Name		Index No.		Civics Group	

DUNMAN HIGH SCHOOL
SENIOR HIGH

2009 PRELIMINARY EXAMINATION

General Certificate of Education Advanced Level

YEAR SIX H1 BIOLOGY (8875)

BIOLOGY 8875 / 01

PAPER 1 Multiple Choice **25 September 09 (Friday)**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST.

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, civics group and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** questions in this paper. Answer **all** questions. For each question there are four possible answers, **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in the **soft pencil** on separate Answer Sheet [**optical answer sheet** (**OTAS**)] provided.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.
Calculators may be used.

Do not open this booklet until you are told to do so.

This question paper consists of **14** printed pages and **2** blank pages (including this cover page).

Section A: Multiple Choice Questions (30 marks)
Answer **all** questions.

1 Which molecules, found in cell surface membranes, contribute to cell recognition?

A cholesterol and glycolipids

B cholesterol and phospholipids

C glycolipids and glycoproteins

D phospholipids and glycoproteins

2 Equal quantities of a 5% starch solution were added to equal quantities of different solutions.

After 5 minutes at room temperature, the solutions were tested with iodine in potassium iodide solution and the depth of colour was recorded using a colorimeter (with an arbitrary scale of 1 to 5, 5 being the darkest blue).

The results are given in the table.

solution		colorimeter reading
1	saliva and dilute HCl	4
2	saliva and dilute $NaHCO_3$	1
3	dilute HCl only	4
4	saliva at 100^{o}C	5
5	saliva at 20^{o}C	3

This experiment suggests that saliva contains a biologically active substance that _____.

A hydrolyses starch in acid conditions

B is denatured by hydrochloric acid

C is promoted in its action by high temperatures

D may be activated by hydrogencarbonate ions

3 Which of the following food samples requires the largest amount of oxygen to oxidize it completely?

A 1 g of amino acid

B 1 g of fat

C 1 g of monosaccharide

D 1 g of polysaccharide

4 Which is the longest phase in the cell cycle of human liver cells?

A prophase

B anaphase

C cytoplasmic cleavage

D interphase

5 Down's syndrome can exist in two forms.

Classic Down's syndrome affects all cells, while the mosaic form arises from the presence of two or more cell types in the body with differences in the chromosome number and structure.

How does the mosaic condition arise?

A non-disjunction of chromosomes in mitosis in early foetal development

B non-disjunction of chromosomes in mitosis during formation of ova

C non-disjunction of chromosomes in mitosis during formation of sperm

D translocation of chromosomes at maturation of ovum or the sperm

6 An experiment is carried out to show that DNA replication is semi-conservative. *Escherichia coli* cells whose DNA contains only 'heavy' nitrogen (15N) are grown in a culture medium containing the normal isotope of nitrogen (14N) and allowed to divide three times.

What will be the percentage of DNA molecules containing both forms of nitrogen after the third division?

A 12.5%

B 25%

C 50%

D 100%

7 Pyrimidine bases contain 4 carbon atoms and purine bases contain 5.

How many carbon atoms does adenosine triphosphate contain?

A 8

B 9

C 10

D 11

8 Transfer RNA _____.

A forms hydrogen bonds between its codon and the anticodon of an mRNA in the A site of a ribosome

B binds to its specific amino acid in the active site of an aminoacyl-tRNA synthetase

C uses GTP as the energy source to bind its amino acid

D is produced in the nucleolus

9 The table shows a comparison between the genomes of a prokaryote and a eukaryote.

	prokaryote	eukaryote
genome length (base pairs)	4,640,000	12,068,000
number of proteins	4,300	6,200
proteins with roles in metabolism	650	650
proteins with roles in energy release	240	175
proteins with roles in protein synthesis	410	750

Which feature of eukaryotes accounts for the differences in the number of proteins with roles in protein synthesis?

A The DNA of a eukaryote has histones.

B The DNA of a eukaryote has introns.

C The DNA of a eukaryote has more base pairs.

D The DNA of a eukaryote is separated from the ribosomes by membranes.

10 Which best describes the correct order (from earliest to latest) in the control of gene expression in protein synthesis?

A polyribosome, promoter, spliceosome, primary transcript

B spliceosome, promoter, primary transcript, polyribosome

C promoter, primary transcript, spliceosome, polyribosome

D primary transcript, spliceosome, promoter, polyribosome

11 How is the coordinated transcription of genes involved in the same pathway regulated?

A The genes are transcribed in one transcription unit, although each gene has its own promoter.

B The genes are located in the same region of the chromosome, and enzymes deacetylate the entire region so that transcription may begin.

C The genes all respond to the same general transcription factors, though they may respond to different specific transcription factors.

D The genes have the same combination of control elements in the enhancer that bind with the particular activators present in the cell.

12 What do telomeres control?

A cell adhesion

B cell aging

C cell fusion

D cell differentiation

13 In a dihybrid cross of heterozygotes, what proportion of the offspring will be phenotypically dominant for both traits?

A 1/16

B 3/16

C 1/4

D 9/16

14 The base height of the dingdong plant is 10 cm. Four genes contribute to the height of the plant, and each dominant allele contributes 3 cm to height.

If you cross a 10 cm plant (quadruply homozygous recessive) with a 34 cm plant, how many phenotypic classes will there be in the F_2?

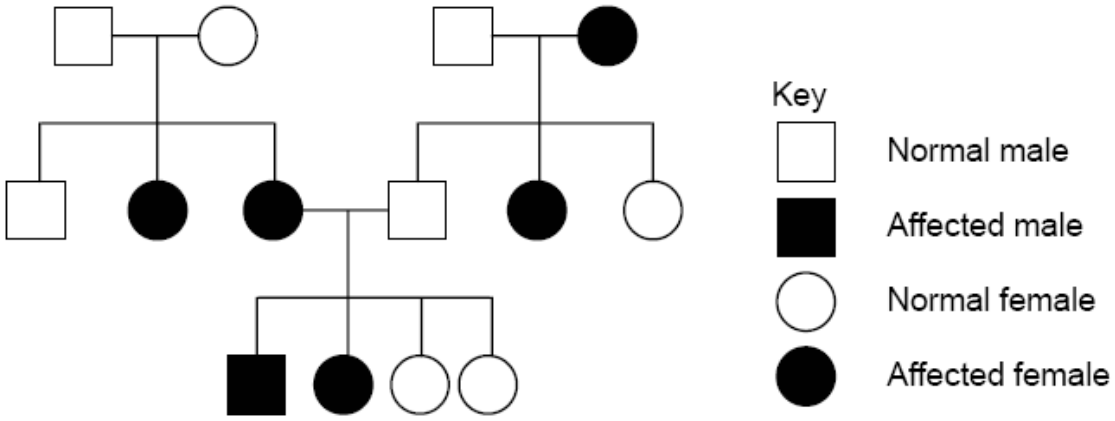
A 4

B 5

C 8

D 9

15 The family tree shows the inheritance of a skin condition.



What is the genetic basis of the skin condition?

A autosomal dominant

B autosomal recessive

C sex-linked dominant

D sex-linked recessive

16 In a classic experiment on photosynthesis, R. L. Hill demonstrated that an illuminated *in vitro* suspension of isolated chloroplasts could produce oxygen in the presence of a hydrogen acceptor such as methylene blue. In this case methylene is reduced. Which one of the following compounds replaces methylene blue in the intact photosynthesising plant?

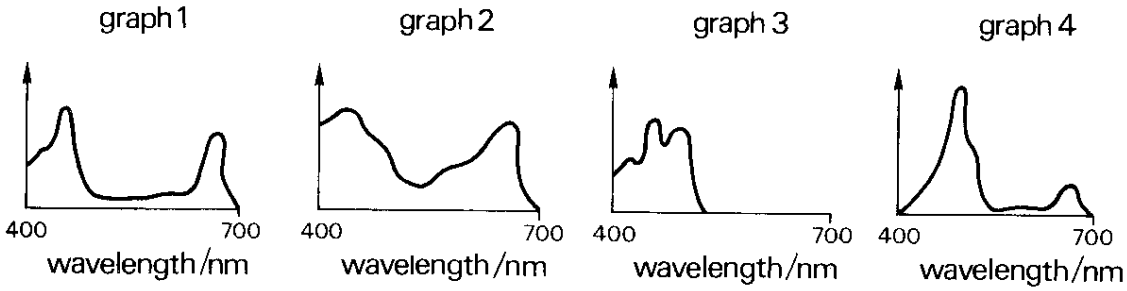
A adenosine triphosphate (ATP)

B carbon dioxide

C nicotinamide adenine dinucleotide phosphate (NADP)

D ribulose bisphosphate (RuBP)

17 Three of the graphs below show the absorption spectra of photosynthetic pigments. One graph shows the action spectrum of photosynthesis for a plant containing the pigments.

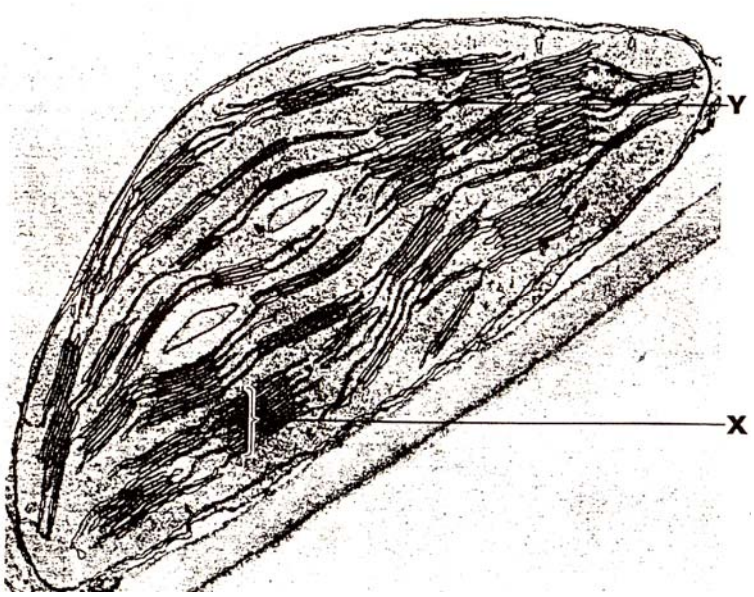


All the x axes show wavelength. Three of the y axes show light absorption. One y axis shows the rate of photosynthesis.

Which of the following identifies the four graphs?

	Absorption spectra			
	Chlorophyll a	**Chlorophyll b**	**Carotenoids**	**Action spectrum**
A	1	4	3	2
B	2	1	3	4
C	3	2	4	1
D	4	2	1	3

18



What are the structures labelled X and Y and what are their main functions?

	Structure **X**	Function of **X**	Structure **Y**	Function of **Y**
A	granum	photolysis of water	stroma	fixation of CO_2
B	granum	fixation of CO_2	lamella	photolysis of water
C	lamella	fixation of CO_2	granum	photolysis of water
D	stroma	photolysis of water	granum	fixation of CO_2

19 What happens to oxygen in the electron transfer chains?

A It is reduced to water.

B It is released as gas.

C It is used as an electron carrier.

D It combines with carbon to form carbon dioxide.

20 Which of the following pathways outlines the order of events during aerobic cellular respiration?

A Glucose → triose phosphate → pyruvate → Krebs cycle → CO_2 + H_2O + ATP

B Glucose → triose phosphate → pyruvate → Krebs cycle → CO_2 + H_2O + ADP + P_i

C Glucose → hexose phosphate → pyruvate → Krebs cycle →CO_2 + H_2O + ADP + P_i

D Glucose → hexose phosphate → pyruvate → Krebs cycle → ethanol + CO_2 + ATP

21 What happens to most of the reduced nicotinamide adenine dinucleotide ($NADH_2$) molecules in cell metabolism?

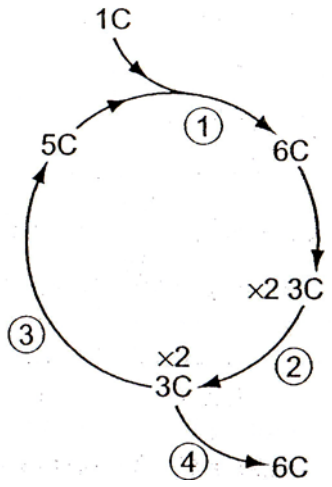
A oxidation in the Calvin cycle

B oxidation in mitochondrial ATP formation

C combination with succinic acid as part of the Krebs cycle

D acting as an oxidising agent for $FADH_2$

22 The diagram shows some phases of the Calvin cycle and the numbers of carbon atoms in the compounds involved.



Which reactions occur at phases 1 to 4?

A

Phase 1	RuBP + CO_2
Phase 2	ATP → ADP + P_i NADP → reduced NADP
Phase 3	ATP → ADP + RuBP
Phase 4	triose → hexose

B

Phase 1	triose → hexose
Phase 2	ADP + P_i → ATP NADP → reduced NADP
Phase 3	ADP + RuBP → ATP
Phase 4	glycerate 3-phosphate → triose

C

Phase 1	triose → hexose
Phase 2	ADP + P_i → ATP reduced NADP → NADP
Phase 3	ADP + RuBP → ATP
Phase 4	glycerate 3-phosphate → triose

D

Phase 1	RuBP + CO_2
Phase 2	ATP → ADP + P_i reduced NADP → NADP
Phase 3	ATP → ADP + RuBP
Phase 4	triose → hexose

23 Which one of the following statements describes a feature of a natural system of classification which an artificial system does ***not*** have?

A A natural system of classification is based on evolutionary relationships between organisms.
B A natural system of classification is based on cytological characters.
C A natural system of classification is based on single characteristics rather than several similar features.
D A natural system of classification is based on phenotypic characters.

24 Which of the following would cause a phenotypic variation among organisms of the same genotype?

A continuous variation within the species
B different sexes
C exposure to different environments
D mutation

25 A eukaryotic gene has "sticky ends" produced by the restriction endonuclease EcoRI. The gene is added to a mixture containing EcoRI and a bacterial plasmid that carries two genes, which make it resistant to ampicillin and tetracycline. The plasmid has one recognition site for EcoRI located in the tetracycline resistance gene.

This mixture is incubated for several hours and then added to bacteria growing in nutrient broth. The bacteria are allowed to grow overnight and are streaked on a plate using a technique that produces isolated colonies that are clones of the original. Samples of these colonies are then grown in four different media:

(i) nutrient broth plus ampicillin;
(ii) nutrient broth plus tetracycline;
(iii) nutrient broth plus ampicillin and tetracycline;
(iv) and nutrient broth containing no antibiotics.

The bacteria that contained the plasmid, but not the eukaryotic gene, would grow _____.

A in the nutrient broth plus ampicillin, but not in the broth containing tetracycline
B in the broth containing tetracycline, but not in the broth containing ampicillin
C only in the broth containing both antibiotics
D in all four types of broth

26 The DNA profiles below represent four different individuals.

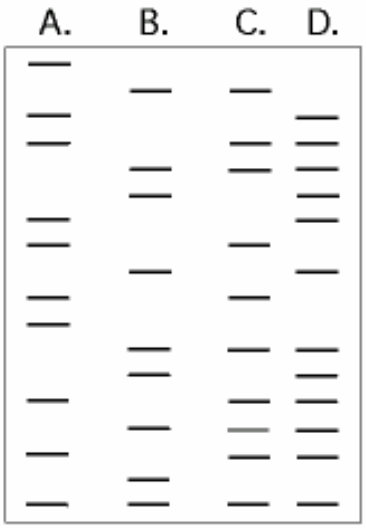


Fig. 26

Which of the following statements is consistent with the results?

A B is the child of A and C.

B C is the child of A and B.

C D is the child of B and C.

D A is the child of B and C.

27 From the list below, which of the following is the most logical sequence of steps for splicing foreign DNA into a plasmid and inserting the plasmid into a bacterium?

I. Transform bacteria with recombinant DNA molecule
II. Cut the plasmid DNA using restriction enzymes
III. Extract plasmid DNA from bacterial cells
IV. Hydrogen-bond the plasmid DNA to nonplasmid DNA fragments
V. Use ligase to seal plasmid DNA to nonplasmid DNA

A I, II, IV, III, V

B III, IV, V, I, II

C III, II, IV, V, I

D II, III, V, IV, I

28 The inherent potential of any living plant cell to develop into entire organism is called _____.

~~A~~ differentiation

B organogenesis

C totipotency

D morphogenesis

29 The genetically engineered supersalmon was created from Atlantic salmon stocks and was capable of growing to a large size in 14 months.

Which of the following is not a benefit intended from the crop?

A Higher yield for farmers

B Minimising pollution

C Decreasing the food consumption of the crops in their lifetime

D Increase in supply to meet world's demand

30 What is a "pharm" animal?

A a transgenic animal that produces large quantities of a pharmaceutical product

B an animal used by the pharmaceutical industry to test new medical treatments

C a cloned animal that was produced from an adult cell nucleus inserted into an ovum

D a genetically engineered animal that produces more meat or milk

END OF PAPER

Name		Index No.		Civics Group	

DUNMAN HIGH SCHOOL
SENIOR HIGH

2009 PRELIMINARY EXAMINATION

General Certificate of Education Advanced Level

YEAR SIX H1 BIOLOGY (8875)

BIOLOGY 8875 / 02

PAPER 2 Core Paper **16 September 09 (Wednesday)**

Additional Materials: Answer Paper **2 hours**

READ THESE INSTRUCTIONS FIRST.

Write your name, civics group and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Do not open this booklet until you are told to do so.

Section A:
Consists of 6 Structured Questions
Answer **all** questions.
Write your answers in the **space provided** on the question paper.

Section B:
Consists of 2 Essay Questions
Answer any **one** question.
Write your answers on the separate **writing papers** provided.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE		
Section A		**/30**
Section B	**1**	**/10**
	2	**/ 5**
	3	**/ 5**
	4	**/10**
	5	**/10**
	6	**/10**
Section C	**7 / 8** *circle accordingly	**/20**
Total		

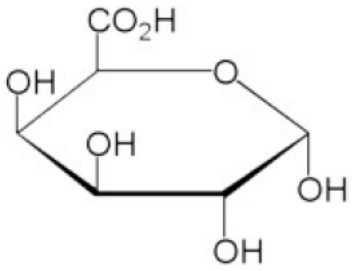
This question paper consists of **15** printed pages and **1** blank page (including this cover page).

Section B: Structured Questions (50 marks)

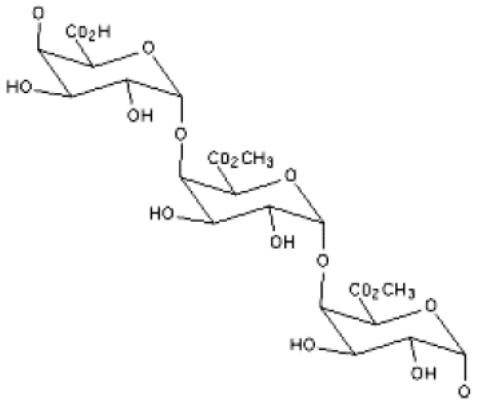
Answer **all** questions in this section.

Question 1

(a) The structure of pectin, one of the polysaccharide components present in plant cell walls, is shown in **Figure 1.1** below. The monomer of pectin is D-galacturonic acid.



D-galacturonic acid



pectin

Figure 1.1

(i) State **two** structural differences between pectin and cellulose. [2]

.....

.....

.....

.....

An important aspect of the ripening process of the tomato fruit is softening. The level of the enzyme polygalacturonase (PG) increases rapidly in the cell wall during ripening.

(ii) Describe briefly how PG leads to tissue softening during ripening. [1]

In countries which do not have well-developed refrigeration systems, spoilage due to fruit ripening contributes significantly to post-harvest losses.

(iii) Suggest a way to delay the ripening process without relying on refrigeration. [1]

(b) The diagram below shows the structure of haemoglobin. It consists of two α chain subunits and two β chain subunits. Each subunit is a conjugated protein associated with a haem group which is the site for oxygen transport. Each haem group in turn contains an atom of Fe^{2+} at its centre.

The haemoglobin molecule is a good transport protein for oxygen as the binding of oxygen to one haem group facilitates the binding of oxygen to the other haem groups on the same haemoglobin molecule. Similarly, when one haem group unloads its oxygen, the other three follows the lead and unloads their oxygen as well. This is known as *cooperative oxygen binding and release*.

The binding of hydrogen carbonate (derived from carbon dioxide that dissolves in the blood) and carbon monoxide reduces the affinity of haemoglobin for oxygen. The hydrogen carbonate binding site is shown in the diagram; the carbon monoxide binding site corresponds to that of the oxygen binding site on the haem group.

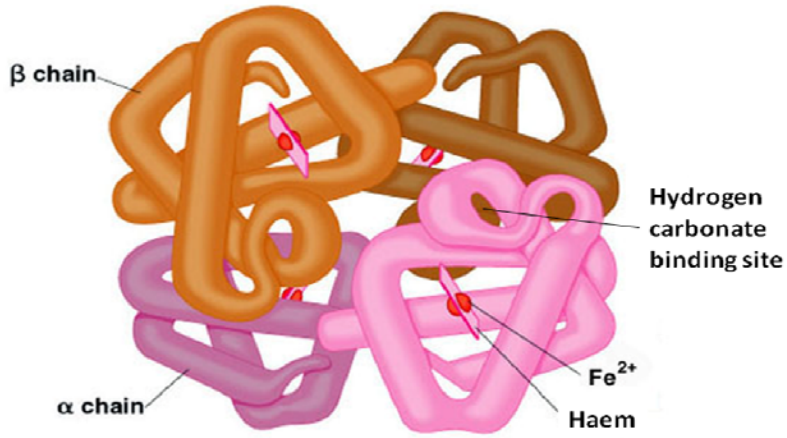


Figure 1.2

(i) With reference to Figure 1.2, what are the evidences that the protein has tertiary and quaternary structure? [2]

(ii) Suggest, in terms of molecular structure, why *cooperative oxygen binding and release* occurs. [2]

(iii) Contrast the mechanisms by which hydrogen carbonate and carbon monoxide cause a reduction in oxygen affinity. [2]

Total: [10]

Question 2

(a) State two differences between RNA and DNA. [2]

(b) State briefly why it is thought that the arrangement of the bases in the nucleic acids is in the form of a 'triplet code'. [3]

Total: [5]

Question 3

(a) Distinguish between the terms *dominant* and *recessive*. [2]

(b) X-linked adrenoleukodystrophy (X-ALD) is a recessive X-linked disorder that causes severe and progressive neurological disability.

Using X^A to represent the dominant normal allele and X^a to represent the recessive allele for X-ALD, draw a genetic diagram to show that the phenotypic ratios of the offspring of a normal male and a female who is a carrier of ALD is 1 normal male : 1 male with ALD : 2 normal females : 0 females with ALD. [3]

Total: [5]

Question 4

Figure 4.1 is a summary of the light independent stage reactions of photosynthesis (Calvin cycle).

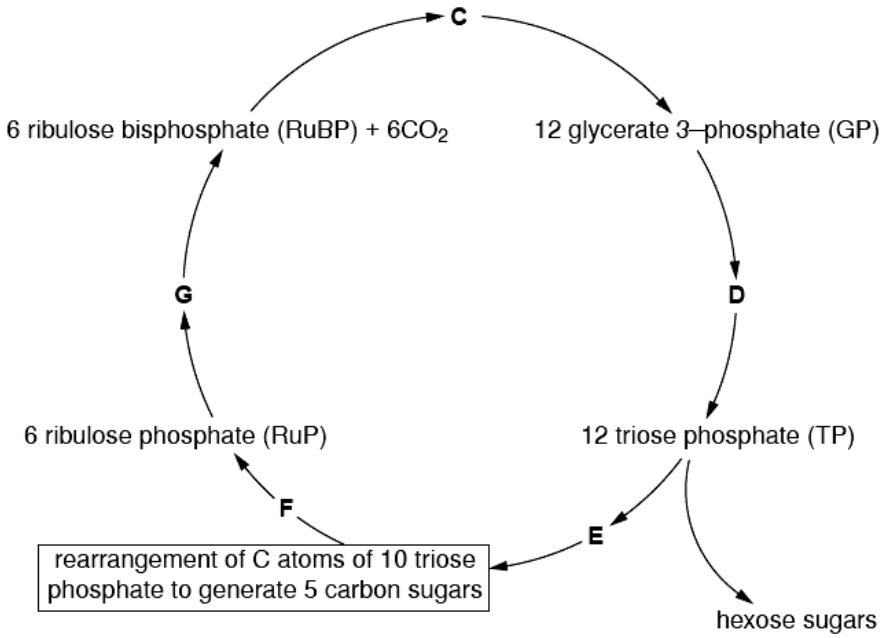


Figure 4.1

(a) **(i)** Name the two products of the **light dependent** stage of photosynthesis that are required in the Calvin cycle. [1]

1

2

(ii) Using Figure 4.1, state the letters of the two steps where chemical named in **(a)(i)** are required. [1]

1

2

(iii) State two possible fates of the hexose sugars shown in Figure 4.1. [1]

1

2

(b) Describe and explain what will happen to the concentrations of ribulose bisphosphate (RuBP) and glycerate-3-phosphate (GP) if carbon dioxide concentration falls. [2]

The rate of photosynthesis is determined mainly by environmental limiting factors. These are light intensity, the availability of carbon dioxide and temperature. Water supply has indirect effects by influencing the availability of carbon dioxide.

(c) Define the term 'limiting factor'. [1]

(d) Explain how water shortage could have an indirect effect on photosynthesis by influencing the availability of carbon dioxide. [2]

Some plants, such as wood sorrel, *Oxalis acetosella*, nearly always grow in shade where light intensity is commonly a limiting factor for photosynthesis. They are known as shade plants. Plants that live in open habitats, for example the daisy, *Bellis perennis*, are called sun plants.

Figure 4.2 shows the net rate of photosynthesis of sun and shade plants in response to increasing light intensity. The net rate of photosynthesis is defined as:

Mass of CO_2 fixed in photosynthesis minus mass of CO_2 produced in respiration, per unit time.

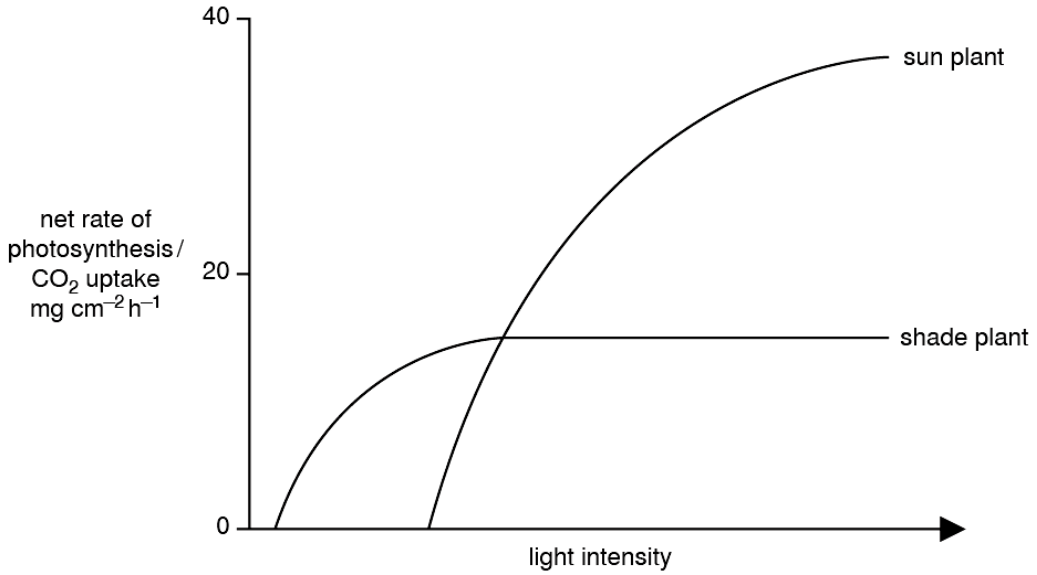


Figure 4.2

(e) Using Figure 4.2, describe the responses of sun plant and shade plant to increasing light intensity. [2]

Total: [10]

Question 5

Figure 5.1 shows the main stages in the polymerase chain reaction (PCR).

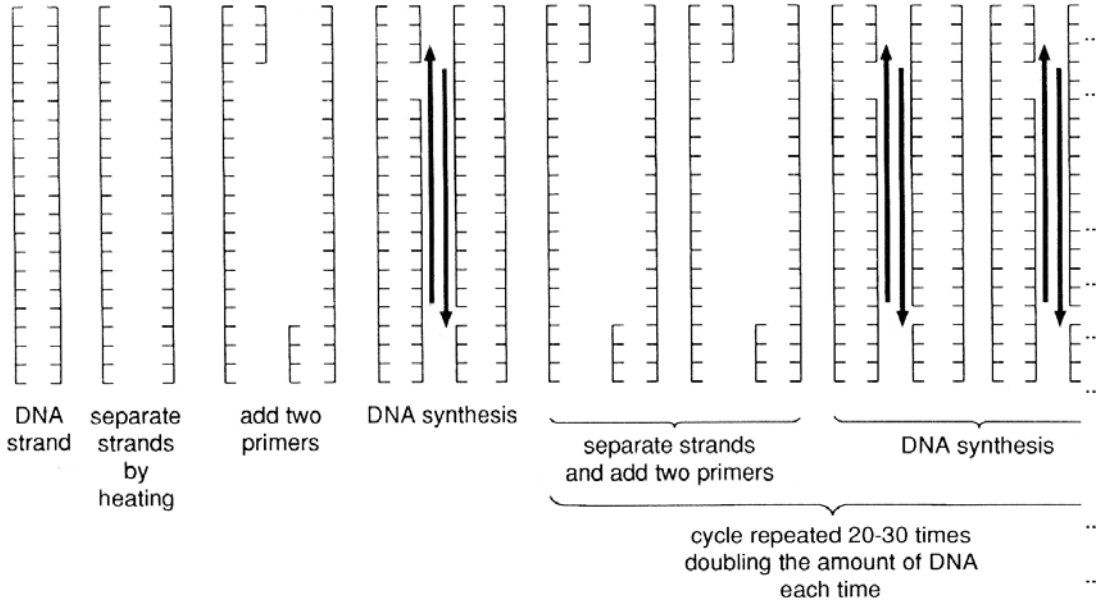


Figure 5.1

(a) Suggest why the brief heat treatment separates the two strands of the DNA double helix. [1]

(b) Suggest why DNA synthesis takes place in opposite directions on the two strands of the DNA double helix. [2]

(c) Explain the advantages of using *Taq* DNA polymerase. [2]

(d) The products of PCR are often subjected to gel electrophoresis after its reaction.

Discuss the principle of gel electrophoresis. [5]

Total: [10]

Question 6

Chemotherapy is often used as part of the treatment regime for patients with cancer. A drug or combination of drugs is administered intravenously and they travel via the blood throughout the body. The drugs used in this treatment will normally target cancer cells that are dividing at a fast rate.

Chemotherapy treatment is usually given in doses two or three weeks apart, during this treatment the blood cell count is frequently monitored. Figure 6.1 shows the blood counts of a person undergoing chemotherapy.

Chemotherapy was given to the person on day 1, day 21 and day 42 after the blood count was taken. Normal blood cell counts are red blood cells 4.5 – 6.1 x $10^6/mm^3$, white blood cells (neutrophils) 2500 – $6500/mm^3$.

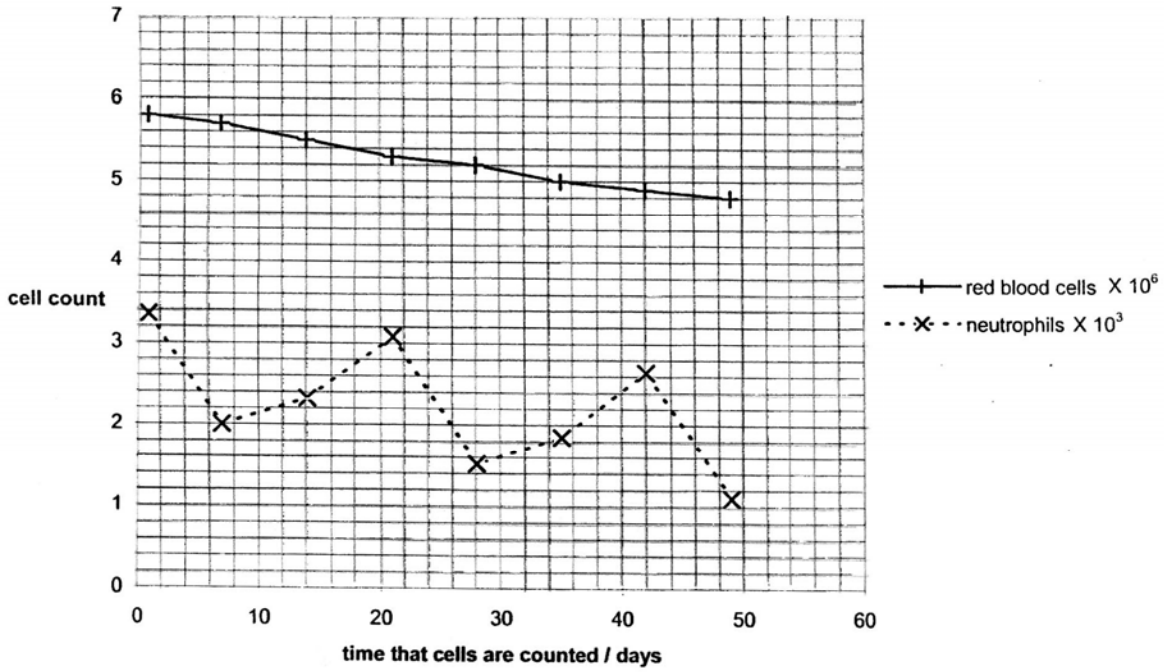


Figure 6.1

(a) (i) What is meant by the term cancer? [2]

(ii) Describe the trends shown in Figure 6.1. [3]

Neutrophils are a type of white blood cell produced as a result of the fast division of stem cells. The neutrophils have a lifespan of between 12 hours and 3 days. Neutrophils are very important in fighting infection.

(b) (i) Describe the features of stem cells. [2]

(ii) Explain the pattern shown by the neutrophils. [2]

(c) Suggest **one** possible reason why further chemotherapy may be delayed if the neutrophil count is too low. [1]

Total: [10]

Section C: Free-response Questions (20 marks)

Answer **one** question.

Write your answers on the separate answer paper provided.
Your answers should be illustrated by large, clearly labelled diagrams, wherever appropriate.
Your answer must be in continuous prose, where appropriate.
Your answers must be set out in sections **(a)**, **(b)** etc., as indicated in the question.

7 **(a)** Describe how the information on DNA is used to synthesise functional polypeptides. [14]

(b) Define control elements and explain how they influence transcription. [6]

8 **(a)** Describe two examples of the effect of the environment, with relationship to natural selection on the phenotype. [6]

(b) Explain how the evidences supported Darwin's theory of evolution. [14]

END OF PAPER