BIOLOGY - 044

2

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Question Number

Space for writing Question Number

Section-A

1. (A) free living and non-pathogenic
2. (D) genetic
3. (C) green seed
4. (B) Infectious for dicot ; has Ti plasmid
5. (C) Soil sample III
6. (B) 6%
7. (A) Sickle cell anaemia
8. (B) a- meiosis-I , b- Meiosis-II, c- no div. , d- mitosis
9. (D) Interspecific competition

Space for writing Question Number

10. (B) Share common ancestors

11. (C) Patient takes immuno-suppressants for first few weeks only.

12. (C) Ethidium Bromide

13. (C) (A) is true, (R) is false

14. (C) (A) is true, (R) is false

15. (a) Both true & (R) correct exp. of (A)

16. (a) Both true & (R) correct exp. of (A)

Space for writing Question Number

5

Section - B

(17) b →

(i) All copulations don't lead to pregnancy because for fertilization to take place, the sperm and ova have to be simultaneously transported to the ampulla of fallopian tube. If the two gametes don't reach simultaneously fertilization will not take place and pregnancy will not happen.

(ii) Meiosis I of spermatogenesis and oogenesis, are markedly different :-

Meiosis-I of spermatogenesis	Meiosis-I of oogenesis
· starts at puberty	· starts during embryonic life but is arrested at prophase-I. It resumes at puberty.
· it is equal division and forms 2 equal sec. spermatocytes	· it is unequal division and forms one large sec. oocyte and a small first polar body.

6

Space for writing Question Number

(18)

(a) - r-DNA technology has helped patients suffering from Type-I diabetes by allowing production of human insulin in E. coli
- Earlier insulin was extracted from pancreas of slaughtered pigs and cattle which led to allergic reactions in some people.
- Now using r-DNA tech. genes encoding A & B chains of insulin have been synthesized and transfered into E. coli. These chains are separately produced and are converted into insulin by forming disulphide bridges b/w the 2 chains.
This insulin is available in the market and can be used by people suffering from Type-I diabetes.

(b) - The advantage is that the insulin produced using r-DNA tech. is identical to human insulin and therefore doesn't cause allergic reactions whereas insulin derived from animal sources cause allergic reactions and inflammation

Space for writing Question Number

(19)

(a) A → Mycorrhizal
B → Free living N_2 fixing bacteria
C → Symbiotic N_2 fixing bacteria

(b) B → eg. Azotobacter

(20) a →

(i) The interaction b/w egret and cattle is commensalism wherein the egret benefits but the cattle is unaffected. Cattles while grazing cause insects to come out which are eaten by the egret. Thus, egrets forage close to cattles.

(ii) The interact" b/w cuckoo and crow is parasitism more specifically brood ~~parasit~~ parasitism ~~whe~~ wherein the cuckoo benefits and the crow is harmed. The cuckoo lays its eggs in the nest of a crow. The crow warms the egg and takes care of it as if it were his own egg.

Space for writing Question Number

(21)(b) DNA is more stable than RNA due to the following reasons:

- RNA has an extra -OH group at 2' position of the ribose sugar. This makes it labile and easily degradable.
- DNA has thymine instead of uracil which is more stable than uracil because of the presence of an additional methyl grp. in thymine (common name - 5-methyl uracil)
- RNA acts as a catalyst in some cases and hence it is highly reactive. DNA is relatively more stable & doesn't react.
- DNA also has a special repair mechanism

Space for writing Question Number

Section - C ⇒

(22)

(a) - A person inhales dust and pathogens but doesn't always fall sick because of the body's ability to fight against these infectious agents. This ability is called immunity

- Innate immunity is a non-specific type of immunity that is present since birth. This immunity provides barriers to prevent the entry of pathogens into our body.
- For eg. - When we inhale dust and pathogens, the mucus lining of the respiratory passage traps them and doesn't let them enter the body thus preventing infection

(b) Barriers of innate immunity ⇒

- Physiological barriers → acid in stomach, lysozymes in saliva and tear.
- Physical barriers → skin prevents entry of pathogens. Mucus lining of respiratory, gastrointestinal and urinogenital tracts also traps ~~microb~~ pathogens + prevents entry.

(23)

a- Genetic code is a sequence of 3 nucleotide bases which code for ~~synthesis~~ ~~symbolises~~ a specific amino acid. There are 64 codons ~~other~~, out of which 62 code for amino acids and 3 act as stop codons.

b- · Scientists knew that genes code for proteins.
· Replication and transcription involves nucleic acids and could be conceptualised on the basis of complementaries.
· But in translation a nucleotide sequence was to be converted into a protein and no complementarity exists b/w the two.
· To solve this problem, scientists introduced the concept of genetic code.
· t-RNA reads the code and ~~at~~ attaches amino acids in the particular sequence.

Space for writing Question Number

(c) Genetic code is 'universal' because a sequence of bases codes for the same amino acids in all organisms except some mitochondrial codons etc.

24) (a) Adv. of micropropagation ⇒
(i) It leads to the formation of thousands of plants in a short span of time.
(ii) All the plants are identical so they maintain their desirable characters. The desirable characteristics are not lost.

(b) micropropagation has been successfully used for the commercial production of tomato, banana, apple etc.

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Space for writing Question Number

(25)

(a) Name of organism → Drosophila ~~melongaster~~ melangaster

(b) · Advt of using Drosophila ⇒

(i) It can be easily grown on synthetic nutrient media

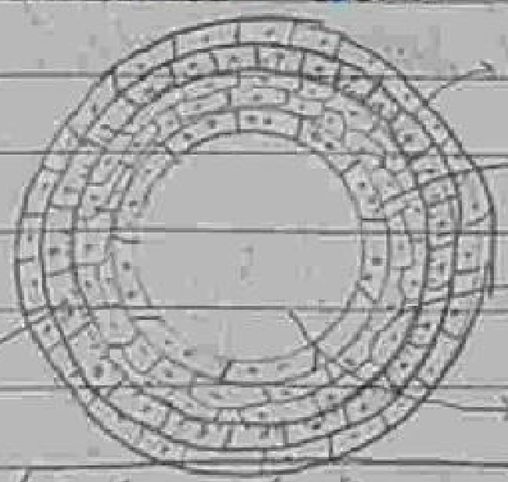
(ii) They complete their life cycle in 2 weeks so multiple generations can be observed

(iii) It shows sexual dimorphism female is longer than the male (larger)

(iv) A single mating produces many offsprings.

(v) It has a number of hereditary variations that can be observed under low power of microscope.

(27)



Enlarged view of microsporangium

Outermost layer → Epidermis → it performs the function of protection & helps in dehiscence.
Innermost layer → Tapetum → nourishes the developing pollen grains.

Space for writing Question Number

(26)	Homologous Organs	Analogous organs
(a)	• They have similar anatomical features but perform different functions.	• They perform the same function but differ in anatomical structure
	• The same structure evolves along different lines in response to different needs.	• Different structures evolve in the same direction due to similar needs
	• It indicates common ancestry	• It doesn't indicate common ancestry.
(b)	It represents divergent evolution	• It represents convergent evolution
eg-	• Vertebrate brain & heart • Thorn and tendril of Bougainvillea and Cucurbita	eg- • Eye of octopus and eye of human. • Sweet potato (root modificat") and potato (stem mod.)

Space for writing
Question Number

(28)

(a) - The procedure shown is ⇒ ~~amn~~ amniocentasis
- In this ~~procedure~~ procus, amniotic fluid is extracted from the uterus / dev. embryo and the genetic composition of the fetal cells is analysed
- Advantage ⇒ It can be used to detect genetic diseases like phenylketonuria & sickle cell anaemia etc.
- Disadvantage ⇒ It is used to determine the sex of the foetus. If it comes out to be female the foetus is often killed (femal foeticide)

(b) Other oral pills contain steroids like progesteron alone or in combination with oestrogen but Saheli is a non-steroidal pill. Moreover, Saheli has fewer side-effects and is very effective. Another advantage is that Saheli has to be taken once a week whereas other pills have to be taken daily.

Space for writing Question Number

Section - D ⇒

(29)

(a) Genetic engineering is the core technique that alters genetic material.

(b) Plasmid ⇒ extra-chromosomal, circular double stranded DNA molecules present in certain bacteria. Plasmids are very important in biotechnology. They act as vectors for the transfer of foreign genetic material. The desired gene is linked with plasmid to form r-DNA. This plasmid is transferred into the host and it replicates to form many copies of the gene of interest. Hence plasmids are essential for gene transfer & cloning. They also help in selection of recombinants through selectable markers.

(c) Action of endonuclease and exonuclease are different as endonuclease breaks sugar phosphate backbone of DNA in the middle of DNA i.e. removes nucleotides from the middle of DNA by recognising specific recognition sequence.

Space for writing Question Number

On the other hand exo-nuclease rumove nucleotides from the edges/ends of the DNA strand.

(30)

(a) Abiotic components of pond ecosystem ⇒ temperature, quality of water (pH, osmolarity etc. features of soil (present at the bottom of the pond), amount and quality of solar radiation.

(b)

Producers	Decomposers
• They convert solar energy into chemical energy in the form of food. They fix solar energy for the entire ecosystem • All consumers directly or indirectly depend upon producers for food.	• They harness the energy present in dead organic matter. They decompose and derive Nutrition from dead organic matter • They clean the organic garbage on the earth and restore soil fertility through nutrient recycling

(c) Transfer of energy b/w trophic levels is not 100% because a lot of the energy is utilised in respiration to perform work, for movement etc. Energy is also lost in the form of heat to the surrounding. This is also in accordance with the 2nd law of thermodynamics (energy transfer can't be 100% effecent) In the end only 10% of energy is passed to the other trophic level.

Section - E

(31) a →

(i) (1) A → Morula
B → Blastocyst
C → Inner cell mass (embryoblast)
D → Trophoblast

(2) C (Inner cell mass) ~~differentiates to~~ forms the embryo after implantation. The embryo then differentiates into the 3 germ layers

(3) The special cells found in 'C' are the stem cells (i.e. Endoderm, ectoderm and mesoderm) cells

These stem cells have the ability to form all the organs and tissues of the body. They are totipotent cells.

(ii) Parturition is induced by a complex neuro-endocrine mechanism. Oxytocin plays a major role in parturition as it stimulates uterine contraction. The contraction of uterus stimulates more release of oxytocin which further increases the strength of uterine contraction. This way contractions become more and more powerful and the baby is expelled from the uterus. Oxytocin is also responsible for the labor pains. It is secreted by the maternal pituitary.

(32) a (i) The disease is AIDS (Acquired Immuno-Deficiency Syndrome) and the causative agent is HIV (Human Immuno-Deficiency Virus)

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(ii) - Once HIV ~~infects~~ enters the body it infects macrophages. The HIV virus transfers its viral RNA genome into the cell where it converts to viral DNA with the help of enzyme reverse transcriptase. The viral DNA is incorporated into the host cell's genome and thus the macrophages start producing more ~~viro~~ virus particles. Therefore acting like a HIV factory.
At the same time they infect Helper T-lymphocytes and replicate within them ~~this~~ ~~they~~ Their progeny virus particles further infect other Helper T lymphocytes causing a reduction in their number. This weakens the immune system making the body susceptible to many diseases. This stage is also accompanied by bouts of fever, weight loss and diarrhoea.

Space for writing Question Number

(iii) Modes of HIV transmission ⇒
(i) From infected mother to foetus through placenta.
(ii) By sexual contact with infected person.

(33) b.
(i) This is an example of co-dominance since the progeny resembles both the parents. Both alleles are equally dominant and both express themselves equally. The progeny cattle has both red and white coat so it resembles both the parents. The red and white hair are equal in number which shows co-dominance.
(ii) Let 'R' represent the allele for red coat and 'r' represent the allele for white coat.

(1) Red dominant over white
- If red is dominant over white the F_2 progeny would have red coat. The recessive allele (r) would not be expressed in F_2 gen.
- In F_2 gen. 75% of calf would have red coat while only 25% would have white coat.

F_2

Parents (P) ⇒ ♂ rr (white coat) × ♀ RR (red coat)

gamete ⇒ r × R

F_1 gen. ⇒ Rr (red coat)

Self pollination ⇒ ♂ Rr × ♀ Rr

gametes ⇒ R, r × R, r

F_2 gen. ⇒

	R	r
R	RR (red coat)	Rr (red coat)
r	Rr (red coat)	rr (white coat)

Genotypic ratio ⇒ 1 : 2 : 1
(RR) (Rr) (rr)

Phenotypic ratio ⇒ 3 : 1
(red coat) (white coat)

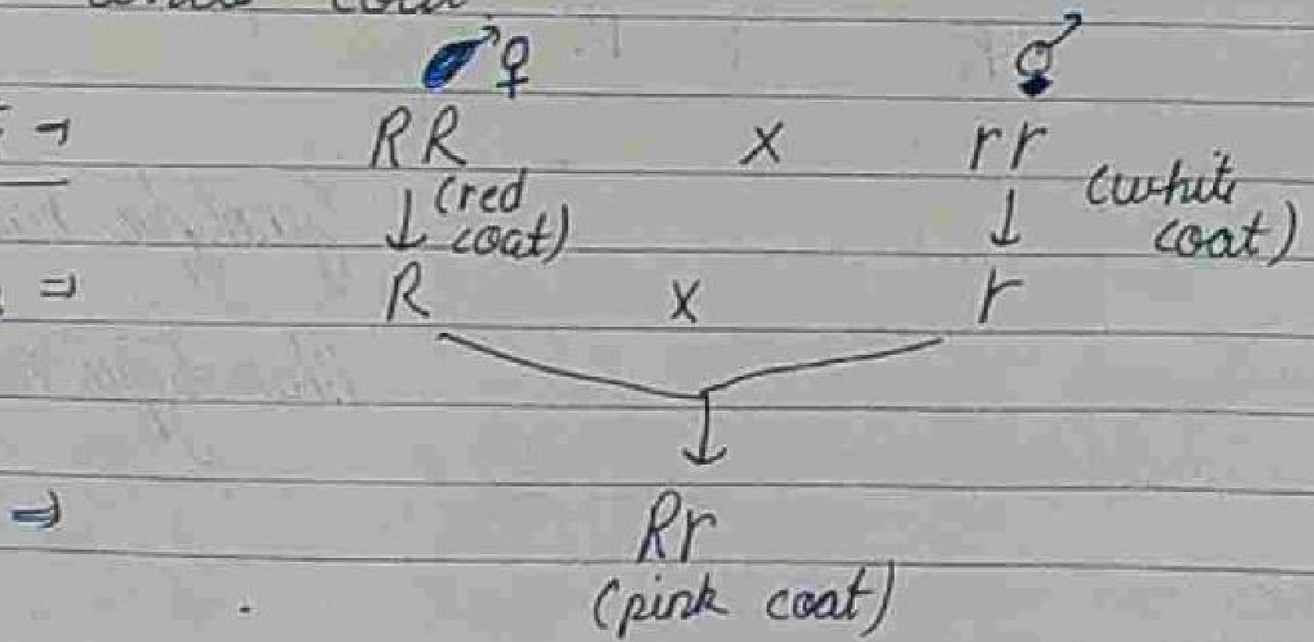
Space for writing Question Number

(2) Red is incompletely dominant

- If this is the case the calf produced in F_1 gen. would have an intermediate phenotype. Since R is incompletely dominant most hair on the calf would be red and some of them would be white. It would appear as if the coat is pink in colour (intermediate phenotype).

- In the F_2 gen. as well the phenotypic ratio would be 1 : 2 : 1 (red : pink : white) i.e. 25% of calves will have red coat, 50% pink and 25% white coat

Cross ⇒



Space for writing Question Number

Self pollination ⇒

♂ ♀

Rr x Rr

Gametes ⇒

R r R r

	R	r
R	RR (red coat)	Rr (pink coat)
r	Rr (pink coat)	rr (white coat)

Genotypic ratio ⇒ 1 : 2 : 1
(RR) (Rr) (rr)

Phenotypic ratio ⇒ 1 : 2 : 1
(red coat) (pink coat) (white coat)

24

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26

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