

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJASTHAN)

I Sem./~~H Sem.~~/~~Summer Term~~ 2017-2018

TEST/QUIZ MIDSEMESTER

Sec. No. _____

Instructor's Name _____

Date 13 October 2017

Day Friday

ID No. _____

Course No. BIOF1110

Name _____

Course Title GENERAL BIOLOGY

No. of Supplementary copies attached : _____

Question No.	Marks obtained	Student's request for rechecking with remarks	Examiner's remarks
1.	2.75		
2.	3.0		
3.	4.0		
4.	5.0		
5.	15.1		
6.	10.2		
7.	15.0		
8.			
Total	45.25		
	(in figures)	(in words)	

INSTRUCTIONS TO CANDIDATES

Examiner's Signature _____

(1) Write clearly and legibly. (2) Enter all the required details on the cover of every answer book. (3) The question number given in the answersheet by the student while answering the question should be the same as in the question paper. (4) Start answering every question from a new page. (5) Write on both sides of the sheet in the answer book. Rough work if any, should be done at the bottom of the page. Finally cross it out and draw a horizontal line to separate it from the rest of the material on the page. (6) Any answer crossed out by the student will not be examined by the examiner. (7) A supplementary answer book should not be asked for until the first answer book is filled up. (8) No sheet should be torn from the answer book. (9) Use of any unfair means will make the candidate liable to disciplinary action. (10) No paper should be brought in the examination hall for scribbling on. (11) A student should not leave the examination hall without handing over the answer book to invigilator on duty.

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Ans 1.

a) Eubacteria.

- They have a peptidoglycan cell wall.
 - They ~~exhibit~~ lack cell organelles.
 - Their genetic material is present in a specific region of the cytoplasm, called nucleoid.
- eg. E. Coli.

b) Plantae

- They ~~live~~ Their cells have a cellulosic cell wall.
- Their ^{live} cells contain chloroplasts.
- Their cells have a large central vacuole.

eg. Mangifera indica (Mango tree)

c) Fungi

- Their cells have a chitinous cell wall. and no chloroplasts.
- They are largely saprophytic.
- They may be unicellular/multicellular.

eg. Yeast (Saccharomyces cerevisiae)

Ans 2. a) The genotype of individual II-4 will be Dd.

The parents' genotypes will be

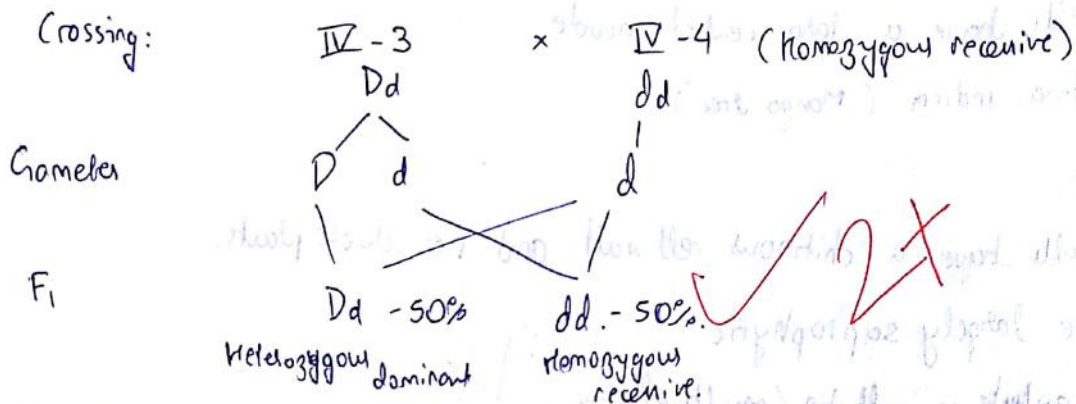
I-1: dd (as it is recessive phenotype, it must be homozygous recessive)

I-2: Dd (some of the progeny, namely II-5, II-6, II-7 and II-8 show the recessive trait (dd). Thus, I-2 must have a heterozygous dominant genotype)

On crossing I-1 and I-2, the only possible genotypes are dd (recessive) and Dd (dominant).

As II-4 shows the dominant phenotype, his genotype must be Dd.

b) Using similar reasoning as above, as the parents of IV-3, II-4 and II-5, have genotypes Dd and dd respectively, IV-3's phenotype must be Dd.



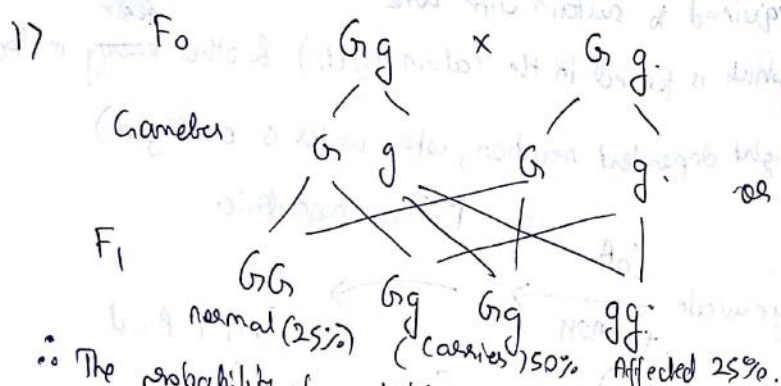
As per the law of segregation, we can say that the possibility of the progeny of IV-3 and IV-4 having the trait is 50%.

Am 3. a). GALT ~~acts on gal~~ is an enzyme which acts on galactose ^{probably} ~~either~~ converting it
~~to an isomer (isomerase) or depending it to sugar~~, which is likely to be glucose

b). It is given that the patient is diseased only if both copies of the genes are affected.

Here, we can say that ~~the~~ it is a recessive genetic disorder.

∴ Thus, GG - normal Gg - carriers gg - affected.



$$\begin{array}{c|cc}
 & G & g \\
 \hline
 G & GG & Gg \\
 \hline
 g & Gg & gg
 \end{array}$$

∴ The probability of a child not having the disease is 25 + 50 = 75%.

∴ $P(\text{2 affected and 2 normal}) = \frac{1}{4} \times \frac{1}{4} \times \frac{3}{4} \times \frac{3}{4} = \boxed{\frac{9}{256}}$

ii) Assuming that the sex chromosomes and the ^{chromosome} ~~gene~~ carrying the GALT gene are assorted independently.

$P(\text{twin girls affected}) = \frac{1}{2} \left(\frac{1}{2} \right) \times \frac{1}{2} \left(\frac{1}{2} \right) = \boxed{\frac{1}{64}}$

* The probability of the two twins, being non-identical, are independent of each other.

* The probability of the child being a girl is $\frac{1}{2}$ in humans. Hence, the answer is each term is halved.

Ans 4 a) The thylakoids (in the grana) are the sites ~~at~~ where light-harvesting complexes are present.

ii) The energy of a photon ~~is~~ excites an electron from a pigment molecule (Chlorophyll a, b or Carotenoids). This energy is transferred to the reaction centre (Chlorophyll a molecule).

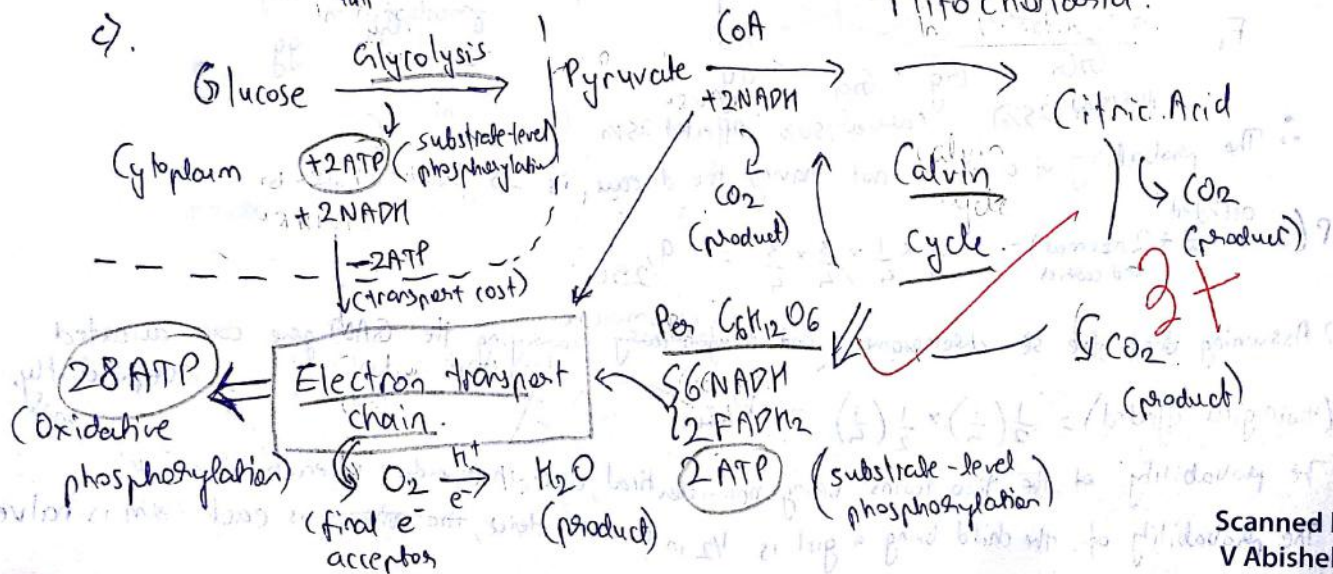
The excited electron ~~energy~~ is captured by an acceptor complex and moves down a transport chain. Thus, the electric current (movement of electron) is caused by sunlight.

b) The products of photosynthesis required to sustain life are:

i) Glucose (produced from GSP, which is formed in the Calvin cycle) & other ~~energy~~ ~~molecules~~ molecules.

ii) Oxygen (produced in the "light dependent reaction, when water is oxidized")

Mitochondria.



Ans a). Looking at (II) and (III), we can see that, the gametes formed after cytokinesis of (III) will contain 3 chromosomes.

Here $n=3$
 $2n=6$
Thus, diploid chromosome number $2n=6$.

b) As all three images represent the stage just after the chromosomes have begun to move to opposite poles, it is the late anaphase - early telophase stage.

i) In I, homologous chromosomes are seen to be separated.

Here it represents Anaphase-I of Meiosis.

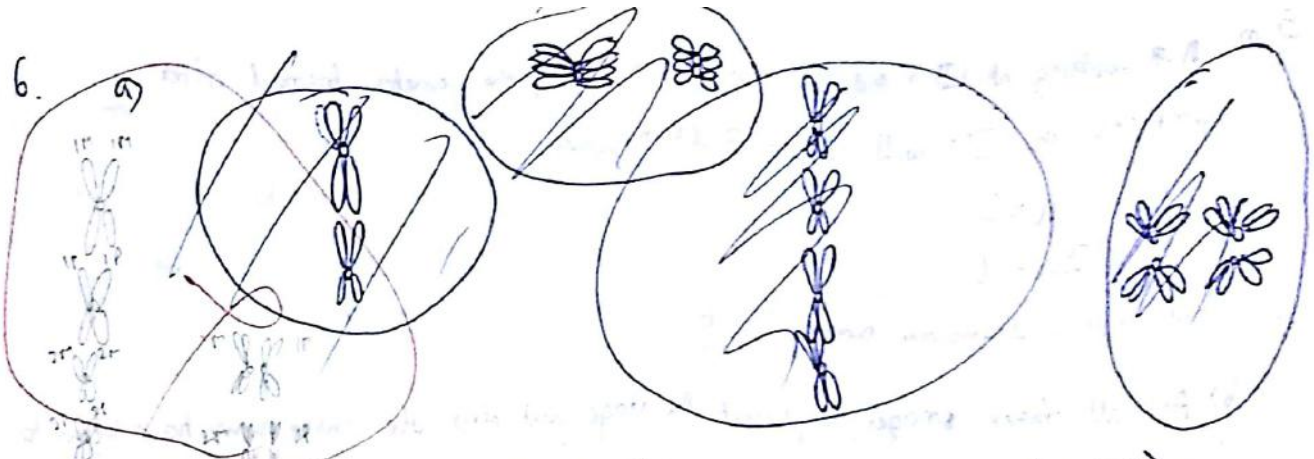
ii) In II, all 6 sister chromatids are separated.

Here, it represents Anaphase of Mitosis.

iii) In III, only 3 sister chromatids are being separated.

Here, it represents Anaphase-II of Meiosis.

Ans 6.



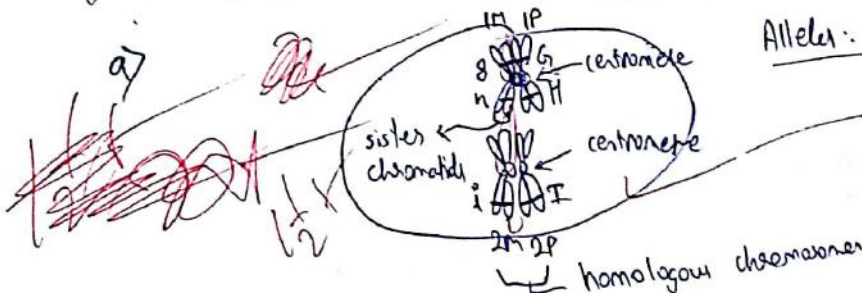
i) As I is located on a different chromosome, (with respect to G and H),
its assortment will be completely independent of ^{the assortment of} ~~the other two~~ G and H.

ii) As G and H are located on the same chromosome, their assortment will not be completely independent of each other.

Being very close (physically), they are likely to ~~be~~ be strongly linked and the possibility of recombinants (due to crossing over) is low.

c) 8 ds DNA molecules will be present. Two copies of each $1_m, 1_p, 2_m$ and 2_p .

Alleles: G, g, h, H, i, I



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Ans 7 a). i). The most prominent error is that of non-disjunction, which can lead to chromosomal disorders (eg. Down's syndrome).
Also, mutations and errors in DNA replication can occur.
And, failure of cell cycle control proteins can lead to tumor development.

ii) Usually the cell checks all processes before proceeding with the S or M phase.

If errors are detected, it enters a G₀ or resting phase, where these errors are rectified. If they are corrected, the cell resumes the cell cycle normally. If not, it usually undergoes autophagy (programmed cell death).

iii) Aneuploidy can lead to chromosomal disorders eg. Down, Turner, Klinefelter syndrome.
Mutations can lead to sickle cell anemia, PKU, Cystic fibrosis.

Failure of cell cycle regulation can lead to tumor development, which may develop into cancer.

b). i) Detoxifies the blood from the intestines.

ii) Stores glycogen (blood glucose regulation)

iii) Immune Detoxifies blood drugs, antibiotics, alcohol from blood.

iv) Produces bile, and hence stimulates lipid uptake (lipid homeostasis)

7c : Corrected Statement.

The fluid portion of the blood plasma that filters out from the glomerulus to the Bowman's capsule is called glomerular filtrate and contains urea, water, glucose, creatinine, and salts.

i) Fluid is filtered from the mesh of capillary capillaries called the glomerulus to the Bowman's capsule (not vice-versa).

ii) The filtered fluid does not contain proteins and platelets as they are too big for ultrafiltration.

3

Ans 8 a) For proteins, there is a strong correlation between ~~structure~~ and function.

Loss of structure results in loss of function.

When pH and temperature are varied, the hydrogen bonds forming the 2° , 3° and 4° structures of proteins are affected. The structural change (denaturation) causes loss of function.

(3) In comparison, the functions of carbohydrates as storage and structural molecules, are not affected, as they are more stable with respect to fluctuations in pH and temperature, than proteins.

b) Cholesterol is necessary because:

i) It is an integral part of cell membranes, as it affects membrane fluidity.

ii) It is the base steroid from which other important steroids, like testosterone and estrogen are prepared by the body.

(3) iii) - It helps in production of Vitamin D.

c) Facilitated Diffusion and Active Transport are protein mediated membrane transport mechanisms.

(3) i) Facilitated diffusion occurs without expenditure of energy as it is ~~the~~ down a concentration gradient.

c) ii Active transport requires expenditure of energy, as it ^{works} against a concentration gradient.

Ans 8d) In both an internal combustion (IC) engine and mitochondrion, the fuel (gasoline or glucose) is combined with oxygen, to release ^{the} chemical energy of the fuel, producing CO_2 and H_2O as by products.

Differences

- (3)
- i) An IC engine is less efficient and the energy produced is converted to ^{do} mechanical work.
 - ii) A mitochondrion is more efficient and the energy produced is used to drive other reactions.
- * The difference in efficiency, is because combustion is single-step in an IC engine, but is multi-step in a mitochondrion.

Ans 8e) The final product, i.e. phenotype, is affected not only by your genes, but also by ~~the~~ environmental factors, experienced throughout life. It is the basis of epigenetics.

Evidences

(1)

i) Two identical twins are not exactly identical, they differ slightly. ^{One} ~~They~~ may even have a genetic disorder while the other does not.

ii) Genetically there should be only 7 heights. However, external factors like diet, nourishment and exercise affect the trait, giving many more phenotypic expressions.

iii) ~~Body~~