

- The recessive alleles, or heterozygosity.
- c) i) A person's sex is determined by sex chromosomes. It is impossible for identical twins to be a girl and a boy because:
They come from the union of one spermatozoid (X or Y) and an egg X.
- Or they come from a single zygote.
Have sex chromosomes
- Or they have the same genes.
- Or come from a single fertilized egg.
- ii) Cloning is an artificial process to produce offspring that are genetically identical to their parents. Potential problems of reproducing animals by this method are:
very complex process, very expensive (need complex materials: an electron microscope. Laser beam, difficult to collect the core charge), requires highly-qualified persons.
Sometimes the cloned cells do not produce the desired results.
- d) Selective breeding (also called artificial selection) is the process by which humans use animal breeding and plant breeding to selectively develop particular phenotypic traits (characteristics) by choosing which typically animal or plant males and females will sexually reproduce and have offspring together.
Importance of selective breeding:
Organic or natural farming does not always assure best results. Selective breeding can be one of the best options for higher production.
Selective breeding permits the encouragement of characteristics that are more beneficial to the farmer. If you have livestock like cows, it can produce more milk than typical cows, when you breed them, the cow will produce more milk and this gene can be passed on to their offspring. When it is implemented with crops, it will grow more than the typical crops. Promoting these advantages methods will surely increase the market value of these products. If you are a businessman, using selective breeding is undeniably a perfect option.

ADVANCED LEVEL BIOLOGY NATIONAL EXAMINATION PAPER 2006
(Biology-Chemistry)

SECTION A: Attempt ALL questions in this section /55 marks

01. a) What is the complementary RNA base sequence for GATCAA? 1 mark
b) From the molecules below;
Amino Acids, Nucleotide, Lipids and water.
i) Choose the molecule that is most abundant in the cells of the human body. 1 mark
ii) Choose the molecule that contains most energy. 1 mark

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Answer:

- a) The complementary RNA sequence for GA TCAA is CUAGUU
 b) i) water molecule is the most abundant in the cells of human body.
 ii) The molecule that contains much energy is lipid.

02. Copy and complete the table below which gives information about three types of mammalian blood cells.

Appearance of blood cell	Name of blood cell	Function
A 		
B 		Makes antibodies
C 		Phagocytosis

4 marks

Answer:

The following is a table which gives the information about 3 types of mammalian blood cells.

Appearance of blood cell	Name of blood cell	Function
A	Red blood cell or erythrocyte	Transport O ₂ and CO ₂ gases in respiration
B	Lymphocyte	Antibodies production (make antibodies)
C	Neitrophyls or granulocytes	Phagocytosis

03. a) Proteins have many roles in humans, for example, in defense against disease. Give an example of such a protein. 1 mark
 b) The diagram below outlines protein synthesis in a cell

Answer:

a) There is no blood capillary in the cornea of the eye for:

- Keeping its transparency.
- The absorption of light.
- To prevent it from being opaque
- Blood cells cause dispersion of light

b) Aqueous humor and choroid supply nutrients to the cornea.

09. a) The plant makes complex food compounds which may be used for energy, growth, repair and reproduction. Give four examples of such food compounds. 2 marks
- b) Before testing for starch the leaf is warmed in ethanol. The ethanol turns green. Why is this? 2 marks

Answer:

a) The plant manufactures nutrients involved in energy production, growth, restoration and reproduction. I give examples of these substances: carbohydrates, lipids, proteins, vitamins, nucleic acid and other organic substances (amino acids, glucose, starch....)

b) Before testing for starch, the leaf is warmed in ethanol. Ethanol turns green because it dissolves in chlorophyll.

10. a) Insulin cannot effectively be taken by mouth. Why is this so? 2 marks
- b) Suggest how people with diabetes can control their blood glucose level. 2 marks

Answer:

a) Insulin cannot effectively be taken by mouth because it can be dispersed, decomposed, denatured or digested.

b) People with diabetes can control their blood glucose level by:

- Treatment by injection of insulin
- Taking too much water.
- Practice physical exercise
- Choice of food to be taken

11. Explain how the structure of a mitochondria is adapted to its function in aerobic respiration. 3 marks

Answer:

The structure of a mitochondria is adapted to its function in aerobic respiration by:

- the presence of a matrix containing enzymes (NAD, FAD.....)
- The presence of cristae and DNA.
- the presence of double membrane.

12. a) In a fruit fly, the gene for red eye colour (R) is dominant to the gene for white eye colour (r). The trait is sex-linked. What would be the genotype of a white-eyed female? 2 marks
- b) A man with blood group B marries a woman with blood group AB. Indicate the type of blood group their children will not have. Show your working. 2 marks

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Answer:

a) Gene of eye of red colour: R

Gene for white eye colour: r

Gene R is dominant over r and was cross-linked. The female genotype for white eye colour is $XrXr$ or Xr .

b) Man of group B can have a genotype BO or BB

Woman of blood group AB can have a group AB.

Possible crossings:

First case: Parents: BO x AB

Gametes: B, O A, B

Offsprings

	B	O
A	AB	AO
B	BB	BO

Possible blood groups/ offsprings are: AB, B, A.

Second case: Parents: BB x AB

Gametes: B, B A, B

	B	B
A	AB	AB
B	BB	BB

Possible blood groups/ offsprings are AB and B.

The blood group their children will not have is blood group O.

13. Many organisms require glucose as a respiratory substrate. Explain how each of the following obtain glucose.

- Saprobiotic fungus 2 marks
- An embryo in a germinating seed 2 marks
- An implanted mammalian blastocyst. 2 marks

Answer:

a) Many organisms require glucose as respiratory substrate. How each of the following glucose is obtained:

For the saprobiotic fungus:

- By degradation of dead organic matter (waste)
- secretion of external digestive enzymes
- By the absorption of digestion products through the hyphae.

b) An embryo in the germinating seed:

- Decomposition of starch/ albumen of cotyledons.
- Decomposition of starch by amylase enzyme secreted by gibberellins hormone.

c) An implanted mammalian blastocyst:

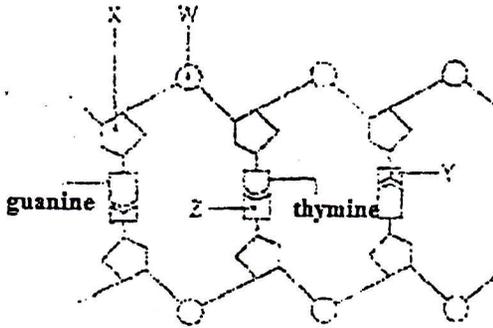
- From mother's blood.
- from placenta
- From umbilical cord (embryonic cord)

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- From food nutrients taken by mothers.

14. The diagram below show a part of a DNA molecule



What do each of the following letters on the diagram represent?

W.....
.....

X.....
.....

Y.....
.....

Z.....
.....

Answer:

W: Phosphate group or phosphoric acid

X: deoxyribose/ sugar.

Y: cytosine

Z: Adenine

SECTION B: ATTEMPT ANY THREE QUESTIONS. (30 MARKS)

15. a) Explain why variation caused by the environment cannot be passed from an organism to its offspring. **5 marks**

b) A cell with 3 sets of chromosomes is said to be triploid, 3n. A cell with 4 sets of chromosomes is said to be tetraploid, 4n. Could meiosis take place in a 3n or 4n cell? Explain your answer. **5 marks**

Answer:

a) **The change affected by the environment cannot be transmitted from one organism to its offspring (phenotype) but does not affect the gene (genotype reproductive cell).**

DNA, part of reproductive organ/cell within an organism is not affected, therefore the environment variation cannot be passed from the organism to its offsprings.

b) **A cell with 3 sets of chromosomes, which can undergo meiosis:**

Less possibility: the cell has 4 sets because it is formation of gametes that are identical in terms of chromosome number, because number of each chromosome pair or because it cannot reproduce sexually.

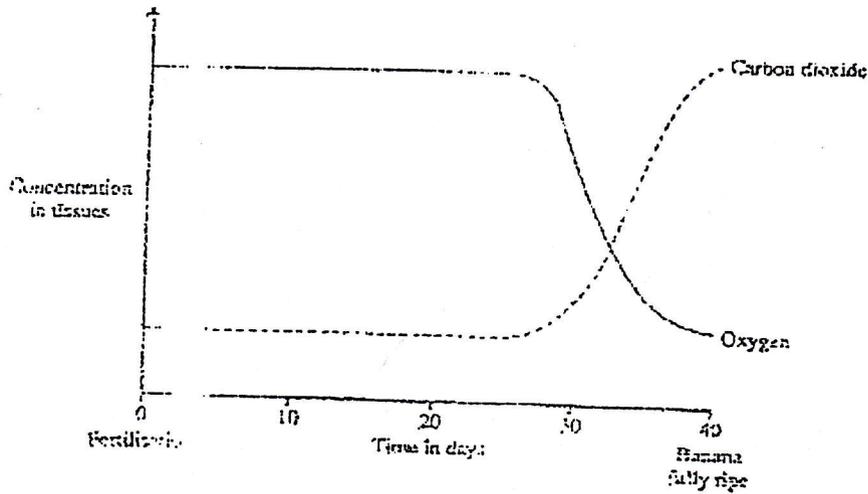
16. The table below shows the cell composition of three samples of blood.

Cell count No.per mm ³	Sample from		
	Peter	John	Joseph
Red blood cells	6.000.000	5.000.000	2.000.000
White blood cells	500	6.000	5.000
Platelets	200.000	220.000	500

- Which person is most likely to have lived at high altitude recently? Explain your answer. **2 marks**
- Which person would be the most likely to become ill if exposed to a virus? Explain your answer. **2 marks**
- Which person's blood is least likely to clot efficiently if injured? Explain your answer. **2 marks**
- Describe the mechanism of blood clotting. **4 marks**

Answer:

- The person most likely to be experienced in a region recently altitude high is Peter because he has a large number of red blood cells to attach a lot of oxygen.
 - The person most likely to become sick if exposed to a virus is Peter because he has little white blood cells.
 - A person whose blood is unlikely to coagulate effectively if it is Joseph who was injured. Because he has little platelets..
 - The mechanism of blood clotting:
 - Agglomeration of platelets, thrombocytes, globulins (platelet) where it belongs to the injury.
 - Formation of the clotting enzyme. Be thrombogenic (prothrombin more thrombokinas- thromboplastin).
 - Ca²⁺ for to thrombin.
 - Ia merges thrombin with fibrinogen to yield fibrin or fibrin filament
 - The filament of fibrin entraps blood cells for the formation of a clot or coagulation.
17. a) The graph below shows the concentration of Oxygen and Carbon dioxide in the tissues of a banana fruit as it ripens.



- i) Through which plant tissue are carbohydrates produced by photosynthesis in the leaves transported to the cells in the fruit? **1 mark**
 - ii) Suggest how oxygen from the atmosphere reaches the cells in the fruit? **2 marks**
 - iii) Explain the relationship between the concentration of oxygen and carbon dioxide over the period shown on the graph. **2 marks**
- b) The respiratory quotient (RQ) of a banana fruit at 10 days was 0.8. At 40 days it was 1.0.
- i) Suggest what caused the change in respiratory quotient over this period. **2 marks**
 - ii) Suggest a method by which you could use a simple biochemical test to measure the amount of reducing sugar in samples of banana fruits. **3 marks**

Answer:

- a)
 - i) The fabric of a plant or spend the carbohydrates produced by photosynthesis in leaves and transported to cells in the fruit is the phloem, sieve tube.
 - ii) The oxygen of the atmosphere enters the cells of a fruit through stomata, lenticels and then diffusing into the tissues of the fruit.
 - iii) Explanation of the relationship between the concentration and carbon dioxide over the period shown on the graph:
From 0 to 30 days, the photosynthesis predominates and after 30 days breathing predominates.
- b)
 - i) the cause of the variation in respiratory quotient: it is the transformation of organic substances (lipids, proteins, amino acids, starch into glucose, ...) This glucose is degraded to raise up to respiratory quotient causing this increase, is that the variation of the metabolite used or gluconeogenesis.
 - It crushes a banana in pure water.
 - It takes a small amount of solution that is obtained in a test tube.
 - It adds Fehling's solution or Benedict and heated:
 - Emergence of red brick colour or a precipitate red brick

- The amount of reducing sugar is determined by the amount of the precipitate.

18. a) Explain what is meant by the following terms:

- i) A density- dependent factor
- ii) A density – independent factor
- iii) Intraspecific competition
- iv) Interspecific competition 4 marks

b) A predator is an animal which kills another animal, a prey for food. What qualities do you think a predator should have in order to kill the prey and what should the prey do to avoid being killed. 6 marks

Answer:

- a) i) **Density dependent factor:** is factor that leaves directly affected by the number of individuals in space, based on density, based on the size of population change.
- ii) **Density independent factor:** who does not let itself directly affected by the number of individuals per unit area and is not based on the density or population size or that do not depend on density.
- iii) **Intraspecific competition:** competition between individuals of the same species.
- iv) **Interspecific competition:** competition between individuals of different species.

19. a) Describe the various sources of variation

b) What is meant by the term point mutation? 10 marks

Answer:

- a) For a given population, there are three sources of variation: mutation, recombination, and immigration of genes. However, recombination by itself does not produce variation unless alleles are segregating already at different loci; otherwise there is nothing to recombine. Similarly, immigration cannot provide variation if the entire species is homo-zygous for the same allele.

1. Mutation

Mutations are the source of variation, but the process of mutation does not itself drive evolution. The rate of change in gene frequency from the mutation process is very low because spontaneous mutation rates are low (Table 24-9).

The mutation rate is defined as the probability that a copy of an allele changes to some other allelic form in one generation. Suppose that a population were completely homozygous A and mutations to a occurred at the rate of $1/100,000$. Then, in the next generation, the frequency of a alleles would be only $1.0 \times 1/100,000 = 0.00001$ and the frequency of A alleles would be 0.99999.

Or

Mutations are changes in the DNA. A single mutation can have a large effect, but in many cases, evolutionary change is based on the accumulation of many mutations.

2. Recombination

The creation of genetic variation by recombination can be a much faster process than its creation by mutation. When just two chromosomes with "normal" survival, taken from a natural population of *Drosophila*, are allowed to recombine for a single generation, they produce an array of chromosomes with 25 to 75 percent as much genetic variation in survival as was present in the entire natural population from which the parent chromosomes were sampled. Or Sex can introduce new gene combinations into a population. This genetic shuffling is another important source of genetic variation.

3. Immigration of genes (Crossing Over)

A further source of variation is migration into a population from other populations with different gene frequencies. The resulting mixed population will have an allele frequency that is somewhere intermediate between its original value and the frequency in the donor population. Suppose a population receives a group of migrants whose number is equal to, say, 10 percent of its native population size. Then the newly formed mixed population will have an allele frequency that is a 0.90:0.10 mixture between its original allele frequency and the allele frequency of the donor population

Or

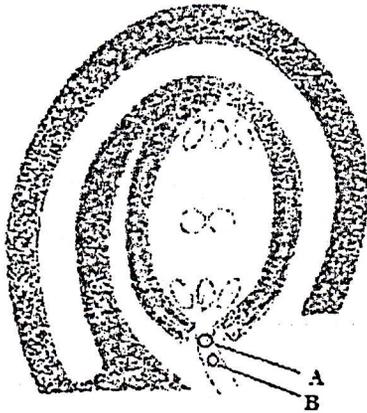
Gene flow is any movement of genes from one population to another and is an important source of genetic variation.

- b) A point mutation, or single base modification, is a type of mutation that causes a single nucleotide base substitution, insertion, or deletion of the genetic material, DNA or RNA. The term frameshift mutation indicates the addition or deletion of a base pair.

A point mutant is an individual that is affected by a point mutation.

SECTION C: THIS SECTION IS COMPULSORY.

20. a) Describe the similarities and differences between male and female gametes. 3 marks
b) The diagram below shows a pollen tube entering the ovule of a flowering plant.



Explain why gametes A and B are genetically identical to each other but differ from each other's male gametes produced by this plant. 6 marks

c) i) Explain how a developing plant embryo gains its nutrients from the food reserve in the seed. 3 marks

ii) Explain two ways in which the placenta is adapted to provide a developing mammalian fetus with its nutrients. 3 marks

Answer:

- a) **Differences:** Male gametes, or sperm, are small and motile while female gametes, or eggs, are larger and stationary. Males produce many more gametes in a lifetime than do females. Male gametes are called sperm and female gametes are called eggs. So some physical differences are that the eggs are spherical in shape, much larger than sperm, and are immobile. Sperms are smaller, are in a cone shape, and have tails so they could move to the egg during fertilization. **Similarities:** Both have haploid number of chromosomes i.e they contain half no. of chromosomes which is 23 while our other body cells contain 46 chromosomes.
- b) Gametes A and B are genetically identical to each other because both come from the same reproductive cell which divide mitotically to produce two male nuclei that are identical but differ from each other because one fertilizes egg cell to form zygote and another one fertilizes polar nuclei to form triploid endosperm.
- c) i) The endosperm which is the reserve of food initially becomes hydrated by absorption of water. The water activates enzymes of respiration which oxidises the available glucose to produce energy. The energy generated is used to synthesize enzymes from the available amino acids. The enzymes break down starch stored in the endosperm to glucose. The glucose is translocated in the glowing regions of the embryo.
- ii) The imbibition of the seed causes the activation of enzymes which are needed and provide nutrients needed by developing embryo.
- ii) Placenta is supplied with so many blood capillaries which allows sufficient nutrients supply.

- It has thin membrane which helps rapid movement of nutrient.

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- It has microvilli which increases surface area
- The cells of placenta have many mitochondria which provide energy needed during the transport of nutrient.

ADVANCED LEVEL CHEMISTRY NATIONAL EXAMINATION PAPER 2007
(Biology-Chemistry)

SECTION A: Attempt ALL questions in this section /55 marks

01. a) Root nodules are mutualistic relationship between a bacterium and a plant. Explain the benefits of the relationship to:

A: The

plant.....

B: The

bacterium.....

..... 2 marks

b) Name the bacteria genera involved in root nodule formation in:

i) Legumes _____

ii) Non-legumes _____

2 marks

c) Briefly explain the purpose of planting legumes in crop-rotation. 3 marks

Answer:

a) The benefits to keep the relationship between plant and bacteria in nodules:

A: the plant receives the available nitrogen (NH_4^+ , NO_2^-)

B: Bacteria: it receives from the housing/ living environment. It receives the carbohydrate.

b) The names of species of bacteria in the formation of root nodules for:

i) Pulses: The rhizobium/ azotobacter

ii) Frankie (Coriana and casiarira)

Nostic/ cyanobacteria (in Cycads)

c) The objective of planting legumes in crop notation

The plants enrich the soil in nitrogen. Indeed, thanks to their nodule bacteria, they set (capture) atmospheric nitrogen and convert it into available nitrogen (NH_4^+ , NO_2^- , NO_3^-) by other plants.

02. a) Suggest why viruses are such a difficult group to classify conventionally. 1 mark

b) State whether you regard viruses as a living or non-living. Give reasons for your answer. 2 marks

c) Explain why viruses are classified as obligatory intracellular parasites. 1 mark

Answer:

a) Viruses are a difficult group to classify because conventionally: