

Sample Paper-1 (2023-24)
Class XII Biology
(Subject Code-044)

Maximum Marks: 70

Time: 3 hours

General Instructions:

- i) All questions are compulsory.
- ii) The question paper has three sections and 33 questions. All questions are compulsory.
- iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; and Section–C has 7 questions of 3 marks each; section-D has 2 case-based question of 4 marks each and section-E has 3 questions of 5 marks each.
- iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION-A

1. The phenomenon wherein, the ovary develops into a fruit without fertilization is called: **1**

- a. Parthenocarpy
- b. Apomixis
- c. Asexual reproduction
- d. Sexual reproduction

Ans.a. Parthenocarpy

2. Mature Graafian follicle is generally present in the ovary of a healthy human female around: **1**

- a. 5 – 8 day of menstrual cycle
- b. 11 – 17 day of menstrual cycle
- c. 18 – 23 day of menstrual cycle
- d. 24 – 28 day of menstrual cycle

Ans. b. 11 – 17 day of menstrual cycle

3. Occasionally, a single gene may express more than one effect. The phenomenon is called: 1

- a. multiple allelism
- b. mosaicism
- c. pleiotropy
- d. polygeny

Ans: c. pleiotropy

4. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is: 1

- a. Autosomal dominant
- b. Autosomal recessive
- c. Sex-linked dominant
- d. Sex-linked recessive

Ans: d. Sex-linked recessive

5. The most accepted line of descent in human evolution is: 1

- a. Australopithecus → Ramapithecus → Homo sapiens → Homo habilis
- b. Homo erectus → Homo habilis → Homo sapiens
- c. Ramapithecus → Homo habilis → Homo erectus → Homo sapiens
- d. Australopithecus → Ramapithecus → Homo erectus → Homo habilis → Homo sapiens.

Ans: c. Ramapithecus → Homo habilis → Homo erectus → Homo sapiens

6. The technology of biogas production from cow dung was developed in India largely due to the efforts of: 1

- a. Gas Authority of India
- b. Oil and Natural Gas Commission
- c. Indian Agricultural Research Institute and Khadi & Village Industries Commission
- d. Indian Oil Corporation

Ans: c. Indian Agricultural Research Institute and Khadi & Village Industries Commission.

7. Which one of the following alcoholic drinks is produced without distillation? 1

- a. Wine
- b. Whisky
- c. Rum

d. Brandy

Ans: a. Wine

8. The transfer of genetic material from one bacterium to another through the mediation of a viral vector is termed as: 1

- a. Transduction
- b. Conjugation
- c. Transformation
- d. Translation

Ans: a. Transduction

9. Significance of the 'heat shock' method in bacterial transformation is to facilitate: 1

- a. Binding of DNA to the cell wall
- b. Uptake of DNA through membrane transport proteins
- c. Uptake of DNA through transient pores in the bacterial cell wall
- d. Expression of antibiotic resistance gene

Ans: c. Uptake of DNA through transient pores in the bacterial cell wall

10. Which of the following contributed in popularising the PCR (polymerase chain reaction) technique? 1

- a. Easy availability of DNA template
- b. Availability of synthetic primers
- c. Availability of cheap deoxyribonucleotides
- d. Availability of 'Thermostable' DNA polymerase

Ans: d. Availability of 'Thermostable' DNA polymerase

11. Silencing of a gene could be achieved through the use of: 1

- a. RNAi only
- b. antisense RNA only
- c. both RNAi and antisense RNA
- d. none of the above

Ans. c. both RNAi and antisense RNA

12. Golden rice is: 1

- a. A variety of rice grown along the yellow river in China
- b. Long stored rice having yellow colour tint

- c. Transgenic rice having the gene for β – carotene
d. The wild variety of rice with yellow-coloured grains

Ans. c. Transgenic rice having the gene for β – carotene

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:

- (a) Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Both Assertion and Reason are false.

13. **Assertion:** Human population now doubles every 35 years as against 200 years in 1600-1800.

Reason: Rapid increase is due to better health facilities and food resources. 1

Ans. A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

14. **Assertion:** Tropical rain forests are disappearing fast from developing countries such as India.

Reason: No value is attached to these forests because these are poor in biodiversity. 1

Answer: (c)

15. **Assertion:** Species are groups of potentially interbreeding natural populations which are isolated from other such groups.

Reason: Distinctive morphological characters are displayed due to reproductive isolation. 1

Answer: (b)

16. **Assertion:** “The Biological Species” concept helps us to ask how species are formed.

Reason: The concept of biological species focuses our attention on the question of how reproductive isolation comes about. 1

Answer: (a)

SECTION-B

17. **If a father and son are both defective in red-green colour vision, is it likely that the son inherited the trait from his father? Comment. 2**

Colour blindness is a common hereditary condition which means it is passed down from parents. When the father is colour blind, he can only pass an X chromosome to his daughter.

Hence a colour blind boy can't receive a colour blind gene from his father, even if his father is colour blind. A father can only pass the Y gene to his son.

18. Mention the applications of DNA fingerprinting. 2

- (1) It is used in forensic science to identify potential crime suspects.
- (2) It is used to establish paternity and family relationships.
- (3) It is used to identify and protect the commercial varieties of crops and livestock.
- (4) It is used to find out the evolutionary history of an organism and trace out the linkages between groups of various organisms.

19. Comment on the utility of variability in the number of tandem repeats during DNA fingerprinting. 2

Tandems are a region in a chromosome which the sequence of DNA stretch is repeated for several times.

It forms a pattern of bands which is unique for each individual and is used in DNA fingerprinting in the forensic department.

20. a. Give an example of convergent evolution and identify the features towards which they are converging. 2
b. How do we compute the age of a fossil? 2

The presence of wings in birds and butterflies is referred to as convergent evolution, and they are adapted for flying. Convergent evolution forms analogous structures.

The age of a fossil can be calculated by radioactive dating.

A comparison is made between the naturally occurring radioactive isotopes with that of the decay product, using known decay rates.

21. What is brood parasitism? Explain with the help of an example. 2

Brood parasitism is a type of parasitism in which an organism lays eggs in the nest of another organism.

Example. Cuckoo lays eggs in the nest of its host, and the hosts incubate the eggs.

During the course of evolution, the **eggs of the parasitic bird have evolved to resemble the host egg in size and colour** to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.

SECTION-C

22. Describe the hormonal control of the reproductive system in human male. 3

- Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone (GnRH).
- The increased levels of GnRH then acts at the anterior pituitary gland and stimulates secretion of two gonadotropins – luteinising hormone (LH) and follicle stimulating hormone (FSH).

- LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis.
- FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.

OR

What is hymen? Why is the presence or absence of hymen not a reliable indicator of virginity or sexual experience?

- Hymen is a thin membrane that partially covers the vaginal opening. The hymen is often torn during the first coitus (intercourse).
- However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling, etc.
- In some women the hymen persists even after coitus. In fact, the presence or absence of hymen is not a reliable indicator of virginity or sexual experience.

23. It is said, that the harmful alleles get eliminated from the population over some time, yet sickle cell anaemia is persisting in the human population. Why? 3

Sickle cell anaemia is persisting in the human population. It is affected individuals carrying mutations in both the parental and maternal inherited haemoglobin gene.

There is an advantage that the patients are better protected against malaria.

And this can be the reason for the harmful alleles of sickle cell anaemia to persist in the human population despite the elimination of harmful genes over time.

24. Explain adaptive radiation with the help of a suitable example. 3

The process of evolution of different species in a given geographical area starting from a point and radiating to other habitats (other geographical area) is called adaptive radiation.

Darwin's finches represent one of the best examples of this phenomenon.

Darwin observed Small black birds in Galapagos Islands which amazed him.

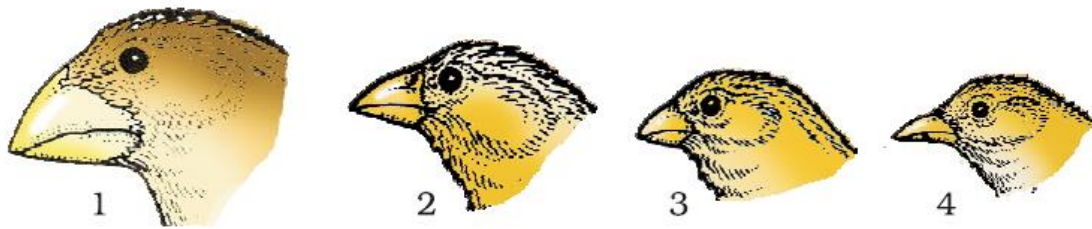
They were later called Darwin's Finches.

There were many varieties of finches in the same island. All the varieties evolved on the island itself.

Many forms of finches with altered beaks arose from the original seed-eating birds enabling them to become insectivorous and vegetarian finches.

Another example is Australian marsupials.

A number of marsupials, each different from the other evolved from an ancestral stock, but all within the Australian island continent.



Variety of beaks of finches that Darwin found in Galapagos Island

25. A man who was bleeding due to injury with old iron objects was taken to a hospital. The doctor gave him an injection to protect him against a deadly disease.

- (a) What did the doctor inject into the patient's body?
- (b) How do you think this injection would protect the patient against the disease?
- (c) Name the disease against which this injection was given and the kind of immunity it provides.

3

- (a) The doctor injected antitoxin. i.e., preformed antibodies against the toxin.
- (b) The preformed antibody will neutralize the toxin and the pathogenic agent.
- (c) It is against tetanus. It is passive immunity.

26. Describe with any three examples the main idea behind the biological control of pests and diseases.

3

The main idea behind the biological control of pests and diseases is to control the number of pests by introducing natural predators to the environment for this pest.

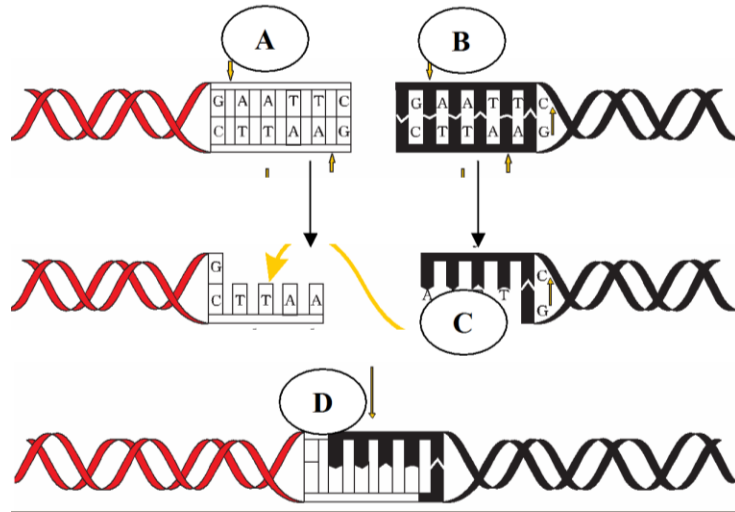
Examples:

No	Organisms	Pathogens
1	Lady birds	Aphids
2	Dragonflies	Mosquitoes
3	Bacillus thuringiensis	Caterpillars
4	Trichoderma	Plant Pathogens
5	Baculoviruses	Insects

27. (i) Labell the missing parts (A, B, C and D) in the following diagram.

3

- (ii) Give the origin of thermostable Polymerase enzyme.



- i(A) Vector DNA, (B) Foreign DNA, (C) Sticky end (D) Recombinant DNA 2
 ii *Thermus aquaticus* 1

28. Name a nematode that infects the roots of tobacco plants and causes a great reduction in yield. Describe the strategy adopted to prevent this infestation. 3

Meloidogyne incognita is the nematode that infects the roots of tobacco plants and causes a great reduction in yield.

Strategy:

A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi).

RNAi takes place in all eukaryotic organisms as a method of cellular defense.

This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).

Source of Complementary RNA:

The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.

Vector Used:

Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells.

These two RNAs being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode.

Consequence:

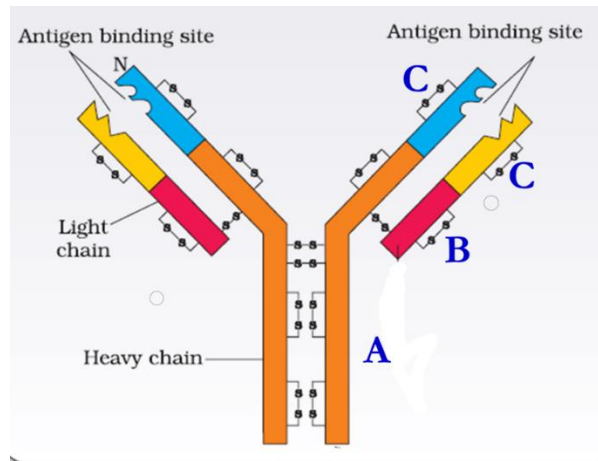
The consequence was that the parasite could not survive in a transgenic host expressing specific interfering RNA.

The transgenic plant therefore got itself protected from the parasite

SECTION-D

29. Observe the given figure and answer the following questions.

4

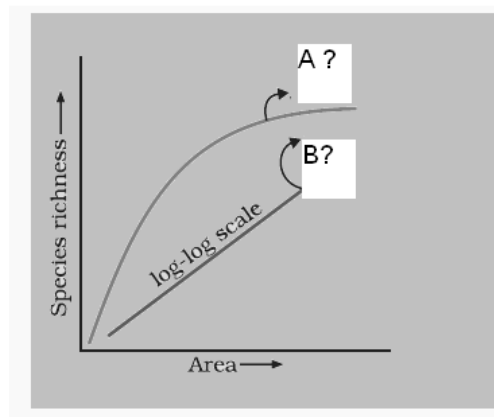


- (a) Name the parts A and B.
- (b) Name the type of antibodies present in colostrum, which protects the newborn from certain diseases.

(c) Why is an antibody molecule represented as H2L2?

- (a) Site A is the constant region for heavy chain. Site B is the constant region for the light chain. 1
- (b) Ig A type 1
- (c) The antibody molecule has two heavy chains (H2) and two light chains (L2) and hence it is represented as H2L2. 2

30. Observe and identify the given graph and answer the following questions. **4**



(a) What does this graph represent?

(b) Write the equation of the curve 'A' & 'B' and explain.

(c) Explain the finding of the great German naturalist and geographer Alexander von Humboldt.

The graph below shows Species-Area relationship. 1

(A) $S = CA^2$ (B) $\log S = \log C + Z \log A$ 1

- (i) Within a region, species richness increases with increasing explored area but only up to a limit
- (ii) Relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola 2

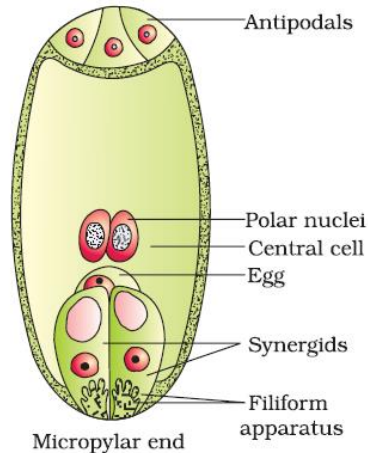
SECTION-E

31.(a) Draw a diagram of a mature embryo sac of an angiosperm and label the following parts in it:

- (i) Filiform apparatus (ii) Synergids
(iii) Egg cell (iv) Central cell
(v) Polar nuclei (vi) Antipodal cells

(b) Write the fate of the egg cell and polar nuclei after fertilization. 5

(a) 3



(b) Fate of the egg cell and polar nuclei after fertilization.

- The egg cell becomes the zygote after fertilization, then it forms the embryo.
- The two polar nuclei and a male gamete fuse to form a triploid primary endosperm Nucleus. (PEN). PEN undergoes repeated mitosis and forms the triploid endosperm tissue. 1+1=2

OR

A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds.

Answer the following questions giving reasons:

- What is the minimum number of pollen grains that must have been involved in the pollination of its pistil?
- What would have been the minimum number of ovules present in the ovary?
- How many megaspore mother cells were involved?
- What is the minimum number of microspore mother cells involved in the above case?
- How many male gametes were involved in this case?

240. One pollen grain participates in fertilization of one ovule
240. One ovule after fertilization forms one seed
240. Each MMC forms four megaspores out of which only one remain functional =
60. Each microspore mother cell meiotically divides to form four pollen grains.
($240/4 = 60$)
480. Each pollen grain carries two male gametes (which participate in double fertilization) ($240 \times 2 = 480$)

32. Assisted Reproductive technology is a gift for the infertile couples who are unable to give birth to young ones. Explain in detail.

5

ARTs are special techniques used for infertile couples to have children.

IVF-In Vitro Fertilization

The fertilization which occurs outside the body in almost similar conditions of the body, followed by **embryo transfer** (ET), is called in-vitro fertilization. This method is popularly known as **test tube baby** programme.

GIFT Gamete Intra Fallopian Transfer:

The **ovum** (gamete) collected from a female donor is transferred in to the fallopian tube of another female who cannot produce ova but can provide suitable environment for fertilisation and further development of the foetus up to parturition is called gamete intra fallopian transfer (GIFT).

ZIFT Zygote Intra Fallopian Transfer:

Transfer of **zygote** up to 8 blastomeres into the fallopian tube is called Zygote Intra Fallopian Transfer.

IUT Intra Uterine Transfer:

Transfer of embryos with more than 8 blastomeres, into the **uterus** is called Intra Uterine Transfer.

Embryos formed by **in-vivo fertilization** (fusion of gametes within the female) also could be used for such transfer to assist those females who cannot conceive.

ICSI Intra Cytoplasmic Sperm Injection:

The sperm is directly injected into the ovum to form an embryo in the laboratory and then embryo transfer is carried out.

AI or IUI Artificial Insemination or Intra-Uterine Insemination:

The semen collected from the husband or a healthy donor artificially introduced either into the vagina or into the uterus of the female is called Artificial Insemination (AI).

OR

At the time of independence, the population of India was 350 million, which exploded to over one billion by May, 2000.

- (a) List any two reasons for the rise in population and any two steps taken by the government to check this population explosion.**
- (b) Mention one positive and one negative application of amniocentesis.**
- (c) Draw a diagram to show tubectomy.**

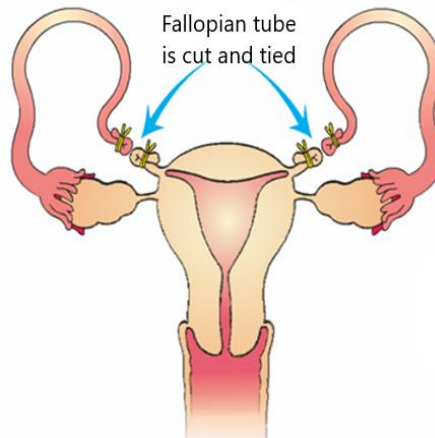
Reasons:

- (a) (i)** There is rapid decline in the death rate, maternal mortality rate and infant mortality rate.
- (ii)** There is increase in the number of people in reproductive age.

Steps taken by the government:

- (i)** Statutory rising of marriageable age of females to 18 years and that of males to 21 years.
 - (ii)** Providing incentives to couples with small families or one who undergoes sterilization like vasectomy or tubectomy.
- (b) (i) Positive application:**
Any genetic disorder of the foetus can be detected.
- (ii) Negative Application:**
It is misused for finding the sex of the foetus followed by female foeticide.

(c) Tubectomy



33. What is Translation? Describe the process with the help of a neat and labeled diagram.

5

OR

Explain the function of Lac-operon with a neat and labelled diagram.

The synthesis of protein (polypeptide) from mRNA is called translation.

- Ribosome acts as cellular factory for protein synthesis.
- The ribosome consists of structural RNAs and about 80 different proteins.
- Ribosome consists of two subunits; a smaller subunit and a larger subunit in its inactive state.

When the smaller subunit joins with the mRNA, translation begins.

Initiation:

- There are two sites in the larger subunit of ribosome;
- P-Site or Peptidyl Site
- A-site, Acceptor Site or Aminoacyl Site.
- The smaller subunit with methionyl tRNA (Met-tRNA) attaches to the larger subunit in such a way that the start codon (AUG) comes in the P-site.

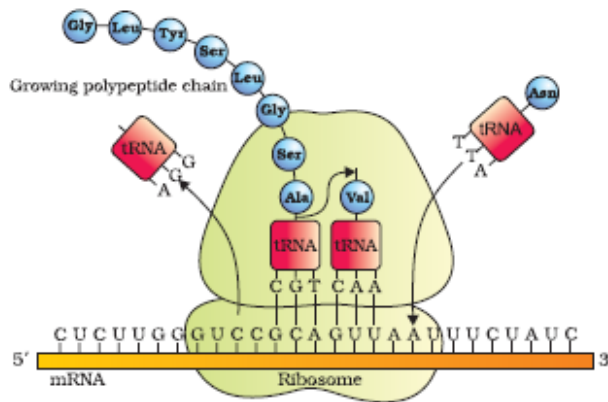
Elongation:

- The ribosome moves from codon to codon along the mRNA in 5' to 3' direction.
- tRNAs transfer amino acids to the A- site of ribosome as per the triplet codes in the mRNA.

- Peptide bond is formed between carboxyl group of amino acid at P-Site and amino group of amino acid at A-Site by the enzyme Peptidyl transferase. The polypeptide grows in length.
- When the tRNA reaches the E-Site, it gets released.

Termination:

- When the ribosome reaches the stop codon, termination of polypeptide occurs as the stop codon doesn't code for any amino acid.
- The release factor enters the A-Site and releases the polypeptide from the ribosome.
- The smaller and larger sub units of ribosome and mRNA dissociate.



OR

Function of Lac-operon with a neat and labelled diagram.

Genes of Lac Operon:

A cluster of genes involved in lactose metabolism in *E. coli* is called Lac operon.

The *lac* operon consists of

Regulator Gene:

one regulatory gene (the *i* gene – here the term *i* does not refer to inducer, rather it is derived from the word inhibitor) and

Structural Genes:

three structural genes (*z*, *y*, and *a*).

Repressor Gene:

The *i* gene codes for the repressor of the *lac* operon.

Substrate:

Lactose is the substrate for the enzyme beta-galactosidase and it regulates switching on and off of the operon.

Hence, it is termed as **inducer**.

The functioning of genes:

In the absence of a preferred carbon source such as glucose, if lactose is provided in the growth medium of the bacteria, the lactose is transported into the cells through the action of permease.

The repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon.

In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer.

This allows RNA polymerase access to the promoter and transcription proceeds.

Transcription and Translation:

The *z* gene codes for beta-galactosidase (β -gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose.

The *y* gene codes for permease, which increases permeability of the cell to β -galactosidase.

The *a* gene encodes a transacetylase.

The Lactose operon expresses as long as the Lactose is present. When all lactose is converted into glucose and galactose, the reaction stops.

