



03



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



23060924

Q. No. 2 (i)

## URIC ACID

- Uric acid is a purine less toxic than urea and ammonia.
- It precipitates from solution allowing 4 nitrogen molecules per uric acid molecule to be excreted.
- 1g of uric acid requires 1ml water for ~~dissolve~~ excretion.

### Advantages:

- First of all, it is less toxic.
- Secondly, it requires small amount of water (only 1ml/g) to be excreted so it is helpful to conserve water in animals in arid environment as these animals have less water available.

Q. No. 2 (ii)



LABELLING

Q. No. 2 (iii)

1- Myofibril

2- Myosin

3- Actin

4- F. Actin

5- Tropomyosin

6- Troponin

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Q. No. 2 (iv)



## PHENOTYPE AND GENOTYPE

Q. No. 2 (v)

Parents ofColor blind son & Non-carrier daughter:Mother:Phenotype: CarrierCapital C = dominant  
small c = recessiveGenotype:  $X^C X^c$ Father:Phenotype: NormalGenotype:  $X^C Y$ 

This is because son inherits X-chromosome from mother while daughter gets father's X-chromosome.

## MISCARRIAGE

Q. No. 2 (vi)

Definition:

"It is the act of giving birth to spontaneously to a foetus too premature to survive, usually before 28<sup>th</sup> week of pregnancy."

Causes: ⇒ Embryo may implant near cervix. As placenta grows, it extends partially/completely over internal cervical opening.

As placenta and foetus grow and uterus stretches, region of placenta over cervical opening may tear and haemorrhage may occur.

⇒ Normally positioned placenta may tear away from uterine wall accomplished by haemorrhaging.

⇒ Chromosomal abnormalities of foetus.





## FOURTH GERM LAYER

Q. No. 2 (vii)

⇒ Neural crest cells have been proposed fourth germ layer.

⇒ Various motor nerves grow out of developing brain and spinal cord but sensory nerves have a separate origin, neural crest cells formed in region of neural plate border.

⇒ After neural tube closure, neural crest cells migrate widely to lateral sides of neural tube and give rise to cranial, spinal and sympathetic ganglion and associated nerves.

Structures derived: Neural crest cells migrate subsequently to various parts of embryo and give rise to peripheral nerves, medulla of adrenal gland, skull bone, teeth and many different cell types.

Q. No. 2 (viii)

### a) INTRON

- These are non-coding sequences in mRNA.
- These are removed during RNA splicing.
- These are not part of mature RNA.

### EXON

- These are coding sequences in mRNA.
- These are not removed during RNA splicing.
- These are part of mature RNA.

### b) HETEROCHROMATIN

- This is condensed region in chromatin fibre.
- Genes of this region unexpressed.
- It is already condensed.

### EUCHROMATIN

- It is uncondensed.
- Its genes expressed.
- It condenses during cell division.

### c) NUCLEOSOME

- It is a complex of DNA duplex wrapped around histone cores.

### PRIMOSOME

- It is a complex of enzymes DNA helicase and primase





## GENETIC DRIFT

Q. No. 2 (ix)

### Definition:

"In some populations, new alleles may be added or some alleles may be removed by chance. This is genetic drift."

Like some individuals may leave behind few more descendants than other. Larger population suffers less from genetic drift. When population is small, there is a chance some rare genotypes may be lost if few individuals fail to reproduce.

Bottleneck Effect: The change in population size with specific genotype and allele due to natural disaster. Like earthquake, flood, hurricane may remove large number of individuals <sup>and phenotypic</sup> unselectively, leaving small surviving population with changed allele frequencies.

Founder Effect: "The establishment of new population by few founders (or single fertilized female) that carries small fraction of total genetic <sup>allelic</sup> variation of original population."

Q. No. 2 (x)



## Q. No. 2 (xi) CYSTIC FIBROSIS

"It is an inherited disease that affects mucus and sweat glands."

People with severe symptoms show serious lung and digestive problems.

Cause: It is caused due to defect in gene conductance trans membrane regulator (CFTR) which encodes a protein that controls movement of water and salts in and out of cell. In people with cystic fibrosis, the gene doesn't work effectively and ~~organ~~<sup>cells</sup> lung, liver, pancreas and other organs secrete abnormal, thick sticky mucus blocking airways and organs. While, normal people have watery mucus that keeps lungs of organs moist and protects them from infection or drying out.

Gene therapy: An in-vivo method is used. Liposomes - microscopic vesicles that form spontaneously when lipoprotein is put in solution are coated with gene needed to cure cystic fibrosis. The solution is then sprayed in patient's nostrils.

## Q. No. 2 (xii) TISSUE CULTURE

### Definition:

"The growth of single cell or group of cells in glassware on artificial medium under aseptic conditions is called tissue culture."

### Animal cell culture:

⇒ Anchorage-dependent: Adherent cells are anchorage dependent and grow as monolayers attached to cell culture vessel. Most cells derived from tissue are anchorage dependent. Since they grow to limited generations they are called finite cell lines.

⇒ Anchorage-independent: Suspension cells can survive and proliferate without being attached to substratum therefore called anchorage-independent. Many haematopoietic cells (cells of liver, spleen, bone marrow), transformed





## INTEGRATED DISEASE MANAGEMENT

Q. No. 2 (xiii)

Definition: "Effective control of particular diseases or all common diseases of population can be achieved by using all relevant, appropriate methods of disease control. This approach of disease control is called integrated disease management."

Objective: • Stop spread of disease • Prevention<sup>NEW</sup> of disease

It has proved very effective way for elimination of dangerous disease.

Method: Integrated disease management includes:

- public awareness about severity of problem, causes and remedies
- Seminars in schools college
- Using print and electronic media
- person-to-person communication
- Using methods of disease control (drug treatment, vaccination, preventive measures)

Q. No. 2 (xiv)

## HUMAN MALE-HETEROGAMETIC

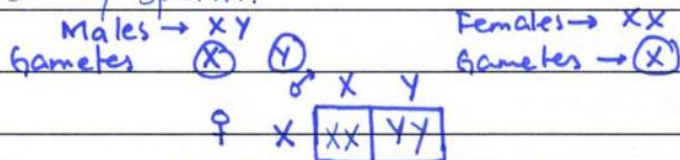
Humans have 23 chromosome pairs, out of which 22 are autosomes and one is sex chromosome that determines gender.

In humans, males are XY and females are XX.

Reason:

Males are heterogametic as they have one X-chromosome and other Y-chromosome so they produce two kinds of sperms (male gametes). Half carry X-chromosome and half carry Y-chromosome so gender of child is determined by sperm.

Cross:



• If X-carrying sperm fertilizes an egg, child will be girl and if Y-





## HORMONES

Q. No. 2 (xv)

Definition: "A small soluble organic molecule effective in low concentration!!

It is chemical messenger that transports signals from one cell to other."

### TYPES

- Steroid Hormones: Hormones produced by adrenal cortex and gonads e.g. cortisolone, aldosterone, estrogen, progesterone, testosterone, etc.
- Proteinous Hormones: Thyrotrophic, gonadotrophic and somatotrophic hormones by anterior pituitary and insulin by pancreas.
- Catecholamine: Adrenaline and non-adrenaline by adrenal medulla.
- Amino acid derivatives: Thyroxine by thyroid gland.
- Peptide Hormones: Melanocyte stimulating hormone by median pituitary. Adrenocorticotrophic hormone by anterior pituitary. Vasopressin (ADH) and oxytocin from posterior pituitary. Calcitonin and parathormone by thyroid and parathyroid glands respectively.

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Q. No. 2 (xvi)



Q. No. 2 (xvii)

INFERTILITYDefinition:

|| "It is failure to achieve pregnancy." ||

Causes of Female Infertility:

1. Failure to ovulate: Sometimes hypothalamus and pituitary gland fail to produce hormones normally. The result is either no follicles develop (lack of FSH) or no egg is released (lack of LH).  
is affected

2. Blocked oviduct: In some females, infertility may be due to diseases causing blockage of oviduct (fallopian tube). It may also be due to infections.

3. Uterus damage: Fibroids are benign (non-cancerous) tumors that grow from uterus and cause infertility.



Q. No. 2 (xviii)

CLEAVAGEDefinition:

"Following fertilization, zygote undergoes mitotic divisions called cleavage."

Patterns:

Holoblastic cleavage: In eggs with small amount of yolk, entire egg divides producing cells of roughly same size. This is holoblastic cleavage.

E.g.: Bony fishes and amphibians.

Meroblastic cleavage: In these eggs, there is large amount of yolk on one side of cell and little cytoplasm concentrated at one end called animal pole. The division takes place in blastodisc, a small ~~area~~ disc of cytoplasm at animal pole. This is termed meroblastic cleavage.

E.g.: Reptiles, birds, some fishes.





Q. No. 2 (xix)

## ECOLOGICAL PYRAMID

### Definition:

"Graphical representation of ecological data."

### TYPES:

Pyramid of Biomass: These represent total amount of biomass at each trophic level. Biomass is an estimate of total amount of living material or mass of organisms. Units may vary. It may be represented as total volume, dry weight or live weight. As we move from one trophic level to next, there is progressive reduction in biomass.

Pyramid of Numbers: These represent number of organisms at each trophic level. Highest number is shown by wider pyramids. As we move up, each trophic level has smaller number of organisms (due to decrease in energy contents available.) This number of herbivores are greater than carnivores.



Q. No. 2 (xx)

ROLE OF MICROBES

- They can be used in house-hold processing industry e.g.

Starting Material	Microbe	Product
Pasteurized Milk	Streptococcus sp. Lactobacillus sp.	Cheese
Variety of organic compounds	Penicillium sp. Saccharomyces sp.	Vinegar (acetic acid)
Cereal grains ground into flour	Saccharomyces cerevisiae	Bread

- They are also used in industrial processes such as brewing.
- They are used in waste water treatment.
- They are used to generate electricity.

















20



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

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**Q. No. 3 (Page 6/6)**





Q. No. 4 (Page 1/6)

(a) HUMAN BRAINi) LABEL:

A - Meninges

B - Cerebrum

C - Pituitary gland

D - Cerebellum

E - Pons

F - Medulla Oblongata

ii) THREE MAIN PARTS OF BRAIN:

1. **Forebrain:** It is the largest part of brain.

It consists of cerebrum, thalamus, limbic system.

2. **Hindbrain:** It consists of cerebellum, pons, medulla oblongata.

3. **Midbrain:** It is reduced in humans. It act as relay centre connecting hindbrain with forebrain.

iii) FUNCTIONS:

**D - Cerebellum:** It controls **equilibrium** i.e. body posture and coordination of action of individual muscles to produce complex activities like walking, writing, standing, etc.

It is also involved in **learning memory storage** for behavior.

**E - Pons:** It connects cerebellum, ~~spinal~~ medulla and cerebrum. It also controls **rate and pattern of respiration and heartbeat.**



Q. No. 4 (Page 2/6)

(b) ALBINISM

	<u>Mother</u>	<u>Father</u>	(As child is albino, both parents must have one recessive gene)
<u>Phenotype</u>	Normal	Normal	
<u>Genotype</u>	Aa	Aa	

(Allele A is dominant over a.)

Gametes

(A) (a)

(A) (a)

Probability:

	A	a
A	AA	Aa
a	Aa	aa

It is clear from the cross that probability for their next child to be normal is  $\frac{3}{4}$  i.e. 75%.

Since albinism is due to recessive gene so child will be albino only if it is homozygous for recessive alleles. If it carries one or two normal alleles, it will be normal.













26



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**Q. No. 4 (Page 6/6)**



Q. No. 5 (Page 1/6)

(a) JOINTSDefinition:

"The place where two bones or bone and cartilage meet is called joint or articulation."

CLASSIFICATION:

Fibrous Joints: "When adjacent bones are connected by fibrous connective tissue mainly consisting of collagen and <sup>fibres</sup> elastin, it is called fibrous joint."

Mobility: They allow no movement.

Joint cavity: They lack joint cavity.  
The gap between them may be narrow or wide.

Examples:

- Bones of skull i.e suture
- Root of tooth and socket in maxilla and mandible.
- Shaft regions of bones in forearm and leg.

Cartilaginous Joints: "When adjacent bones are connected by cartilage (either hyaline or fibrocartilage), which is a tough but flexible type of connective tissue, it is called cartilaginous joint."

Mobility: They allow little / slight movement.

Joint cavity: They lack joint cavity.

Examples:

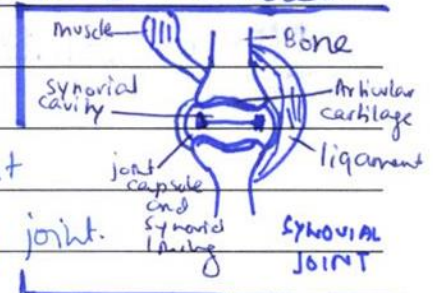
- Costal cartilage that attaches ribs to sternum



Q. No. 5 (Page 2/6) Synovial Joints: "The ends <sup>of bones</sup> are covered by hyaline cartilage and held together by tube like capsule of dense fibrous tissue <sup>surrounding</sup>."

Mobility: They allow free movements.

Joint capsule: Joint capsule is composed of outer layer of ligaments and inner layer of synovial membrane that secretes synovial fluid.



Examples:

- Hinge joint
- Pivot joint
- Ball-and-socket joint
- Gliding joint.

## DISORDERS OF SKELETON

### SCIATICA:

|| "It refers to pain, weakness, numbness or tingling in legs." ||

Cause: It is caused by injury to or pressure on sciatic nerve.

Most common causes are: slipped disc, pelvic injury, fractures or tumours.

Arthritis: || "It is inflammation in joints." ||

Symptoms: Pain on walking that occurs even later at rest, crackling sounds in joint, difficulty getting up from chair, pain in walking up and down stairs.

### Types:

• Osteoarthritis: is a progressive disease in which articular cartilages gradually soften and disintegrate. It affects hip, knee and





Q. No. 5 (Page 3/6) membrane becomes inflamed due to faulty immune system.

- Gouty Arthritis: is a metabolic disorder in which large amount of uric acid is retained in blood and sodium urate crystals are deposited in joints.

Most common joint affected is of big toe.

## (b) GEL ELECTROPHORESIS

(i)

### Definition:

"It is a technique used in molecular biology to separate different sized fragments of charge bearing polymers (protein, RNA and DNA) under influence of electric field in a gel medium of agarose or polyacrylamide."

### Procedure:

The molecules to be sorted are dispensed in well in a gel medium and connected to power source. When electric current is supplied, molecules move to opposite pole through gel.

### Principle:

"The movement of molecules / fragments in gel is primarily dependent on their size."

- The distance a DNA fragment travels is inversely proportional to its length.
- Therefore, small fragments move faster through gel than



Q. No. 5 (Page 4/6) Other factors: The movement also depends on:

- charge
- number of strands (single or double)
- shape of molecule (linear or circular)
- concentration of gel (pore)

different sized.

Thus, molecules are separated into distinct bands on gel.

### Visualization of fragments!

To visualize RNA or DNA, gel is placed on ultraviolet transilluminator.

Bands can be seen as thick and thin.

Thick bands represent high concentration of same sized fragments.

Thin bands represent lower concentration.

If particular sized fragment is to be separated for further analysis piece of gel containing that band is cut and DNA is purified again.

DNA bands can also be transferred from gel to nitrocellulose membrane for autoradiography.

However DNA diffuses in gel over time so examination or autoradiography should be done shortly after cessation of electrophoresis.

(ii)

### NEED

It is needed in different experiments in biotechnology to





Q. No. 5 (Page 5/6) • This separation produces a banding pattern on gel.

- The gel is proceeded for further treatments to observe banding pattern which can be used to deduce sequence of DNA or RNA. Such as by autoradiography, or by UV-rays.
- It is used in different techniques of biotechnology like DNA sequencing and DNA analysis.
- It is also used when a particular sized molecule is to be used for further analysis. Piece of gel containing that band is cut and DNA can be purified and used for analysis.





32



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**Space for Diagram/rough work**



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**Q. No. 5 (Page 6/6)**