

**SECTION – A**

**1. ELISA technique is based on the principle of**

- (A) DNA replication**
- (B) Antigen and Antibody interaction**
- (C) Pathogen and Antigen interaction**
- (D) Antigen and Protein interaction**

**Ans** (B) /Antigen and Antibody interaction

[1 Mark]

**2. Micropropagation can be achieved by**

- (A) Self-pollination**
- (B) Asexual reproduction**
- (C) Tissue culture**
- (D) Vegetative propagation**

**Ans** C / Tissue Culture

**OR**

**The microbes commonly used in kitchens are**

- (A) Lactobacillus and Yeast**
- (B) Penicillium and Yeast**
- (C) Microspora and E. coli**
- (D) Rhizopus and Lactobacillus**

**Ans** A / Lactobacillus and Yeast

[1 Mark]

**3. Meselson and Stahl carried out centrifugation in  $\text{CsCl}_2$  density gradient to separate :**

- (A) DNA from RNA**
- (B) DNA from protein**
- (C) The normal DNA from  $^{15}\text{N}$ -DNA**
- (D) DNA from tRNA**

**Ans** C / The normal DNA from  $^{15}\text{N}$ -DNA

[1 Mark]

**4. Self-pollination is fully ensured if**

- (A) the flower is bisexual.**
- (B) the style is longer than the filament.**

- (C) the flower is cleistogamous.  
 (D) the time of pistil and anther maturity is different.

Ans C / Flower is Cleistogamous

OR

**Zoospores are the reproductive units to carry asexual reproduction in**

- (A) *Chlamydomonas*  
 (B) *Spirogyra*  
 (C) Yeast  
 (D) *Rhizopus*

Ans A / *Chlamydomonas* [1 Mark]

**5. The main barrier that prevents the entry of micro-organisms into our body is**

- (A) Antibodies  
 (B) Macrophages  
 (C) Monocytes  
 (D) Skin

Ans D / Skin

[1 Mark]

## SECTION – B

**6. Name the genus of baculovirus that acts as a biological control agent in spite of being a pathogen. Justify by giving three reasons that make it an excellent candidate for the job.**

Ans Genus -*Nucleopolyhedrovirus*, species-specific , Narrow spectrum , No negative impact on (plants /mammals/ birds /fish ) non-target organisms =  $\frac{1}{2} \times 4$

OR

**“Micro-organisms play an important role for the biological treatment of sewage.”  
 Justify**

Ans Primary effluent passed into aeration tanks, constantly agitated and air is pumped in , allows growth of useful aerobic microbes into flocs / (masses of bacteria and fungal filaments), these microbes consume organic matter and reduce Biochemical oxygen demand (BOD) of effluent. =  $\frac{1}{2} \times 4$

[2 Marks]

**7. It is often observed that the chances of a person suffering from measles in his or her lifetime are low if he or she has suffered from the disease in their early childhood. Justify the statement.**

Ans Memory cells develop during measles in early childhood, subsequent encounters with the same pathogen elicits a highly intensified secondary / anamnestic response. = 1+1

[2 Marks]

8. **Wings of birds and wings of butterflies contribute to locomotion. Explain the type of evolution such organs are a result of.**

Ans They are not anatomically similar in structure but perform same function , hence these are analogous structure =  $\frac{1}{2} + \frac{1}{2}$

type of evolution is convergent evolution = 1

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similar habitat of birds and butterflies has resulted in selection of similar adaptive features (wings) in different groups of organisms , but towards the same function =  $\frac{1}{2} + \frac{1}{2}$

convergent evolution = 1

[2 Marks]

9. **How does an amoeba respond to unfavourable conditions, and on arrival of favourable conditions ?**

Ans unfavourable conditions-Amoeba withdraws its pseudopodia, and secrete a three-layered hard covering or cyst around itself / by encystation ,

Favourable conditon-encysted Amoeba divides by multiple fission , and produces many minute Amoeba or pseudopodiospores. =  $\frac{1}{2} \times 4$

[2 Marks]

10. **Where do the following events occur in the life-cycle of *Plasmodium* ?**

(a) **Gametocyte development**

(b) **Sexual reproduction**

(c) **Asexual reproduction**

Ans a. Human host in RBCs/ red blood cells =  $\frac{1}{2}$

b. Mosquito host in the gut /Stomach / Intestine =  $\frac{1}{2}$

c. Liver cells , red blood cells/RBCs  $\frac{1}{2} \times 2$

[ $\frac{1}{2} + \frac{1}{2} + 1 = 2$  Marks]

11. **How is the MOET programme carried out for herd improvement ? Explain**

Ans In this method a cow is administered hormone with FSH-like activity, to induce follicular maturation and super ovulation/ produce 6-8 eggs, Female is either mated with an elite bull or artificially inseminated, the fertilised eggs at 8-32 cell stage are recovered non-surgically and transferred to surroagte mothers. =  $\frac{1}{2} \times 4$

[2 Marks]

12. **Given below is one of the strands of a DNA segment :**



(a) **Write its complementary strand.**

(b) Write a possible RNA strand that can be transcribed from the above DNA molecule formed.

Ans (a) 5' ATGCATGCATGCATGC → 3' (polarity = ½, nucleotide sequence = ½)

(b) 5' AUGCAUGCAUGCAUGC → 3' (polarity = ½, nucleotide sequence = ½)

[1 + 1 = 2 Marks]

### SECTION C

13. Differentiate between wind pollinated and insect pollinated flowers.

Ans **Wind pollinated**

Pollen grains are light non sticky/well exposed stamens/ Large feathery stigma/ single ovule in each flower/ Small flowers packed in inflorescence (Any three) = ½ × 3

**Insect pollinated**

Pollen grains sticky/ Floral rewards/ Fragrant /Nectar rich/ Large Flower / Foul odour (Any three) = ½ × 3

[3 Marks]

14. Generally it is observed that human males suffer from hemophilia more than human females, who rarely suffer from it. Explain giving reasons.

Ans This is a sex linked / X chromosomes linked recessive disease ,the heterozygous female / carrier for hemophilia may transmit the disease to sons (male progeny), The possibility of hemophilic female/daughter is rare because mother of such a female has to be at least carrier and the father should be hemophilic. = 1+1+1

[3 Marks]

OR

F<sub>1</sub> progeny of pea plant bearing violet flowers and snapdragon plant bearing red flowers were selfed to produce their respective F<sub>2</sub> progeny.

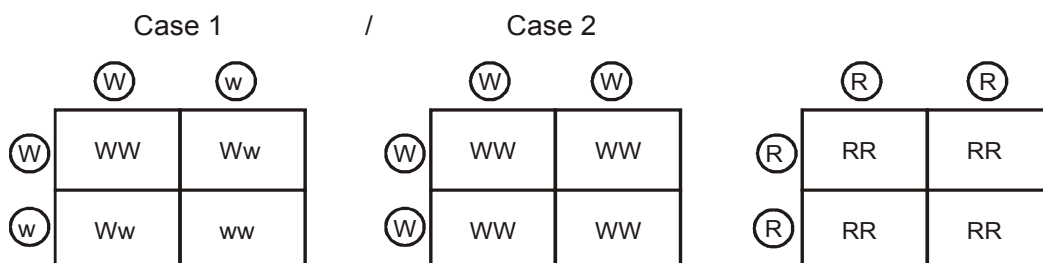
Compare the phenotypes, the genotypes and the pattern of inheritance of their respective F<sub>2</sub> progeny.

Ans F<sub>1</sub> Violet flower of Pea

Ww    Ww                      /    WW    WW  
Selfing                                      Selfing

F<sub>1</sub> Red flower of snapdragon

RR    RR  
Selfing

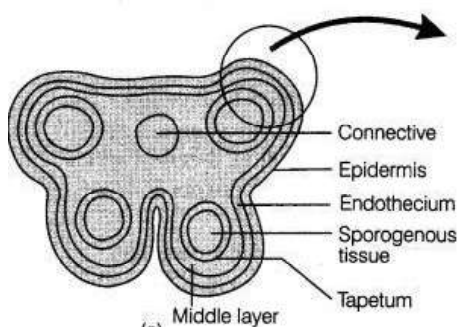


Phenotypic ratio	100% WW /	Phenotypic ratio	
Violet : White	all violet flowers	Red	
3 : 1		100%	$\frac{1}{2} \times 2$
Genotypic Ratio		Genotypic Ratio	
1 : 2 : 1		RR (100%)	$\frac{1}{2} \times 2$
Pattern of inheritance			
Pea plant		Complete dominance	$\frac{1}{2}$
Snapdragon		Incomplete dominance	$\frac{1}{2}$

[3 Marks]

15. Draw a schematic transverse section of a mature anther of an angiosperm. Label its epidermis, middle layers, tapetum, endothecium, sporogenous tissue and the connective.

Ans



$$= \frac{1}{2} \times 6$$

[3 Marks]

16. Alien species invasion has been a threat to biodiversity. Justify with the help of a suitable example. List any other three causes responsible for such a loss.

Ans Example of Alien species invasion

Nile Perch, introduced into lake Victoria (in East Africa), led to extinction of Cichlid fish (more than 200 species) in the lake

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Introduction of African cat fish (*Clarias gariepinus*), for aquaculture, posing threat to indigenous catfish

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Introduction of carrot grass (*Parthenium*) / *Lantana* / Water hyacinth (*Eichhornia*), which are invasive weed, that pose threat to native species

or any other appropriate example.  $= \frac{1}{2} \times 3 = 1\frac{1}{2}$

Causes of biodiversity loss

- Habitat loss and fragmentation
- Over exploitation

(iii) Co-extinction

$$= \frac{1}{2} \times 3 = 1\frac{1}{2}$$

[3 Marks]

**17. Explain the changes that milk undergoes when suitable starter/inoculum is added to it. How does the end product formed prove to be beneficial for human health ?**

Ans Lactobacillus / lactic acid bacteria (LAB) present in inoculum , grows in milk at a suitable / optimum temperature, multiplies converting milk to curd, produce acids that coagulate and partially digest the milk proteins. =  $\frac{1}{2} \times 4$

This improves its nutritional quality by increasing Vitamin B<sub>12</sub>, LAB check diseases causing microbes in our stomach =  $\frac{1}{2} \times 2$

[3 Marks]

**18. Name any two natural cloning vectors. Give reasons that make them act as cloning vectors. Write the two characteristics the engineered vectors are made to possess**

Ans Plasmids , bacteriophages =  $\frac{1}{2} + \frac{1}{2}$

ability to replicate within bacterial cells , high copy number within the bacterial cells =  $\frac{1}{2} + \frac{1}{2}$

Characteristics of engineered Vectors: easy linking of foreign DNA ,

Selection of recombinants from non- recombinants /selectable marker =  $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

**19. (a) Explain the principle on the basis of which DNA is separated by the technique of Gel electrophoresis.**

**(b) How is the separated DNA visualised ?**

Ans (a) Since DNA fragments are negatively charged molecules , they can be separated by forcing them to move towards the anode, under the electric field through a medium / matrix /

Agarose , The DNA fragments separate as per their size smaller fragments move the farthest. =  $\frac{1}{2} \times 4$

(b) They are visualised by staining with ethidium bromide compound, under exposure of UV light. =  $\frac{1}{2} \times 2$

[3 Marks]

**20. Study the table given below and identify a, b, c, d, e and f :**

Crops	Variety	Resistance to disease
a	Pusa sadabahar	b
c	d	White rust
e	Himgiri	f

Ans	Crop	Variety	Resistance to diseases.
a.	Chilli	-	b. Mosaic Virus /Leaf Curl
c.	Brassica	d. Pusa Swarnim/karan Rai	-
e.	Wheat -	f. Leaf & stripe rust / hill bunt.	
$= \frac{1}{2} \times 6$			
[3 Marks]			

**OR**

**What is plant breeding ? Explain the two steps involved in classical plant breeding.**

**Plant breeding** is the purposeful manipulation of plants species in order to create desired plant types, that are better suited for cultivation / better yield / disease resistant.

$$\frac{1}{2} \times 2 = 1$$

**Classical Plant breeding** involves crossing or hybridisation of pure lines , followed by artificial selection to produce plants with desirable traits of higher yield / nutrition / resistance to diseases. = 1+1

[3 Marks]

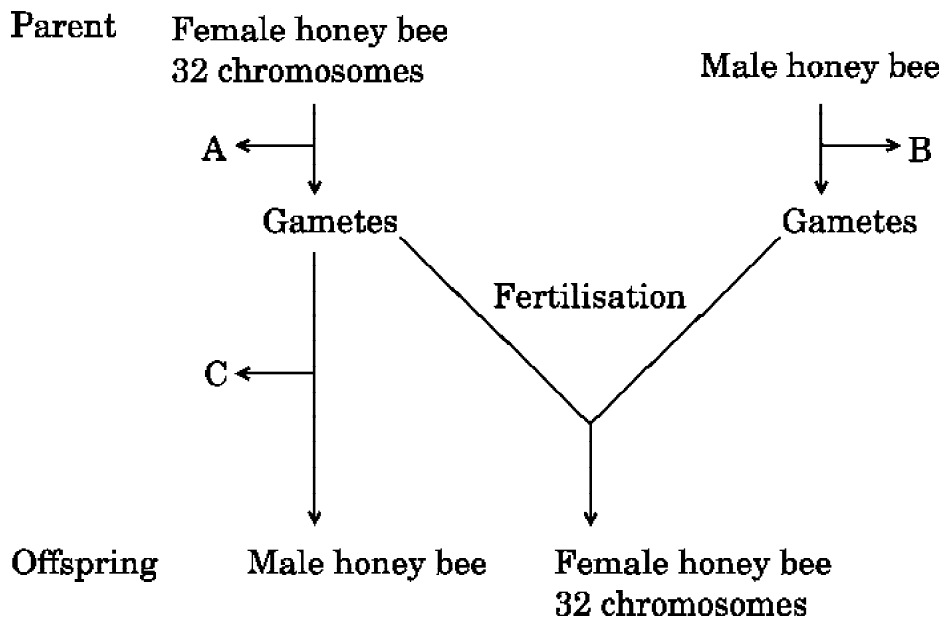
**21. What is the natural ageing of a lake called ? How is it caused ? Write the impact of uncontrolled human activities on it ?**

Ans Natural ageing of a lake is called Eutrophication , It is caused due to nutrients such as nitrogen/ nitrates and phosphorus/phosphates being drained by streams into lakes , Effluent from insdustries and homes and agriculture wastes have resulted in cultural or Accelerated Eutrophication. = 1+1+1

[3 Marks]

### SECTION D

**22. he cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination mechanism. Honey bee is an interesting example to study the mechanism of sex-determination. Study the schematic cross between the male and the female honey bees given below and answer the questions that follow :**



- (a) Identify the cell divisions 'A' and 'B' that lead to gamete formation in female and male honey bees respectively.
- (b) Name the process 'C' that leads to the development of male honey bee (drone).

Ans (a) 'A' - meiosis

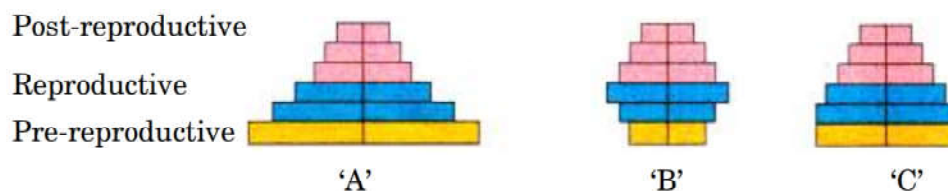
'B' - Mitosis

(b) 'C' - Parthenogenesis

= 1+1+1

[3 Marks]

23. Study the age pyramids 'A', 'B' and 'C' of the human population given below and answer the questions that follow :



(a) Identify pyramids 'B' and 'C'.

(b) Write the basis on which the above pyramids are plotted.

Ans (a) B- Stable population = 1

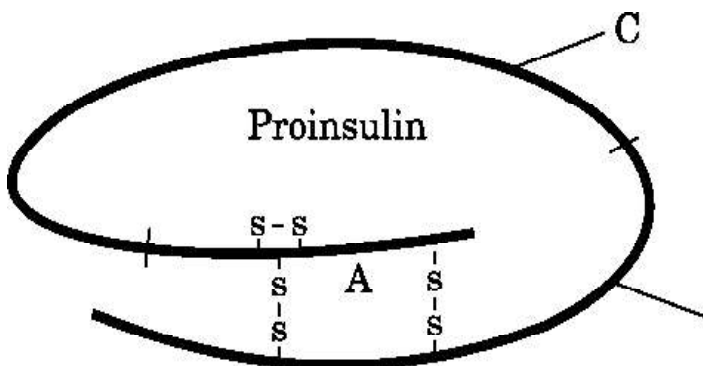
C- Declining population = 1

(b) Age Distribution of male and female of human population = 1

[2 + 1 = 3 Marks]



24. Insulin in the human body is secreted by pancreas as prohormone/proinsulin. The schematic polypeptide structure of proinsulin is given below. This proinsulin needs to undergo processing before it becomes functional in the body. Answer the questions that follow



- State the change the proinsulin undergoes at the time of its processing to become functional.
- Name the technique the American company Eli Lilly used for the commercial production of human insulin.
- How are the two polypeptides of a functional insulin chemically held together ?

- Ans
- 'C' Peptide is removed = 1
  - r-DNA technology / Recombinant DNA Technology = 1
  - Disulphide bonds = 1

[ 3 Marks]

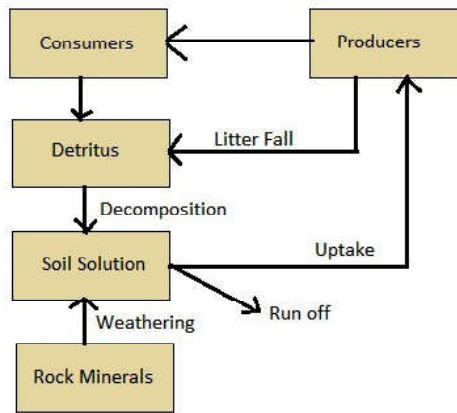
### SECTION E

25. Describe the model of phosphorus cycle in the terrestrial ecosystem.

Ans Phosphorus a major constituent of biological membrane / nucleic acids / cellular energy transfer system , Many animals need it for making shells / bones and teeth , the natural reservoirs of phosphorous is rock , which contains phosphorous in the form of phosphate reserves , on weathering minute amount of phosphate dissolve in soil solution , and absorbed by roots , Herbivores , obtain these elements from plants waste products and dead organism , decomposed by phosphate-solubilising bacteria , releasing phosphorus =  $\frac{1}{2} \times 10$

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Marks can also be awarded for the steps given in the proper sequence, with other details



= ½ marks for each given label

[5 Marks]

OR

**Describe the DDT biomagnification occurring in an aquatic food chain. State the negative effects the process has on the organisms at the last trophic level of the food chain.**

Ans Biomagnification refers to increase in concentration of the toxicant at successive trophic levels, Toxic substance accumulated by an organism cannot be metabolised or excreted and is passed on to the next higher trophic level =  $\frac{1}{2} \times 2$

Biomagnification of DDT in an aquatic food chain

Water → Zooplankton → small fish → Large Fish → Fish eating bird. =  $\frac{1}{2} \times 5$

0.003 ppb    0.04 ppm        0.5 ppm        2 ppm        25 ppm

High concentration of DDT disturb calcium metabolism in birds, causes thinning of eggshell, their premature breaking eventually causing decline in bird population =  $\frac{1}{2} \times 3$

[ 5 Marks]

26. (a) **Explain the process of DNA replication in prokaryotes.**

(b) **Write the phase in cell cycle where DNA replication occurs in a cell. What will happen if cell division fails to occur after DNA replication in a cell ?**

Ans a. Replication of DNA begins at origin of replication site, DNA dependent DNA polymerase helps in polymerisation of deoxynucleotide, replication occurs within a small opening- replication fork, Polymerisation take place in 5' → 3' direction only, one strand grows in continuous manner while the other DNA strand grows in discontinuous manner (small stretches), discontinuously synthesised fragments are later joined by the enzyme DNA ligase. =  $\frac{1}{2} \times 6$

- b. 'S' Phase / synthesis phase = 1  
 polyploidy / polyploids = 1

[5 Marks]

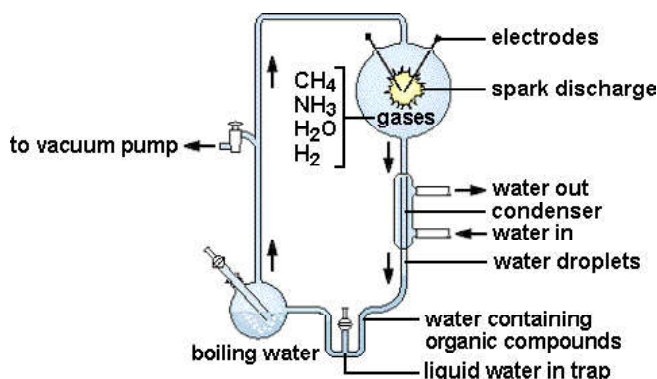
OR

**State the hypothesis proposed by Oparin and Haldane. Describe how S.L. Miller experimentally supported it.**

- Ans a. Proposed that first form of life could have come from pre-existing non living organic molecules, and that formation of life was preceded by Chemical evolution/formation of diverse organic molecules from inorganic constituents. = 1+1
- b. Miller created similar conditions in laboratory as existed on the earth, before the origin of life, by creating electric discharge, in a closed flask, containing  $\text{CH}_4$  and  $\text{H}_2$  and  $\text{NH}_3$ , and water vapour at  $800^\circ\text{C}$ , observed formation of amino acids =  $\frac{1}{2} \times 6$

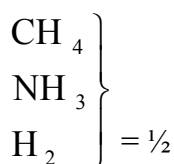
[5 Marks]

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Label- Electrodes =  $\frac{1}{2}$

Electric / Spark discharge =  $\frac{1}{2}$



Boiling water =  $\frac{1}{2}$

Water containing organic compound =  $\frac{1}{2}$

Condenser =  $\frac{1}{2}$

[ 5 Marks]

27. (a) IVF is a very popular method these days that is helping childless couples to bear a child. Describe the different steps that are carried out in this technique.
- (b) Would you consider Gamete Intrafallopian Transfer (GIFT) as an IVF ? Give a reason in support of your answer.

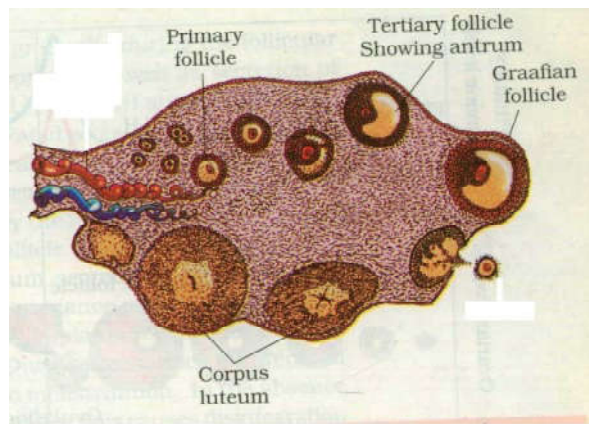
- Ans (a) Ova from the wife /donor (female) and sperms from the husband / donor (male) , are collected and induced to form zygote , in simulated conditions in laboratory , the zygote/ early embryos(upto 8 blastomeres) then transferred into the fallopian tube(ZIFT), and embryos with more than 8 blastomeres, into the uterus(IUT) to complete its further development. =  $\frac{1}{2} \times 6$
- (b) No, GIFT cannot be considered as IVF technique because fertilisation takes place in the female body / in vivo. =1+1

[3 +2 = 5 Marks]

**OR**

- (a) Draw a sectional view of a human ovary and label primary follicle, tertiary follicle, Graafian follicle and corpus luteum in it.
- (b) Name the gonadotropins and explain their role in oogenesis and the release of ova.

Ans a.



=  $\frac{1}{2} \times 4$

b. LH , FSH =  $\frac{1}{2} + \frac{1}{2}$

Both LH and FSH increase during follicular phase and stimulate follicular development , secretion of estrogen by the growing follicles, LH surge ( rapid secretion of LH) during mid cycle / 14th day induces rupture of graafian follicle, and release of ova / secondary oocyte  
=  $\frac{1}{2} \times 4 = 2$

[2 + 3 = 5 Marks]