education

Department:
Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2006

BIOLOGY PAPER 1

HIGHER GRADE

OCTOBER/NOVEMBER 2006

306-1/1E

BIOLOGY HG: Paper 1

306 1 1E   HG

MARKS: 200

TIME: 2 hours

This question paper consists of 15 pages.

GAUTENG

INSTRUCTIONS AND INFORMATION

Read the following carefully before answering the questions:

1.   Answer ALL the questions.

2.   Write ALL the answers in the ANSWER BOOK.

3.   Start the answer to each question at the top of a NEW page.

4.   Number the answers exactly as the questions are numbered.

5.   Write neatly and legibly.

6.   If answers are not presented according to the instructions of each question, candidates will lose marks.

7.   ALL drawings should be done in pencil and labelled in ink.

8.   Only draw diagrams or flow charts when requested to do so.

9.   The diagrams in the question paper may not necessarily be drawn to scale.

10.   The use of graph paper is NOT permitted.

11.   Non-programmable calculators, protractors and compasses may be used.

GAUTENG

SECTION A

QUESTION 1

1.1   Various possible answers are provided for each question. Indicate the correct answer by writing only the **letter** of your choice next to the relevant question number.

    1.1.1   A function of the liver is to …

        A   produce bile.
        B   secrete proteins.
        C   reabsorb water.
        D   absorb digested food.

    1.1.2   Which ONE of the following substances is concerned with the neutralisation of the acidity of the chyme?

        A   Water
        B   Saliva
        C   Pancreatic juice
        D   Enzymes

    QUESTIONS 1.1.3 to 1.1.5 are based on the accompanying diagram. Study the diagram and answer the questions that follow:

    Part of the human gaseous exchange system
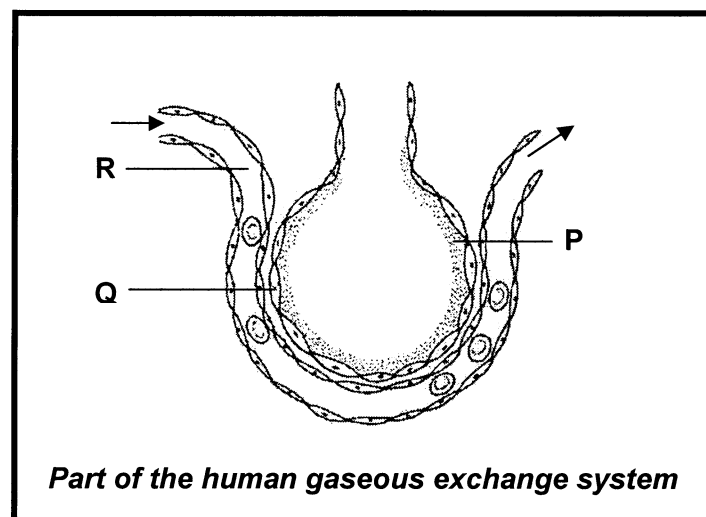
    1.1.3   The cells marked Q, are …

        A   columnar epithelial cells.
        B   squamous epithelial cells.
        C   ciliated epithelial cells.
        D   cuboidal epithelial cells.

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1.1.4   The blood vessel labelled R is a branch of the …

         A   pulmonary vein.
         B   hepatic portal vein.
         C   hepatic vein.
         D   pulmonary artery.

1.1.5   Which of the following functions are performed by the substance
         labelled P?

         (i)   Prevents cells from drying out
         (ii)   Protects against mechanical injury
         (iii)   Allows gases to diffuse in a dissolved state
         (iv)   Facilitates breathing movements

         A   (i) and (ii)
         B   (i) and (iii)
         C   (i), (ii) and (iv)
         D   (i), (ii), (iii) and (iv)

1.1.6   Which of the following materials must be carried to muscles to
         enable them to respire aerobically?

         A   Glucose and lactic acid
         B   Oxygen and lactic acid
         C   Glucose and carbon dioxide
         D   Glucose and oxygen

1.1.7   Towards the end of a long period of starvation, which molecules
         will most likely be used to synthesise glucose?

         A   Cellulose
         B   Glycogen
         C   ATP
         D   Galactose   **(7 x 2)**   **(14)**

GAUTENG

1.2   Give the correct **biological term** for each of the following descriptions.   Write
       only the **term** next to the relevant question number.

       1.2.1   Glands between the bases of the villi in the jejunum and ileum

       1.2.2   A compound formed by the union of carbon dioxide and
                haemoglobin

       1.2.3   The cell organelle concerned with the production of ATP during
                cellular respiration

       1.2.4   The organic acid that accumulates in the muscle fibres during
                strenuous exercise

       1.2.5   A disease caused by a diet high in carbohydrates and extremely
                low in proteins which results in cracked skin and damage to the
                liver

       1.2.6   An element that distinguishes proteins from fats

       1.2.7   The cultivation of fields to grow plant populations of a single
                species   (7)

1.3   Indicate whether each of the statements in COLUMN I, applies to **A only, B
       only, both A and B** or **none** of the items in COLUMN II. Write **A only, B only,
       both A and B**, or **none** next to the relevant question number.

	COLUMN I	COLUMN II
1.3.1	Regulates the glucose level in blood	A Bile B Insulin
1.3.2	Regulate(s) the breathing rate	A Medulla oblongata B Chemo-receptors in the aorta
1.3.3	Turns milky in the presence of carbon dioxide	A Soda lime B Lime water
1.3.4	A product of fermentation in plants	A Oxygen B Alcohol
1.3.5	Takes place in the cytoplasm, outside the mitochondrion	A Krebs cycle B Oxidative phosphorylation
1.3.6	Influences the rate of diffusion of gases	A Diffusion gradient B Thickness of tissue surfaces

                                                                     (6 x 2)   (12)

1.4   Study the following table that is based on the chemical tests for organic food compounds and answer the questions that follow. Write down the numbers 1.4.1 to 1.4.8 and next to each the names of the reagents and the changes that best complete the table.

| Chemical compound	Reagent(s)	Change for a positive result
Starch	1.4.1	1.4.2
Proteins	1.4.3	1.4.4
Fats/Lipids	1.4.5	1.4.6
Glucose solution (concentrated)	1.4.7	1.4.8

(8)

1.5   A group of students carried out an experiment to determine whether it is possible to increase food production in plants. They planted equal numbers of lucerne seedlings (food for farm animals) of the same age and size in six separate greenhouses. Different temperatures were maintained in the different greenhouses. All the other factors were kept exactly the same in each of the six greenhouses. After two weeks the dry mass of the plants in each greenhouse was determined and the results are indicated in the table below.

Study the information in the table and answer the questions that follow:

Greenhouse	Temperature °C	Dry mass (kg)
1	20	3
2	25	6
3	30	9
4	35	12
5	40	10
6	45	9

1.5.1   Which process is responsible for food production in plants?   (1)

1.5.2   At which temperature was the production of food the greatest?   (2)

1.5.3   Describe the relationship between the amount of food produced and temperature.   (4)

1.5.4   Why did the students measure the dry mass of the lucerne plants instead of their total mass?   (2)

(9)

1.6   The following diagram shows parts of the human digestive system and its
       associated organs. Study the diagram and answer the questions that follow:

Parts of the human digestive system
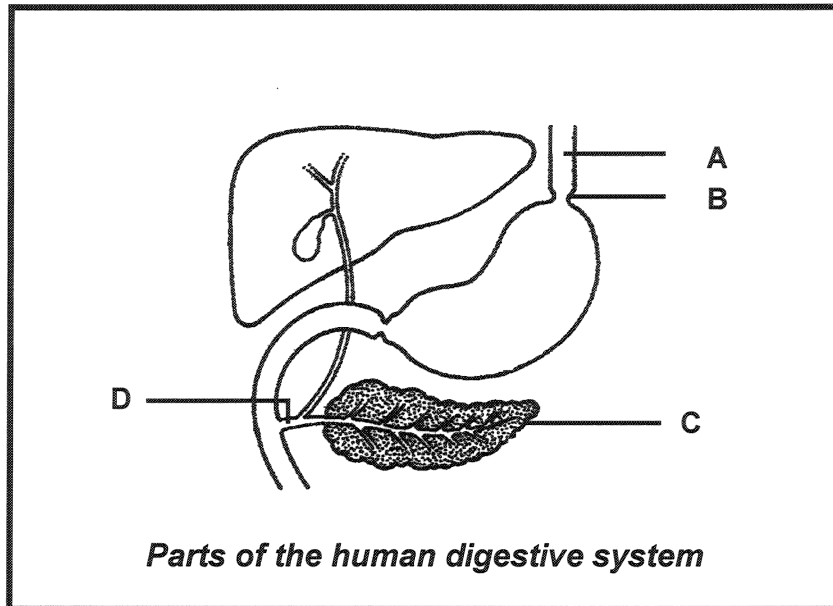
1.6.1   Label parts A to D.   (4)

1.6.2   Name any TWO enzymes from C which act in the small intestine
         and briefly describe the role of each.   (6)
                                                                              (10)

                                              TOTAL QUESTION 1:   60
                                              TOTAL SECTION A: 60

SECTION B

QUESTION 2

2.1   In an investigation, five test tubes marked A, B, C, D and E respectively, contained 1 g each of an unknown substance S. Substances X and Y were dissolved in water and then added to the test tubes as shown in the table. The test tubes were subjected to various treatments. After the treatments, a new substance P formed in some of the test tubes and the amounts of these are shown in the table.

Study the table and answer the questions that follow:

Test tube	Contents of test tubes	Amount of new substance (P) formed in grams
A	S + X + Y (alkaline medium)	0,0
B	S + X (acidic medium)	0,2
C	S + X +Y (acidic medium)	0,6
D	S + Y (acidic medium)	0,0
E	S + boiled X (acidic medium)	0,0

2.1.1   Which test tube(s) give(s) evidence that X is the active substance converting S to P?   (2)

2.1.2   What type of organic substance is X most likely to be?   (1)

2.1.3   Identify substance Y. Give a reason for your answer.   (3)

2.1.4   Explain why there is no product formed in test tube E.   (2)

2.1.5   In which region of the human alimentary canal is substance X most likely to be found? Give a reason for your answer.   (3)

2.1.6   How much of substance P in grams would you expect to form if a test tube F was added and S + X + Y were placed in a n eutral medium?   (1)
                                                                                          (12)

2.2   Study the diagram of an organelle below and answer the questions that follow:

Structure of an organelle
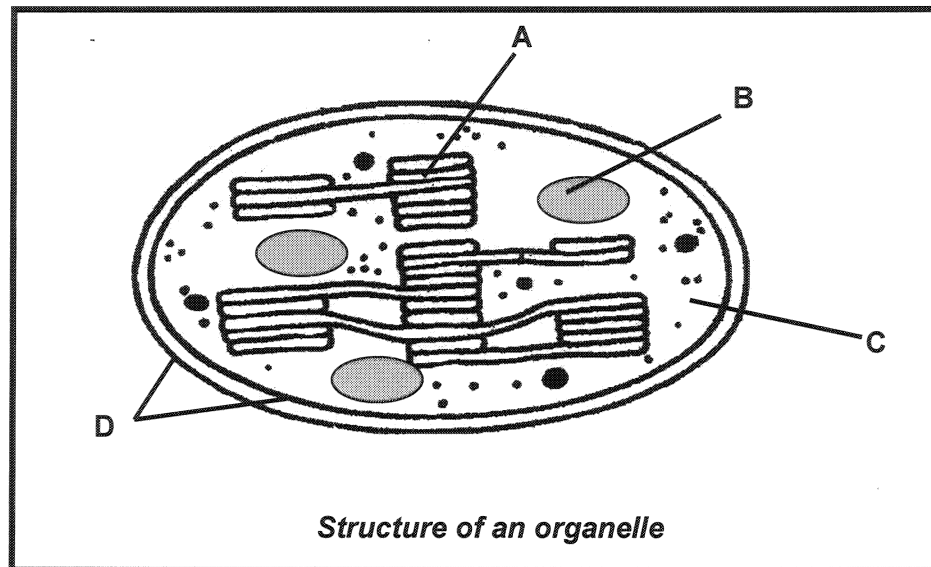
2.2.1   Give the letter and name of the part:

(a)   Which stores the product of photosynthesis   (2)
(b)   Where carbon dioxide is used   (2)
(c)   That will only be active in light   (2)

2.2.2   What is the difference between the carbon dioxide concentration on the inside and on the outside of membrane D during photosynthesis? Explain your answer.   (5)

2.2.3   Describe what would happen to a water molecule during the process of photosynthesis, when it enters A.   (5)

(16)

2.3   Tabulate THREE differences between photosynthesis and cellular respiration.   **(7)**

TOTAL QUESTION 2:   35

QUESTION 3

3.1 A learner wanted to determine the composition of honey. He/She placed a drop of honey on filter paper. He/She also placed separate drops of glucose, sucrose and lactose on similar positions on the filter paper. One end of the filter paper was dipped into a solvent containing an enzyme.

The solvent flowed up the filter paper, pulling with it the glucose and the substances making up sucrose, lactose and honey at different rates.

The diagram below shows the results of the experiments.

Experiment to determine the food composition of honey
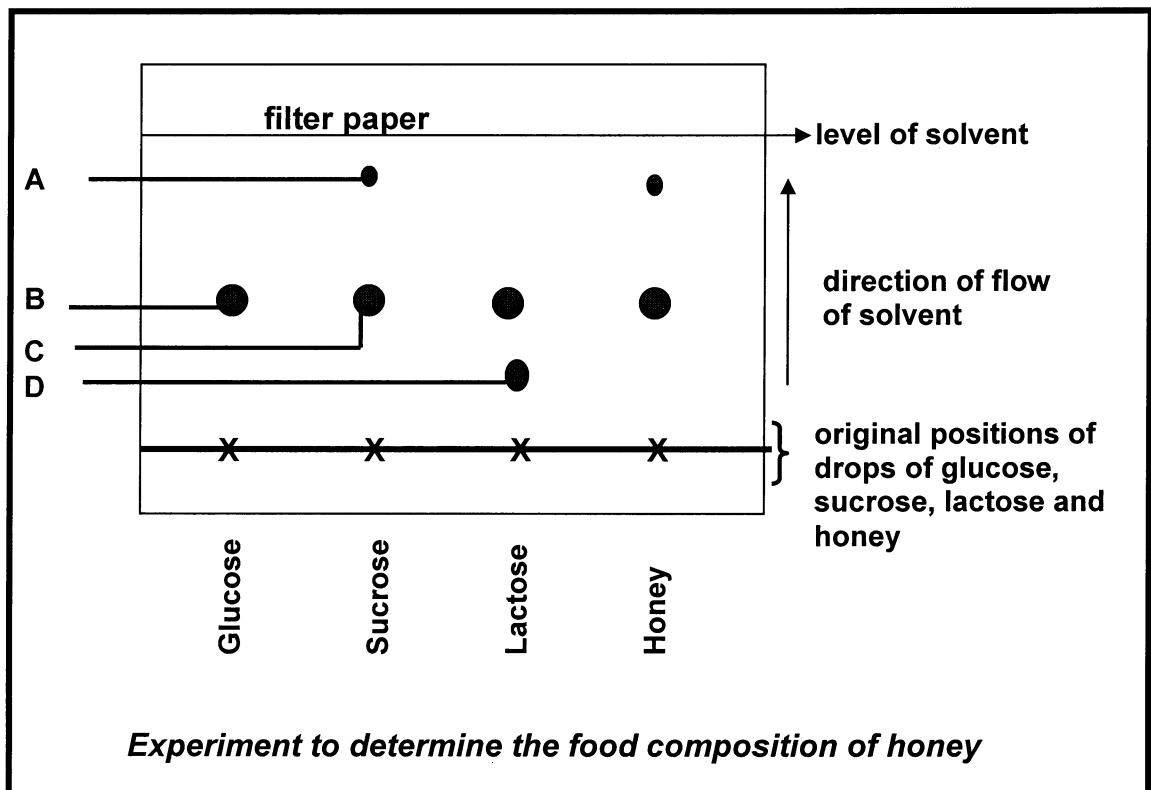
3.1.1 Name the substance that moved the ... distance.

(a) greatest (1)
(b) shortest (1)

3.1.2 Name substances A, B, C and D. (4)

3.1.3 Based on the results, name TWO monosaccharides present in honey. (2)

(8)

3.2   In an experiment, puppies of the same litter and the same average mass were divided into two groups, A and B. They were fed the following diets for a period of six weeks and weighed on a weekly basis.

Group	Days 0 to 21	Days 22 to 42
A	Proteins, glucose, starch, fats, mineral salts and water	The same as for day 0 to day 21 plus 10 ml milk per day
B	The same as group A from day 0 to day 21 plus 10 ml milk per day	Proteins, glucose, starch, fats, mineral salts and water

The results of this experiment are represented in the table below:

Time (days)	Average mass (g)	
	Group A	Group B
0	35	35
7	42	60
14	38	70
21	50	78
28	60	70
35	75	62
42	78	60

3.2.1   Draw TWO line graphs on the same axes to show the average mass of each group of puppies over time.   (15)

3.2.2   Why were puppies of the same litter used in the experiment?   (2)

3.2.3   Between days 21 and 42, the average mass of Group B showed a continuous decrease. Give a reason for this decrease in mass.   (2)

3.2.4   What conclusion can be made from the results of the experiment?   (2)

3.2.5   Identify TWO organic nutrients in milk that are most likely responsible for the results of the experiment.   (2)

3.2.6   What was the average mass of the puppies in Group A on day 21?   (2)

3.2.7   According to your graph, on which days was the mass of group A and B equal?   (2)

                                                                         (27)

                                            TOTAL QUESTION 3:   35

QUESTION 4

4.1   Read the following passage and then answer the questions that follow:

> In 1990 the estimated impala population in a certain environment was approximately 8 000. Large populations of lions and cheetahs were also present. Between 1990 and 2000 about half the sizes of the populations of lions and cheetahs were eliminated. By 2002 the number of impala increased to about 80 000 and nearly all the grass, shrubs and young trees had been eaten. During the winter, 80% of the impala population was wiped out and this decline continued until only 4 000 impala were left. The vegetation, however, continued to degenerate for a long time. In the beginning it was estimated that the carrying capacity of the area was only 20 000 impalas.

4.1.1   By referring to the passage, give ONE example of:

   (a)   Intraspecific competition   (2)
   (b)   Interspecific competition   (2)
   (c)   Predation   (2)
   (d)   A density independent factor   (2)

4.1.2   Draw a food chain to illustrate the feeding relationships in this area during 1990.   (3)

4.1.3   Why did the impala population continue to decline after 80% had died during the winter?   (2)

4.1.4   Why did the vegetation continue to deteriorate in spite of the large decrease in the impala population?   (2)

4.1.5   Explain what is meant by carrying capacity.   (2)
                                                                              (17)

4.2   A gardener wanted to know the number of weeds in his/her vegetable garden
       which is 10 m wide and 3 m long. He/She took a number of quadrat samples
       as shown in the diagram below. Each quadrat was 1 m² and the number in the
       quadrat indicates the number of weeds. Study the diagram and answer the
       questions that follow:

15		7			20				
				11			5		
	10								16

Quadrats in the vegetable garden

4.2.1   Were the samples taken at random? Explain your answer.   (3)

4.2.2   Calculate the following:

         (a)   The average number of weeds in the samples taken   (3)

         (b)   The size of the weed population in the vegetable garden
               (Show ALL the calculations for both (a) and (b).)   (3)

4.2.3   Name ONE direct method the gardener could use to determine the
         size of the weed population.   (1)
                                                                                  (10)

4.3   Explain EACH of the following terms:

4.3.1   Population dynamics   (3)

4.3.2   Lag phase   (2)
                                                                                   (5)

4.4   List THREE ecological problems facing humankind today.   **(3)**

                                                          TOTAL QUESTION 4:   35
                                                          TOTAL SECTION B: 105

SECTION C

QUESTION 5

5.1   The diagrams below show how much energy, in kilojoules (kJ), is needed by a man to do various activities for an hour. The bar graphs illustrate the effect of exercise on the man's rate and depth of breathing. Study the diagrams and bar graphs and answer the questions that follow:

sleeping	standing	work	walking	running
300 kJ	**400 kJ**	**650 kJ**	**1 200 kJ**	**2 400 kJ**

The effect of exercise on the man's rate and depth of breathing
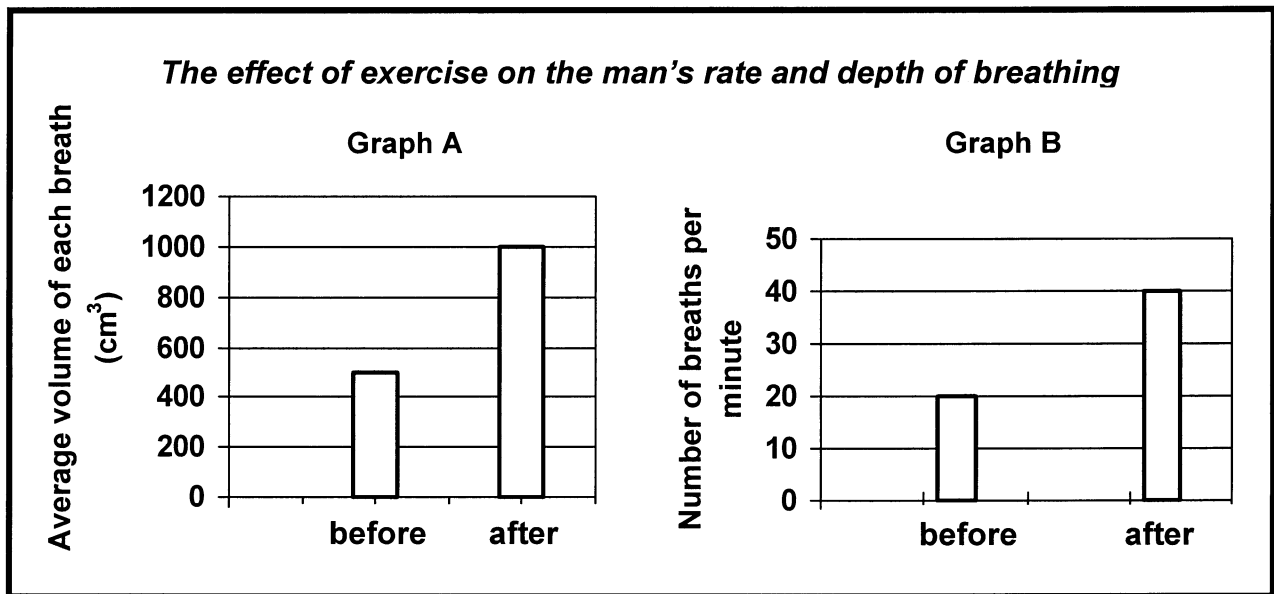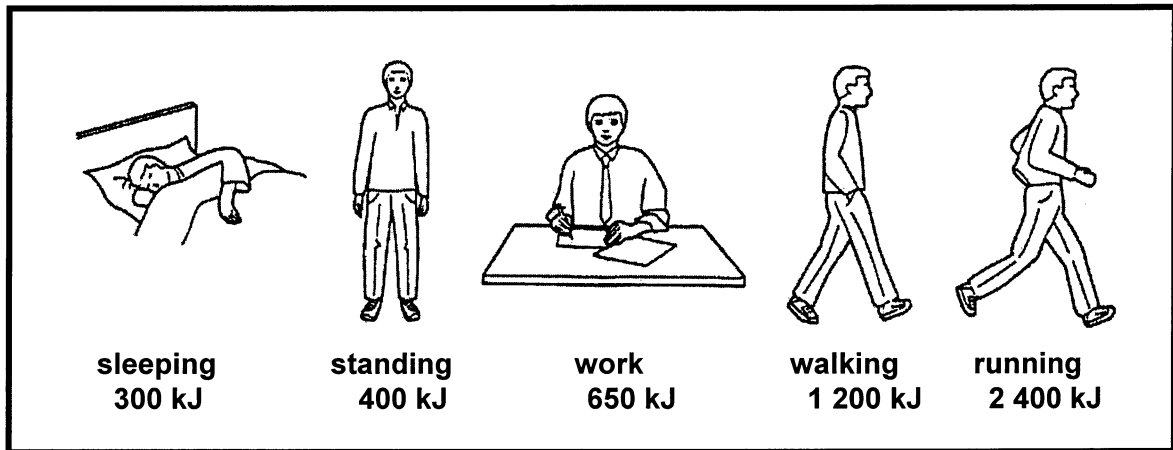
Graph A

Graph B

5.1.1   Identify an activity that used 20 kJ per minute.   (2)

5.1.2   Sleeping uses 300 kJ of energy per hour. Suggest what this energy
        is used for.   (2)

5.1.3   According to graph A, state the effect of exercise on the depth of
        breathing.   (1)

5.1.4   Give the total volume of air that passes in and out of the man's
         lungs each minute after exercise. Show ALL the calculations.   (3)

5.1.5   The main reason for breathing during exercise is to take in oxygen
         which is used for energy release.

         (a)   Which phase of cellular respiration releases most energy?   (2)

         (b)   Briefly explain why the man continues to breathe heavily
                shortly after an exercise.   (2)

5.1.6   It was claimed that the air that the man was breathing contained
         150 particles (such as pollen grains) per 500 cm^3 of air.

         (a)   Calculate the number of particles he would inhale per hour
                when he is not exercising. Show ALL the calculations.   (3)

         (b)   Briefly explain why very few of these particles would reach
                the alveoli.   (2)
                                                                               (17)

5.2   Discuss the mechanism of breathing as it occurs in the human body.

      NOTE: NO marks will be allocated for answers given in the form of diagrams
             and flow charts.

                                                        Factual Content: (15)
                                                            Synthesis: (3)
                                                                               (18)

                                                     TOTAL QUESTION 5:   35
                                                     TOTAL SECTION C: 35

                                                         GRAND TOTAL: 200