were made, if the thickness and diameter of each coin was 2 mm and 2 cm respectively? $(\pi = 3.14)$ *

Answer: Radius of each coin, $r = \frac{2}{2} = 1$ cm
Thickness of each coin, h = 2 mm $= \frac{2}{10} = 0.2$ cm (1 cm = 10 mm)
Let the number of coins made be n.

It is given that a metal parallelopiped is melted to make the coins.
∴ n × Volume of metal in each coin = Volume of the metal cuboid

$$\Rightarrow n = \frac{\text{Volume of the metal cuboid}}{\text{Volume of metal in each coin}}$$

$$\Rightarrow n = \frac{16 \times 11 \times 10}{\pi r^2 h}$$

$\Rightarrow \quad n \_\_\_\_\_ == 2800$

Thus, the number of coins made are 2800.

4. Solve the following sub – questions (Any two): [8]

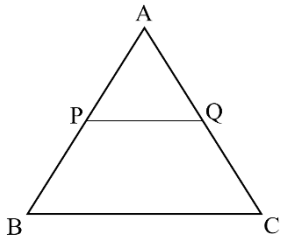
(i) In ΔABC, PQ is a line segment intersecting AB at P and AC at Q such that seg PQ ∥ seg BC. If PQ divides Δ ABC into two equal parts having equal areas, find $\frac{BP}{AB}$.

Answer: In above figure ΔABC, PQ ∥ BC

A – P – B and A – Q – C

and ar (ΔAPQ) = ar (□ PBCQ) ...

In ΔAPQ and ΔABC



∠A = ∠A ….. (common angle)

∠APQ = ∠ABC …. (corresponding angle)

∴ ΔAPQ ~ ΔABC ….. (A – A similarity test)

∴ $\frac{ar\ (\Delta ABC)}{ar\ (\Delta APQ)} = \frac{AB^2}{AP^2}$ (Theorem of areas of similar triangles) ….. (i)

Now,

ar $(\Delta APQ) = ar\ (\square\ PBCQ)$ (Given)

∴ $\frac{ar\ [\square PBCQ]}{ar\ [\Delta APQ]} = \frac{1}{1}$

Adding 1 on both sides,

∴ $\frac{ar\ [\square PBCQ] + ar\ (\Delta APQ)}{ar\ (\Delta APQ)} = \frac{1+1}{1} = \frac{2}{1}$

$\therefore \frac{\text{ar}(\Delta ABC)}{\text{ar}(\Delta APQ)} = \frac{2}{1}$ …. (ii) [$\because$ ar (ΔAPQ) + ar $(\square PBCQ)$ = ar (ΔABC)]

∴ From (i) and (ii)

$\therefore \frac{\text{ar}(\Delta ABC)}{\text{ar}(\Delta APQ)} = \frac{2}{1} = \frac{AB^2}{AP^2}$

$\frac{AB}{AP} = \frac{\sqrt{2}}{1}$ (by taking square roots on both sides)

Let $AB = \sqrt{2}x$ …. (iii)

and $AP = 1x$

Now, BP = AB – AP

$\therefore BP = \sqrt{2}x - 1x = (\sqrt{2} - 1)x$ …. (iv)

From (iii) and (iv)

$\therefore \frac{BP}{AB} = \frac{(\sqrt{2}-1)}{\sqrt{2}}$

(ii) Draw a circle of radius 2.7cm and draw a chord PQ of length 4.5 cm. Draw tangents at point P and Q without using centre.

Answer:

Step of construction:

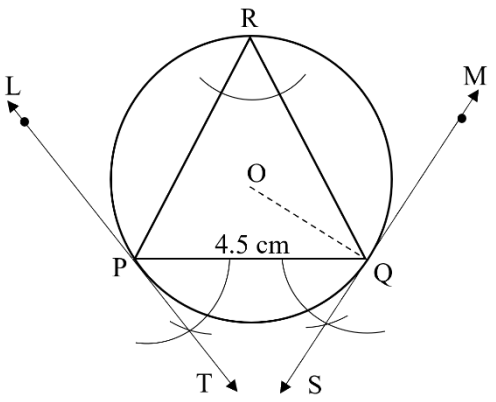
Step 1 : Draw a circle of with centre O and radius 2.7 cm

Step 2 : Draw a chord PQ of length 4.5 cm

Step 3 : Taking a point R on the major arc QP, join PR and QR.

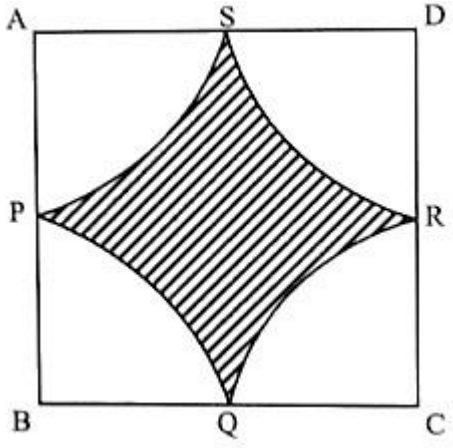
Step 4 : Make ∠QPT = ∠PRQ and ∠PQS = ∠PRQ.

Step 5 : Produce TP to L and SQ to M.



Hence, TPL and SQM are the required tangents.

(iii) In the figure given □ ABCD is a square of side 50 m. Points P, Q, R, S are midpoints of side AB, side BC, side CD, side CD, side AD respectively. Find area of shaded region.*



Answer: Answer is not given due to the change in reduced syllabus.

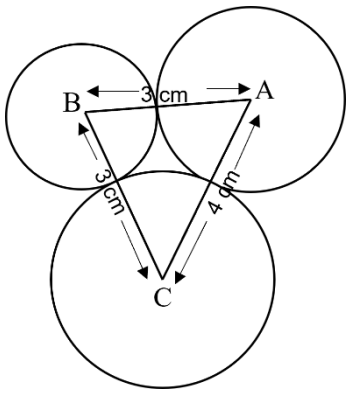
5. Solve the following sub – questions (Any one): **[3]**

(i) Circles with centres A, B and C touch each other externally. If AB = 3 cm, BC = 3 cm, CA = 4 cm, then find the radii of each circle.

Answer: Suppose radius of circle with centre A is x cm

∴ Radius of circle with centre B = (3 − x) cm (∵ AB = 3cm)
and radius of circle with centre C = (4 − x) cm (∵ CA = 4cm)

∴ (3 – x) + (4 – x) = BC = 3
∴ 3 − x + 4 − x = 3
∴ 7 – 2x = 3
∴ 2x = 7 – 3
∴ 2x = 4
∴ x = 2
∴ Radius of circle with centre A = 2cm
∴ Radius of circle with centre B = (3 – x)
= (3 – 2)
= 1 cm
∴ Radius of circle with centre C = (4 – x)
= (4 – 2)
= 2 cm



(ii) If $\sin\theta + \sin^2\theta = 1$
Show that: $\cos^2\theta + \cos^4\theta = 1$

Answer: $\sin\theta + \sin^2\theta = 1$ …. (Given)

But $\sin^2\theta + \cos^2\theta = 1$ …. (Standard result)

∴ Putting the value 1 in given relation we get.

$$\sin\theta + \sin^2\theta = \sin^2\theta + \cos^2\theta$$

∴ $\sin\theta = \cos^2\theta$ …. (i)

Now as per given relation

$$\sin\theta + \sin^2\theta = 1$$

∴ $\cos^2\theta + (\cos^2\theta)^2 = 1$ […. From equation (i)]

∴ $\cos^2\theta + \cos^4\theta = 1$ Hence proved.