



03



متعلقہ سوال کا جواب صرف مختص کردہ جگہ پر اور بیرونی نشان کے اندر دیا جائے۔



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Q. No. 2 (i) The nitrogenous waste excreted by the organisms depend on the availability of water. **Uric acid is a purine** less toxic than urea and ammonia. It precipitates from solution allowing **4 nitrogen atoms per uric acid molecule** to be excreted. **1g of nitrogen in the form of uric acid** requires just **1ml water** for its excretion. It has evolved in two groups with major water loss problem:-

- **terrestrial invertebrates**
- **egg-laying vertebrates.**

Q. No. 2 (ii) "The area where **gaseous exchange with environment** actually takes place is called respiratory surface."

Properties of an ideal respiratory surface.

1. It should be **moist and permeable** to assist in diffusion.

2. It should be **thin** because diffusion is effective over a distance of **1mm or less.**

3. It should have **large surface area** for sufficient gaseous exchange.

4. It should have a **good blood supply.**

5. It should have **good ventilation**



Q. No. 2 (iii) The labelling is as follows:

- 1: myofibril
- 2: myosin
- 3: F. actin
- 4: actin
- 5: Tropomyosin
- 6: Troponin.

Q. No. 2 (iv) "A reflex action is an immediate, automatic and involuntary response to a stimulus." The path of nerve impulse during reflex action is called **reflex arc**. A reflex arc contain five basic components:-

- **Sensory neuron**
- **receptors**
- **interneurons**
- **motor neurons**
- **effectors.**

Forexample, we withdraw our hand from a hot object as a reflex. This cannot be



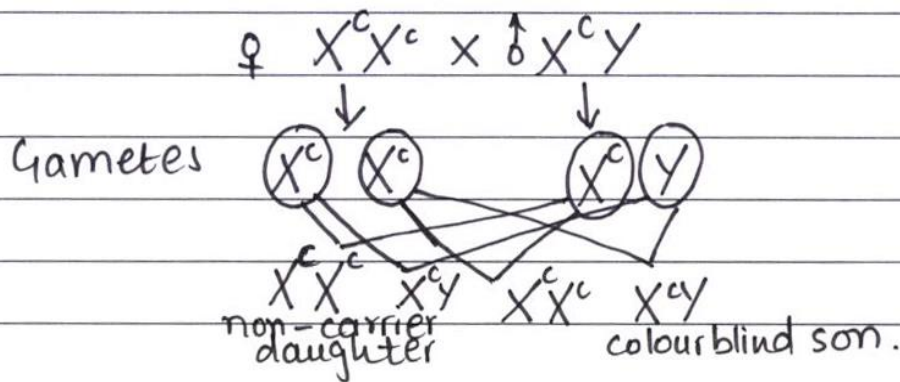
Q. No. 2 (v) If parents have a colour blind son and non-carrier daughter then their

• **Phenotypes:** Both are normal. (Trichromatic)

• **Genotypes:** Mother has heterozygous genotype $X^C X^c$

while father has homozygous genotype:-
following genotype: $X^C Y$

where X^C = normal X^c = recessive and disease causing.



Q. No. 2 (vi)

"Miscarriage is the act of giving birth spontaneously to a foetus too premature to survive usually before the 28th week of pregnancy."

→ **CAUSES:-**

The embryo \bar{p} may implant near the cervix. So as placenta grows it extends across the internal opening of cervix leading to torn and haemorrhage. A normally positioned placenta may tear away from endometrium leading to haemorrhage and



Q. No. 2 (vii) Neural crest cells have been proposed as the 4th germ layer. They grow on lateral sides of the neural tube and give rise to cranial, spinal and sympathetic ganglia and associated nerves. They form peripheral ^xnerve^x nerves, skull bones, teeth, medulla of adrenal gland, etc. Due to immense number of cell types they give rise to they are proposed as neural crest cells.

Q. No. 2 (viii)

a) INTRON

- The non-coding region of mRNA.

EXON

- The coding region of mRNA.

b) HETEROCHROMATIN

- Highly condensed, non-expressed region of chromatin fibre.

EUCHROMATIN

- loosely condensed, expressed region of chromatin fibre.

c) NUCLEOSOME

PRIMOSOME



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Q. No. 2 (ix) "Genetic drift refers to the phenomena in which **some alleles are removed** from a population **by chance**." It is also called **neutral selection**. The genotype that is removed may be advantageous, disadvantageous or of no particular advantage or disadvantage. It is caused by two effects:

- 1. BOTTLENECK EFFECT** :- In which a genotype is removed from a population **due to natural disaster** e.g. flood, fire, cyclone.
- 2. FOUNDER EFFECT** : In which new population is formed from few founders (or a single fertile female) containing a small ratio of parental population's genotype.

Q. No. 2 (x)



Q. No. 2 (xi) **Cystic fibrosis** is an **inherited disease** which affects the **mucous and sweat glands**. It is due to defect in **cystic fibrosis trans membrane conductance regulator gene** which controls movement of ions and water into and out of body cell. When the gene is defective, **abnormally thick mucus** is produced which **obstructs the air passages**. Under normal condition mucus protects against dehydration, infection. It can be cured by **gene therapy** in which normal gene is placed in **liposomes** and sprayed into patient's nostrils. Liposomes are microscopic vesicles arisen from breakdown of lipoproteins.

Q. No. 2 (xii) "Growing of a single cell or group of cells on **glassware under aseptic conditions** is called tissue culture." Animal cell culture involves two techniques:-

1. ANCHORAGE DEPENDENT

Cells derived from tissues grow in the form of **monolayer attached to culture vessel**. They grow for limited generations hence are called **finite cell line**.

2. ANCHORAGE INDEPENDENT

Some



Q. No. 2 (xiii) The elimination of a single disastrous disease or all the diseases of human population by utilizing all **appropriate methods** as and when required **ensuring the participation of community** in this regard is called **integrated disease management (IDM)**. The objective is to prevent the spread of disease and its new onset. This is highly effective program for **disease control**. It makes use of all available methods such as **preventive measures, vaccination, therapies**, etc. Awareness among the public is ensured through seminars, print and electronic media.

Q. No. 2 (xiv) Sex determination pattern in humans is **XY-XX type**. where female is homogametic **XX** producing **same types of eggs**. while **male is heterogametic XY** forming sperms of two types:-

half containing **X** chromosome and half **Y**. It is the **sperm** which decides the **gender of offspring**. **sex ratio** between male and female

♀ XX × ♂ XY

↓ ↓

gametes (X) (X) (X) (Y)

↓ ↓

(X)	(X)	(Y)
(X)	XX	XY
	♀	♂



Q. No. 2 (xv) "Hormones are small soluble organic molecules which are required in low concentration and transfer information between different body parts (**chemical messengers**).

• **Steroid hormones**: Hormones secreted by Adrenal cortex, testis, ovaries and placenta. e.g. estrogen, progesterone, aldosterone, testosterone^{etc}.

• **Proteinous hormones**: Somatotrophic, Thyrotrophic and Gonadotrophic hormones secreted by anterior pituitary and insulin by pancreas

• **Catecholamine**: Adrenaline and nor-adrenaline.

• **Amino acid derivatives**: Thyroxin by thyroid gland.

• **Peptide hormones**: Melanocyte stimulating hormones, oxytocin, vasopressin, calcitonin and Parathormone

Q. No. 2 (xvi) "Biological rhythms are cyclic physiological changes or changes in the activity of living things which are **in response to periodic environmental changes.**"

Biological clock tends to maintain these rhythms even in absence of external stimulus. They help an organism become **better adapted in an environment.**

Biological rhythms may be **24-hour cycle or circadian rhythm** e.g. sleep wake cycle, blood pressure, secretions of various glands, etc. They can be **monthly rhythms** such as



Q. No. 2 (xvii) "Infertility is failure to achieve pregnancy." It causes in female include:-
• Failure to ovulate:

Sometimes hormonal imbalance leads to infertility. Either **follicle doesnot mature (Lack of FSH)** or **ovulation doesnot occur (Lack of LH)**.

• Blocked oviduct:

Infertility may be due to blocked oviduct. The blockage may be congenital or due to infection.

• Damage to uterus:

Fibroids are benign (non-cancerous) tumors in the uterus which can cause infertility.

• Endometriosis:

Pieces of endometrium form in places other than uterus e.g. in ovaries.



Q. No. 2 (xviii)

“Following fertilization, the first
myo mitotic division of zygote
is called cleavage.”

There are two patterns of cleavage:-

1. HOLOBLASTIC:

In eggs with evenly divided yolk the whole egg divides, into cells of roughly the same size. This is known as holoblastic cleavage. e.g. bony fishes and amphibians.

2. MEROBLASTIC:

The eggs of reptiles, birds and some fishes contain greater amount of yolk and small amount of cytoplasm concentrated at animal pole. Thus, cleavage occurs only in blastodisc i.e. the small disc of cytoplasm at animal pole.



Q. No. 2 (xix) "The graphical representation of ecological data is called ecological pyramid."

• Pyramid of Energy: It represents the total energy at each trophic level. There is decrease in energy as we move towards upward / higher trophic levels.

• Pyramid of number: Represents the number of organisms at each trophic level. These also decrease in higher levels. Thus producers are more than consumers.



Q. No. 2 (xx) Microbes can be used in following ways for human welfare:-

• Food processing:- Microbes influence the quality, availability and quantity of food. They can be used to convert one substance to another. e.g. **milk into cheese and yougurt, sugar into alcohol and bread.**

• Industrial Processes:- Microbes are used in various industrial processes because (a) a number of chemicals can be used and produced (b) They offer high specificity (c) They can be used to acquire isomers such as **L-amino acids**, etc.

• Energy Production: They breakdown the **sludge** to produce monosaccharides and amino acids which are converted into alcohols and acids and eventually **methane gas** which is used as **biogas (energy source)**



The relevant question should be answered only in the allotted space and inside the outer mark



Q. No. 3 (Page 2/6)

A large area consisting of 21 horizontal lines, intended for the student to provide a written answer to the question.



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The relevant question should be answered only in the allotted space and inside the outer mark

Space for diagram/rough work



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Q. No. 3 (Page 6/6)



Q. No. 4 (Page 1/6) **a) HUMAN BRAIN**

- (i) A: cerebral cortex
B: cerebrum.
C: Pituitary gland.
D: cerebellum.
E: Pons
F: Medulla Oblongata.

ii) PARTS OF BRAIN

The three parts of human brain are:-

- forebrain
- Midbrain
- Hindbrain

- Forebrain further consists of 3 parts:-
cerebrum, thalamus, limbic system.
- Midbrain is reduced in humans and contains **reticular formation** that connects forebrain and hind brain.
- Hindbrain also consists of 3 parts:-
cerebellum, pons and medulla oblongata.

iii) FUNCTIONS

⇒ **D (CEREBELLUM):-**



Q. No. 4 (Page 2/6)

also controls the action of individual muscles to produce complicated movements such as running, walking, riding bicycle and doing delicate work with hands. It is also involved in learning memory storage for behaviour.

⇒ E:- (PONS)

Pons acts as a relay centre connecting medulla, cerebellum and cerebrum. It also controls heart beat and breathing rate. It is a part of brain stem.

⇒ E (MEDULLA OBLONGATA)*

Medulla controls automatic functions of body such as heartbeat, breathing rate, blood pressure, swallowing, etc.

b) Albinism is a recessive gene. Thus, in females it will only be manifested in case of homozygous recessive i.e. if she obtains recessive alleles from both parents. A female containing only one gene for albinism will be carrier but will not manifest symptoms of the



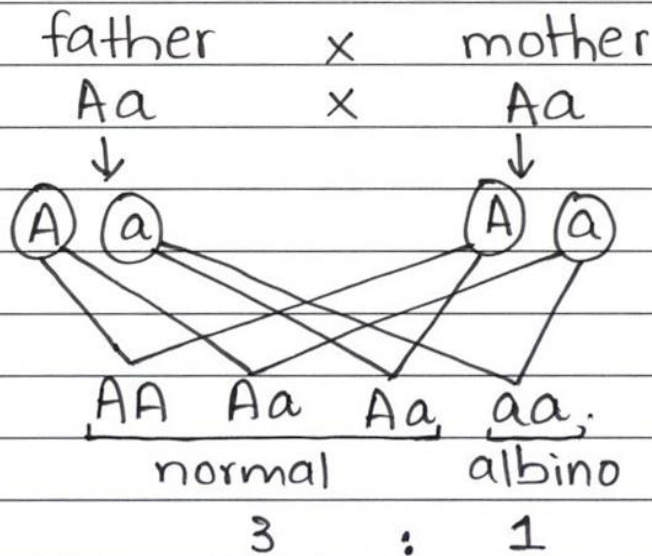
Q. No. 4 (Page 3/6)

one recessive allele will manifest the disease as it has only one X-chromosome and the disease is X-linked recessive.

All male children of an affected mother will be affected and daughters may be carrier depending on whether father is normal or affected.

while all female children of an affected father will be carriers while male children will not be affected. Males obtain X chromosome of mother)

Albinism is only manifested in **homozygous recessive form**.



Since normal parents had albino child parents must be **heterozygous**, then the probability for normal child is:-

P - a - favourable cases - 3



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Q. No. 4 (Page 6/6)



Q. No. 5 (Page 1/6) **a) JOINTS**

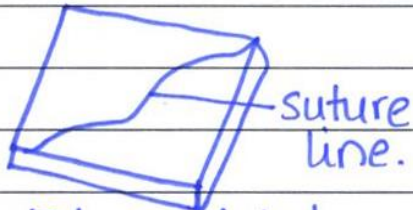
"A Joint (or articulation) is a place where **two bones or bone and cartilage join together.**"

The study of joints is known as **arthrology**. Joints are classified into 3 types on the basis of their mobility:-

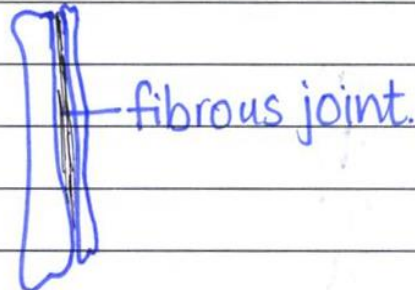
I. FIBROUS JOINTS:-

Fibrous joints are **completely immovable joints**. They are present between bones joined through fibrocartilage. The bones may not have a joint cavity between them. They are present:-

- (a) bones of skull (suture)
- (b) in the shaft region of long bones of the forearm and leg.
- (c) between root of tooth and socket in maxilla or mandible (jaw bone).



▲ Fibrous joints between skull bones.



▲ between long bones.



Q. No. 5 (Page 2/6)

2. CARTILAGENOUS JOINTS:-

These joints allow slight movement. They are present between bones joined by hyaline cartilage. Again joint cavity between bones is not present. They are present

(a) between vertebrae.

(b) intercostal cartilage connecting ribs to sternum.

(c) pubic symphysis.

3. SYNOVIAL JOINTS:-

Synovial joints are freely movable. They are cavity oriented joints. The bones are separated by articular cartilage. They are enclosed by an inner layer of ligament and outer inner layer of synovial membrane. The synovial membrane secretes the synovial fluid.

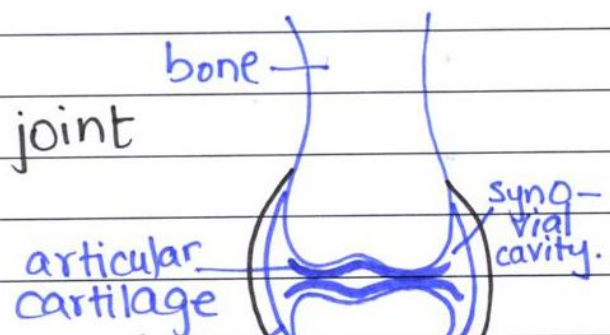
Examples of synovial joints are:

(a) Hinge joint

(b) Pivot joint

(c) Ball and socket joint

(d) Gliding joint





Q. No. 5 (Page 3/6) Skeletal deformation may be hereditary e.g. arithritis or may be hormonal e.g. osteoporosis or may be due to malnutrition e.g. rickets etc. Here we will see spondolysis and sciatica:-

1- SPONDOLYSIS:-

It is the immobility and fusion of vertebral joints. Cervical spondolysis results from cervical degeneration, slipped disc, etc.

2 SCIATICA:-

Sciatica refers to weakness, numbness, tingling and pain in leg. It is due to pressure or damage to the sciatic nerve. Causes may include a fall, injury, blow, tumor, slipped disc.

b) GEL ELECTROPHORESIS

"Gel electrophoresis refers to a technique of biotechnology in which different sized fragments of charge bearing polymers (amino acids, nucleic acids and proteins) are separated"



Q. No. 5 (Page 4/6) (i) PRINCIPLE :-

The principle of gel electrophoresis is based on the concept that the **distance** a DNA fragment will travel is **inversely proportional to its size**. The sample containing different sized fragments is added in **agarose or polyacrylamide gel** and placed in electrophoresis chamber. When electric field is applied, the **DNA fragments move towards positive pole**.

The **longer size fragments** remain backward as compared to small sized fragments which move ahead. Thus the **mixture of DNA fragments** is separated into different **bands**.

VISUALIZATION OF BANDS:

These bands can be visualized by using a **transilluminator** so that banding sequence in the gel appears on the x-ray film from where it can be read. This technique is known as **autoradiography**. This must be done quickly after segments have separated because after sometime, **DNA fragments diffuse in the gel**.



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Q. No. 5 (Page 5/6) ii) USE IN BIOTECHNOLOGY:-

Gel electrophoresis is needed to :-

- **separate** different sized fragments of DNA
- for **DNA sequencing**.
- for obtaining a DNA fragment for further analysis.
- During **DNA fingerprinting**.



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Space for Diagram/rough work



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Q. No. 5 (Page 6/6)