St. Stephen's Girls' College
Final Examination 2015-2016

Biology Paper 1 (SECTION B) SYF, KFL

Form 6 __ Class No.: _____ Name: _____

SECTION B (Question-Answer Paper B)

INSTRUCTIONS FOR SECTION B

1. Write your class, class number and name in the space provided on this page.

2. The questions in this Question-Answer Paper carry 84 marks. Answer ALL questions.

3. Write your answers to Section B in the spaces provided in this Question-Answer Paper.

4. Supplementary answer sheets will be provided on request. Write your class, class number and name on each sheet. Tie them loosely but securely with a string INSIDE this Question-Answer Paper.

5. Present your answers in paragraphs wherever appropriate.

6. The diagrams in this section are NOT necessarily drawn to scale.

Section	Marks
A	
B	
Total	
Percentage (%)	

SECTION B

Answer ALL questions. Put your answers in the spaces provided.

1. For each cell structure listed in column 1, select from column 2 *one* phrase that correctly describes its property or function. Put the appropriate letter in the space provided. (3 marks)

Column 1		***Column 2***	
Vitamin C	_____	A	A component of the pigment in red blood cells
		B	Lipid-soluble
Vitamin D	_____	C	Easily destroyed when exposed to oxygen
		D	Needed to prevent night blindness
Iron	_____	E	A component of bone; important for keeping bones strong
		F	Its deficiency may lead to sickle-cell anaemia

2. Phenylketonuria (PKU) is a disease caused by mutations of the gene coding for the enzyme PAH. The table shows part of the DNA base sequence coding for PAH. It also shows a mutation of this sequence which leads to the production of non-functioning PAH.

DNA base sequence coding for PAH	C	A	G	T	T	C	G	C	T	A	C	G
DNA base sequence coding for non-functioning PAH	C	A	G	T	T	C	C	C	T	A	C	G

(a) (i) What is the maximum number of amino acids for which this base sequence could code?

_____ (1 mark)

(ii) Explain how this mutation leads to the formation of non-functioning PAH. (3 marks)

_____

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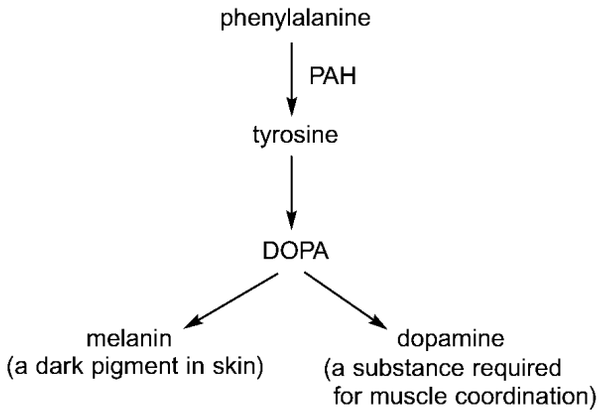
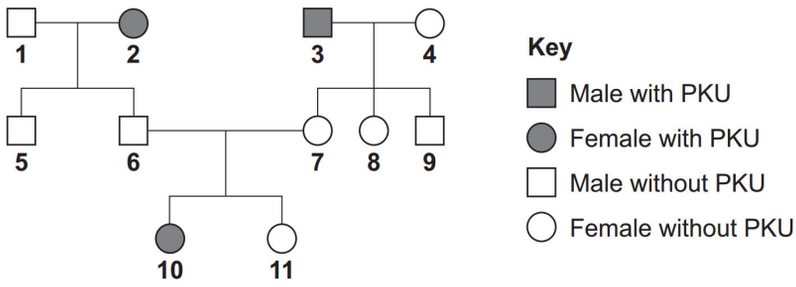
_____

(b) PAH catalyses a reaction at the start of two enzyme-controlled pathways. The diagram shows these pathways.



Use the information in the diagram to give two symptoms you might expect to be visible in a person who produces non-functioning PAH. (2 marks)

(c) The following pedigree shows the inheritance of PKU in one family.

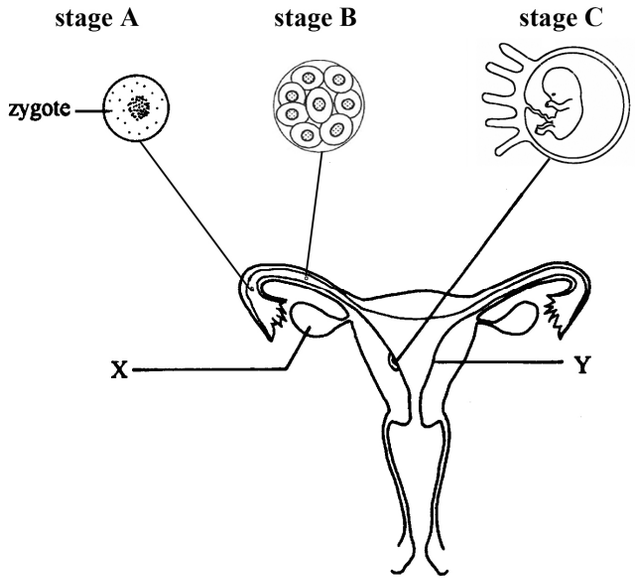


(i)Give one piece of evidence from the above pedigree that PKU is caused by a recessive allele. (1 mark)

(ii)Individual 1 and 2 give birth to individual 5. Two years later, they give birth to individual 6. Explain why individual 5 and 6 do not show identical body characteristics. (3 marks)

(Total: 10 marks)

3. The diagram below shows the female reproductive system and three different stages of embryonic development:



(a) Explain why the identical cells in stage B can later develop into different cells that make up the foetus in stage C. (3 marks)

(b) Describe how the foetus obtains nutrients for growth. (3 marks)

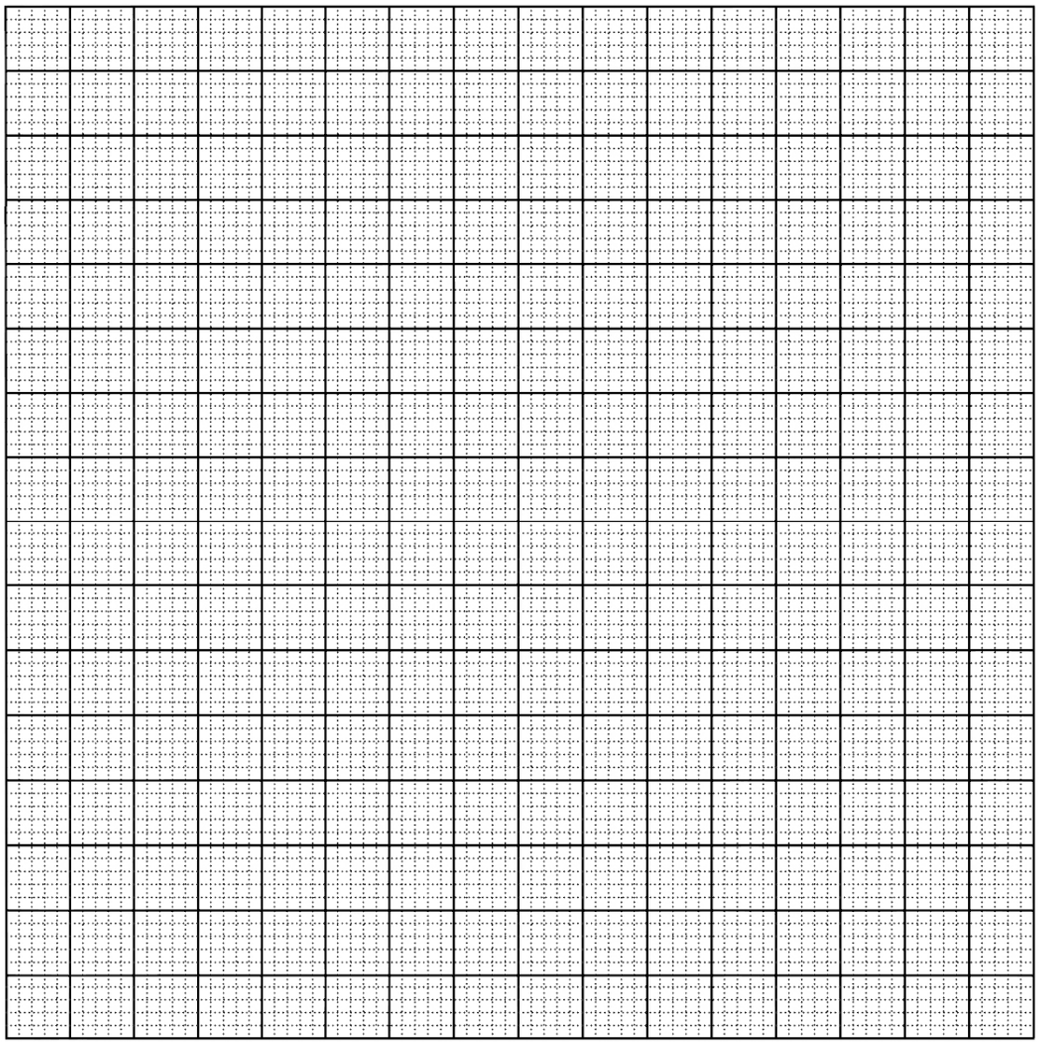
(c) Suggest an appropriate method of birth control that can be applied to structure Y. State how contraception can be achieved. (2 marks)

(Total: 8 marks)

4. The uptake of potassium ions by plant tissue immersed in different initial concentrations of potassium chloride solution and at two different temperatures was investigated. The results of the experiment are shown in the table below.

Initial concentration of potassium chloride solution/mM	Uptake of potassium ions/ arbitrary units $hour^{-1}$	
	at 4°C	at 18°C
0	0	0
5	14	30
10	18	38
20	22	53
40	23	55

(a) Plot the above data in graphical form. (4 marks)



(b) The plant tissue has an internal potassium ion concentration of 50 mM. Explain why the potassium uptake must involve active transport. (1 mark)

_____

_____

(c) Explain the effect of temperature on the rate of potassium ion uptake. (2 marks)

(d) Rubidium ions have similar properties to potassium ions and, when present in the external solution, reduce the rate of potassium uptake. Suggest a reason for this observation. (1 mark)

(Total: 8 marks)

5. Dengue fever is a mosquito-borne viral disease.

(a) In the past, some investigators conducted a test to study whether the mosquito was the vector of dengue fever. They allowed some mosquitoes to bite patients with dengue fever. After 7 days, these mosquitoes were taken to dengue-free areas and were allowed to bite volunteers there.

(i) Why was it necessary for the latter part of the study to be conducted in dengue-free areas? (1 mark)

(ii) Describe a non-specific defence response of the body when the dengue virus was transmitted to the volunteer. (2 marks)

(iii) There are different subtypes of dengue virus. Explain why a person who has recovered from dengue fever caused by a particular subtype of the dengue virus will develop immunity to that subtype. (3 marks)

(b) Figure 5.1 shows the average annual number of dengue fever cases reported to the World Health Organisation (WHO) and the average annual number of countries reporting dengue fever from 1955 to 2007. Figure 5.2 shows the global average air temperature over the same period.

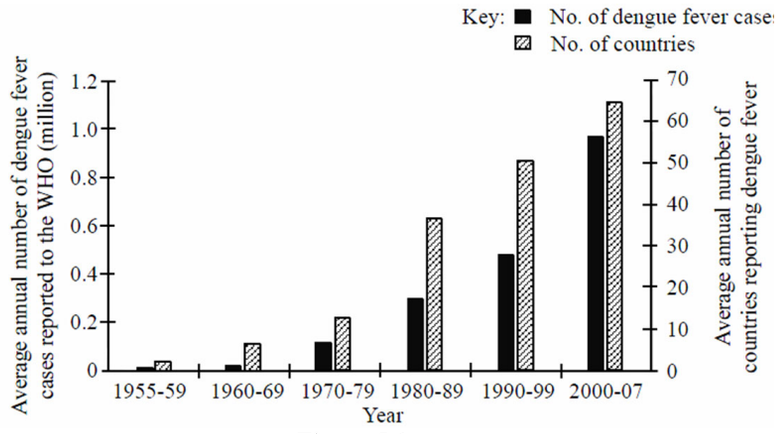


Figure 5.1

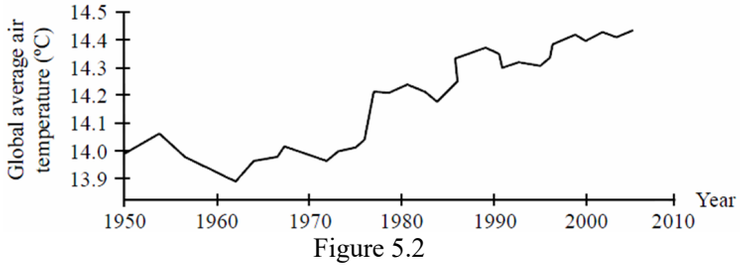


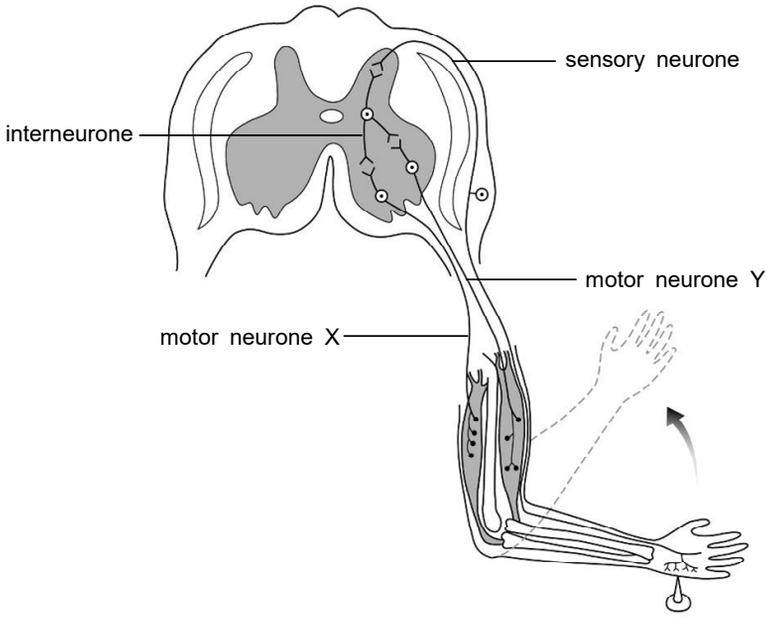
Figure 5.2

(i) What relationship between the incidence of dengue fever and global average air temperature can be observed from the trends shown in Figures 5.1 and 5.2? (1 mark)

(ii) With reference to the trends shown in the above figures, predict and explain how global warming may affect the spread of dengue fever. (3 marks)

(Total: 10 marks)

6. The diagram below shows the nervous pathway in the withdrawal reflex of the hand.



(a) Explain why the reflex action shown is involuntary. (1 mark)

(b) Along which motor neurone, X or Y, do nerve impulses travel during the withdrawal reflex? Explain your answer. (3 marks)

(c) The table below shows the time taken for nerve impulses to travel along the sensory neurone, interneurone and motor neurone in the nervous pathway.

Neurone	**Time** (ms)
Sensory neurone	0.5
Interneurone	0.01
Motor neurone	0.3

The time interval between the stimulus and the response is longer than the sum of the time shown in the table. Suggest ***one*** reason for this. (2 marks)

(Total: 6 marks)

7. The liver is an organ that is metabolically very active, carrying out over 500 different functions. Some of its important functions include converting chemicals including toxins, into other compounds.
Fig. 7.1 outlines some of the reaction pathways that take place in the liver cells.
The ***underlined words*** represent toxic compounds.

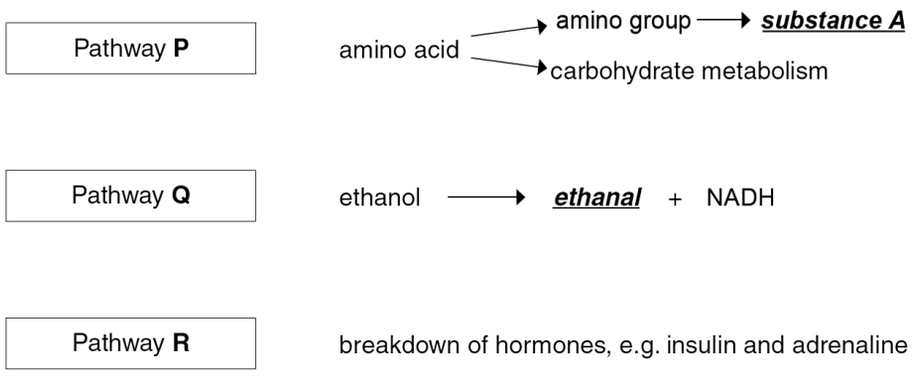


Fig. 7.1

(a) Name the toxic product substance A in Pathway P and the organ to which substance A is transported for removal from the body. (2 marks)

Substance A: _____

Substance A is transported to :_____

(b) Insulin only remains in the bloodstream for a relatively short time. Pathway R breaks down insulin in the liver.
Explain what might happen to a person if the liver did not break down insulin. (2 marks)

_____

_____

_____

_____

(c) Alcohol (ethanol) is oxidised in the liver by Pathway Q. If a person has a high alcohol intake, it will result in the production of excess NADH.
State precisely where in the liver cell the excess NADH can be re-oxidised. (1 mark)

_____

_____

(d) State one function of the liver that is related to digestion. (2 marks)

_____

_____

(Total: 7 marks)

8. In a field study, Alice collected three living specimens (A, B and C). The following table shows the features observed in these specimens.

Features	**A**	**B**	**C**
Place where they are found	on land	in water	on decaying wood
Colour	green	green	grey
Roots	present	absent	absent
Stems	present	absent	absent
Leaves	present	absent	absent
Flowers	present	absent	absent
Number of cells	multicellular	unicellular	multicellular
Hyphae	absent	absent	present

(a) Name the substance that makes specimens A and B green in colour. (1 mark)

_____

(b) Name the kingdom to which specimens A, B and C belong. (3 marks)

A: _____

B: _____

C: _____

(c) Specimen A releases oxygen in sunlight but releases carbon dioxide in darkness. Explain. (4 marks)

_____

_____

_____

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(d) How can the activity of specimen C contribute to the growth of specimen A? (2 marks)

_____

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_____

(Total: 10 marks)

9. Milk contains a protein called casein. The enzyme protease can digest casein. Peter carried out an experiment to study the effect of temperature on the activity of protease:

   - A test tube containing 10 cm^3 of milk suspension was immersed in a water bath at 0 ºC for 10 minutes.
   - 10 cm^3 of protease solution was added to the test tube and the time taken for the mixture to become colourless was measured and recorded.
   - The experiment was repeated at different temperatures (20 ºC, 40 ºC, 60 ºC, 80 ºC, 100 ºC).

   The table below shows the result obtained.

Temperature (ºC)	**Time** (second)
0	112
20	65
40	31
60	16
80	60
100	∞

(a) Point out the major mistake that Peter made when performing the above experiment. (1 mark)

_____

_____

(b) The pH of the reaction mixture should be kept constant during the experiment. Why? Suggest how this can be done. (2 marks)

_____

_____

_____

_____

(c) State two other variables that should be kept constant during the experiment. (2 marks)

_____

_____

(d) Peter concluded that the optimum temperature for protease is 60ºC. His teacher suggested Peter should modify his experiment in order to obtain a more precise optimum temperature. Suggest how he could do so. (1 marks)

_____

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(Total: 6 marks)

10. A scientist investigated ATP production in a preparation of isolated mitochondria. He suspended the mitochondria in an isotonic solution and added a suitable respiratory substrate together with ADP and phosphate. He bubbled oxygen through the preparation.
    (a) Why was the solution in which the mitochondria were suspended isotonic? (1 mark)

    _____

    _____

    (b) Explain why the scientist did not use glucose as the respiratory substrate. (2 marks)

    _____

    _____

    _____

    _____

    (c) Explain why the oxygen concentration would change during this investigation. (1 mark)

    _____

    _____

    (Total: 4 marks)

11. Describe the structural features that enable the leaves to obtain raw materials for photolysis and carbon fixation of photosynthesis. Discuss the significance of photolysis to carbon fixation, and the importance of these two processes for the continued life of humans. (12 marks)

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END OF SECTION B

*****END OF PAPER *****