Biology (964)

OVERALL PERFORMANCE

The number of candidates for this subject was 4221. The percentage of candidates who obtained a full pass was 76.71%, an increase of 1.74% compared with the previous year.

The achievement of candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	4.64	6.76	10.99	14.43	13.93	12.08	13.88	7.23	7.03	5.36	3.67

RESPONSES OF CANDIDATES

PAPER 964/1 (MULTIPLE-CHOICE)

Keys

Question number	Key	Question number	Key	Question number	Key
1	**C**	18	**D**	35	**C**
2	**B**	19	**A**	36	**D**
3	**B**	20	**D**	37	**C**
4	**B**	21	**C**	38	**C**
5	**D**	22	**A**	39	**D**
6	**C**	23	**C**	40	**B**
7	**D**	24	**C**	41	**C**
8	**B**	25	**D**	42	**C**
9	**A**	26	**A**	43	**D**
10	**C**	27	**B**	44	**D**
11	**D**	28	**B**	45	**D**
12	**B**	29	**C**	46	**B**
13	**D**	30	**D**	47	**C**
14	**C**	31	**C**	48	**B**
15	**C**	32	**A**	49	**C**
16	**A**	33	**C**	50	**B**
17	**D**	34	**A**		

General comment

The mean score was 29.18 and there was a very good spread of scores with a standard deviation of 9.17. More than 80% of candidates answered questions 22, 33, 38 and 50 correctly. Question 30 was answered correctly by less than 30% of candidates. The rest of the questions fell in the medium range with 30% to 80% of candidates obtaining correct answers.

PAPER 964/2 (STRUCTURE AND ESSAY)

General comments

In general, the candidates' answers were satisfactory in terms of planning and presentation. Only a few candidates managed to answer accordingly and systematically.

Question 1

In part (*a*), candidates were not able to interpret the diagram given. Almost all candidates were not able to state the anticodon for amino acid S. Candidates answered ACU which was actually the mRNA codon instead of the anticodon 5'-AGU-3' or 3'-UGA-5'. Candidates also failed to include the polarity, 5' and 3', of the anticodon.

In part (*b*), many candidates knew how to read the genetic code table, and thus, managed to state the name of amino acids *P* which was aspartic acid and *Q* which was asparagine correctly.

In part (*c*), a number of candidates managed to state what happened to amino acid *R* correctly. Some candidates answered wrongly as they did not study the table given to know that all UC_ codon codes for serine were due to the degeneracy of the genetic code. They assumed that acid *R* would be replaced with another amino acid.

In part (*d*), a majority of candidates answered amino acid *R* remained as serine, but very few mentioned that the polypeptide produced would be longer than one amino acid and the additional amino acid was asparagine, and that amino acid *S* was changed from threonine to leucine. The most common answer given by most candidates was that frame shift mutation occurred.

Quite a number of candidates were able to explain the effect of deletion of three bases as loss of one amino acid only, and when one base is deleted, frame shift mutation occurred. Many failed to mention that when three bases were deleted the resulting polypeptide would be shortened by one amino acid. Some candidates wrote frame shift mutation as only frame mutation.

Question 2

In part (*a*), many candidates gave the answer as posterior pituitary gland. However, some gave the answer as pituitary gland or anterior pituitary gland.

In part (*b*), many candidates were able to name the antidiuretic hormone (ADH) and gave its function, i.e., to increase the permeability of the collecting duct or distal tubule to water, correctly. However, some candidates spelt the hormone name as anti duretiic or antidiuratic. A number of candidates wrote the function is to control water absorption from the distal convoluted tubule and collecting duct, while some did not mention the permeability to water, as required by the marking scheme.

In part (*c*), most candidates only mentioned that dehydration caused water content to decrease, but the correct answer was dehydration or excessive water loss caused the blood volume to decrease. Many candidates also wrote about the blood becoming hypertonic.

In part (*d*), quite a number of candidates managed to describe in detail how hormone *X* controls the increase in blood osmolarity. However, certain important keywords such as above the set point/300 mosm/L, more water is reabsorbed, diffuse into blood capillaries and return to set point were not stated in most of the candidates' answers. Instead they wrote, blood osmolarity increases or blood osmolarity returns to normal. Many candidates wrote, increases water reabsorption, but the correct answer was increases water reabsorption into the blood.

Question 3

In part (*a*), almost all candidates were able to state the genotype of the *Drosophilla* correctly. However, a few candidates did write the genotype as *RR* or *rr* instead of X^RX^R or X^rX^r as in the case of sex-linked genes, and X^rX^r or X^rY^r for white-eyed male.

In part (*b*), a majority of candidates were able to draw the genetic diagram showing crosses until the F_2 generation although a few of them failed to draw a proper, complete and accurate genetic diagram. In some cases the P, F_1, F_2 and gametes were not written as required. Some candidates did not draw lines to show the formation of progenies from gametes, while some did not specify the phenotypes of F_2. Candidates did not include x to indicate crossing of the two parents.

In part (*c*), some candidates did not seem to understand the meaning of reciprocal cross. A few candidates managed to get the genotype correct, but failed to obtain any mark because the phenotypes were not indicated. Candidates also failed to draw a correct genetic diagram based on their answers in (*c*)(i). Some candidates did not indicate which the male or female parent was.

In part (*d*), some candidates answered well this part. A majority of candidates failed to give the correct meaning of sex-linked genes. Some of them gave inaccurate answers such as the gene located on X chromosomes or the gene which is controlled by sex chromosome. The correct answer was genes that are located on the sex chromosomes.

Question 4

In part (*a*), the scientific names of organisms *Paramecium aurelia* and *Paramecium caudatum* or *P. Aurelia* and *P. caudatum* or Paramecium aurelia and Paramecium caudatum or P. Aurelia and P. caudatum were written incorrectly by most candidates. They wrote the names as Paramecium aurelia and Paramecium caudatum or P. Aurelia and P. caudatum. Only a few candidates managed to write the term *interspecific competition* between the two species of paramecium. None of the candidates managed to write about P. aurelia being able to better utilise the limited resources or that P. aurelia outcompeted P. caudatum and the later species declining to extinction. Quite a number of the candidates' answers described the changes of the population related to time instead of competition between the two different species.

In part (*b*), almost none of the candidates were able to give all the five possible characteristics of P. Aurelia. Several candidates only mentioned competitor and can utilise resources, but the accepted answers were better competitor and better utiliser of resources.

In part (*c*), a majority of candidates were unable to give the correct conclusion of the said experiment. Only a few candidates mentioned competitive exclusion in their answer. Some gave an incomplete conclusion such as the species which is a better competitor will survive, but the correct answer was the species which is a better competitor and fitness will survive while the other will be excluded.

Question 5

In part (*a*), most candidates tabulated their answers and the answers given were not in the form of complete sentences such as requires light vs. light is not required. This format of answering was not acceptable and most candidates failed to obtain marks. It is not advisable to answer essay questions in a table form. However, if the candidates presented their answers in the table form, marks will still be given if the sentences used were complete statements. Some candidates mentioned photosynthesis only occurs in plants which was incorrect because it occurs in all organisms having chlorophyll.

In part (*b*)(i), only a number of candidates were able to define heterotroph correctly.

In part (*b*)(ii),a majority of candidates were not able to describe the various types of heterotrophic nutrition. Candidates were still not able to differentiate between heterotroph which referred to the organism and heterotrophic nutrition which referred to the type of nutrition. Among example of answers given by candidates include parasite and saprophytes as heterotrophic nutrition. They also wrote about feeding relationship between the organisms instead of using the specific terms for nutrition such as parasitism instead of the correct parasitic nutrition. A few candidates only managed to give examples of holozoic, saprophytic and parasitic nutrition, but failed to describe the process involved.

Question 6

In part (*a*), the candidates were required to describe the transmission of impulse. The description of the transmission of impulse across synapse was well answered by a majority of candidates who remembered the sequence. This was the only question where many candidates obtained full marks. A common mistake made by many candidates was equating postsynaptic membrane with postsynaptic neuron. Some gave incomplete facts such as it causes the uptake of calcium ions. However, the correct answer was it causes the uptake of calcium ions from the synaptic cleft. Some candidates mentioned that sodium ions diffuse into post synaptic membrane, although the accepted answer was sodium ions diffuse into the post synaptic neuron.

In part (*b*), the candidates were required to describe the mechanism of action of cocaine. Quite a number of candidates managed to describe in detail the mechanism of action of cocaine although there were candidates who described the mechanism of action of curare involving neurotransmitter acetylcholine instead of the action of cocaine which involved the neurotransmitter dopamine. Candidates who knew dopamine was the neurotransmitter involved here gave reasonably good answers. However, many candidates failed to mention the role of the transporter protein, and wrongly stated that cocaine binds to the receptor protein on the postsynaptic membrane.

Question 7

In part (*a*), the candidates were required to write a description on the sporophyte generation of *Dryopteris* life cycle. Many candidates described the gametophyte generation. Some candidates could not differentiate between sorus and spores, and only a few mentioned sori as being found on fronds. The correct answer was sori are found on the lower or abaxial surface of fronds. Several candidates spelt indusium as insudium. There were also candidates, who mentioned the fertilisation of an egg and a sperm, but the accepted answer was the fertilisation of an egg and a sperm will produce a zygote (2n). Very few candidates answered spore mother cells undergo meiosis.

In part (*b*), the candidates were required to describe the sexual reproduction in *Paramecium* sp. Only a number of candidates managed to describe in detail the conjugation process of sexual reproduction in *Paramecium* sp. The point that almost all candidates missed was the joining of the two compatible mating

types, and almost all candidates who answered this part just wrote two parameciums join at their oral groove. A few candidates who attempted this question hardly answered anything right.

Question 8

In part (*a*), the candidates were required to describe the main stages of embryonic development in animals. Some candidates managed to answer according to the answer scheme. Some candidates were unable to mention the correct stages which are involved such as cleavage, gastrulation and organogenesis. Others gave explanations without mentioning the stages and this was not accepted because the descriptions were dependent on the stages. There were also cases where the terms were wrongly spelt such as gastrulation was spelt as grastulation and organogenesis was spelt as orgagenesis.

In part (*b*), the candidates were required to explain on the roles of human placenta in foetal development in relation to its structures. However, very few marks were obtained by candidates. Most candidates knew the functions of placenta, but they were unable to give the exact facts. They did not state water as one of the materials passed through the umbilical vein from mother to foetus. They also mentioned deoxygenated blood and waste pass through the umbilical artery from the foetus to mother, but the correct answer was carbon dioxide and nitrogenous waste pass through umbilical artery from the foetus to mother. Several candidates mentioned placenta produces progesterone and estrogen without explaining the function of both hormones. The majority of candidates only obtained marks when they mentioned it prevents the mixing of mother's blood and foetal's blood.

Question 9

In part (*a*), the candidates were required to describe the effects of radiation and chemical agents of mutation. Most candidates were able to provide examples of the agents of mutation. However, some spelt colchicine as cholcicine and many candidates could not correctly describe the effects of the agents of mutation. They only mentioned that colchicine inhibits spindle formation without mentioning whether it happens during mitosis or meiosis, or that X-ray causes the gene mutation instead of X-ray causes the formation of free radicals that destroy or modify nucleotides.

In part (*b*), the candidates were required to explain on how autopolyploid plants were obtained. Most candidates were unable to answer correctly and this may be due to the lack of understanding about the topic. Some gave incomplete statements such as inhibiting spindle formation instead of inhibiting spindle formation in mitosis or meiosis, and non-disjunction produces diploid gamete instead of non-disjunction during meiosis produces diploid gamete.

Question 10

In part (*a*), the candidates were required to define allopatric and sympatric speciation. Very few candidates managed to give the correct definitions, while others gave incomplete or wrong definitions. Some defined allopatric speciation as the speciation that occurs when one species becomes geographically separated and evolves into new species. The correct definition was the speciation that occurs when one population becomes geographically separated and subsequently evolves into new species. Most candidates also did not state within the same geographical region in defining sympatric speciation.

In part (*b*), the candidates were required to explain the roles of geographical isolation in the speciation process. Most answers given were incomplete. Many candidates did not mention that when one population was geographically separated, <u>two</u> demes or subpopulations were formed. Some candidates explained in detail the mechanism of reproductive isolation which was irrelevant and not the answer required by the question.

In part (*c*), the candidates were required to illustrate, by means of a genetic diagram, the stages involved in the hybridisation between the two given species forming a new species. Answers given were not satisfactory. Most candidates did not include the symbol x between the two species to indicate crossing such as *S. alterniflora* x *S. stricta*. They also did not write gametes, F_1 and F_2. Apart from that, scientific names were also incorrectly written and the explanation on the F_1 and F_2 hybrids were not provided.

PAPER 964/4 (WRITTEN PRACTICAL TEST)

Question 1

In part (*a*), the candidates were required to complete the volume of distilled water added. Test tube *A* 2.5 ml, test tube *B* 2 ml, test tube *C* 1.5 ml , test tube *D* 1 ml, test tube *E* 0.5 ml and test tube *F* 0 ml. A majority of the candidates answered well this part.

In part (*b*), the candidates were required to state the rate of reaction per minutes. Test tube *A* 0.17 min^{-1}, test tube *B* 0.33 min^{-1}, test tube *C* 0.50 min^{-1}, test tube *D* 0.66 min^{-1}, test tube *E* 0.66 min^{-1} and test tube *F* 0.66 min^{-1}. A majority of the candidates answered well for this part.

In part (*c*), a majority of the candidates were able to correctly plot graph of the rate of reaction against the concentration of enzyme and manage to get full marks.

In part (*d*)(i), a majority of the candidates were able to state the relationship between the rate of reaction and the concentration of enzyme. In (*d*)(ii) a majority of the candidates able to state substrate concentration as the limiting factor.

In part (*e*), a majority of the candidates were able to state the enzyme amylase and the role of the amylase that catalyses the reaction.

In part (*f*), a majority of the candidates were able to expect no reaction occurs when test tube is immersed in water at temperature more than 60°C because enzyme is denatured.

Question 2

In part (*a*), many candidates gave the answer for *P* as bile instead of bile duct. *Q* is stomach, *R* is ileum, *S* is ceacum and *T* is pancreas.

In part (*b*) and (*c*), the answers depend on their answer in part (*a*). The answer for part (*b*) is bile liquid and the fuction is emulsify fat. The answer for part (*c*) is insulin.

In part (*e*), a majority of the candidates were able so state stomach/*Q* where protein is digested.

In part (*f*), most candidates answered correctly ceacum for cellulose digested.

In part (*g*), most candidates answered correctly *V* as villi, and could state its importance for provide large surface area and effective absorption.