

Friday 11 January 2013 – Afternoon

A2 GCE HUMAN BIOLOGY

F224/01 Energy, Reproduction and Populations

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
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Centre number							Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.



Where you see this icon you will be awarded marks for the quality of written communication in your answer.

- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 In the United Kingdom, health practitioners provide advice on family planning and contraception.

Many studies of the success and failure rates of different forms of contraception have been carried out.

Table 1.1 summarises the data from several studies which compared the effectiveness of some forms of contraception.

Form of contraception	Percentage of pregnancies that occur despite using contraception	
	Lowest percentage recorded in any study	Mean percentage of all studies
Birth control pill	0.1	7.6
Condom	3.0	13.9
Hormone implants	0.1	0.2
Hormone injections	0.3	3.1
Diaphragm	6.0	12.1

Table 1.1

(a) (i) Using the data in Table 1.1, comment on the effectiveness of the condom as a form of contraception.

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..... [2]

(ii) Suggest why a health practitioner may decide to prescribe hormone implants rather than birth control pills to a sexually active woman.

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..... [2]

(iii) Table 1.1 shows that hormone injections are a less effective method of contraception than hormone implants.

Suggest and explain why.

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..... [2]

(iv) Describe and explain how hormone implants prevent pregnancies.

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..... [3]

(b) The 'morning-after pill' is regarded as an emergency contraceptive pill by health practitioners in the United Kingdom.

Suggest biological and ethical reasons why some people may be opposed to the use of the emergency contraceptive pill as a method of contraception.

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..... [2]

[Total: 11]

- 2 (a) ATP provides an immediate source of energy for metabolic processes such as active transport and muscle contraction. ATP is a nucleotide.

Another nucleotide which is found in cells is NAD. NAD is used in many metabolic reactions involving energy transfer, including the Krebs cycle.

Fig. 2.1 represents the molecular structure of ATP and NAD.

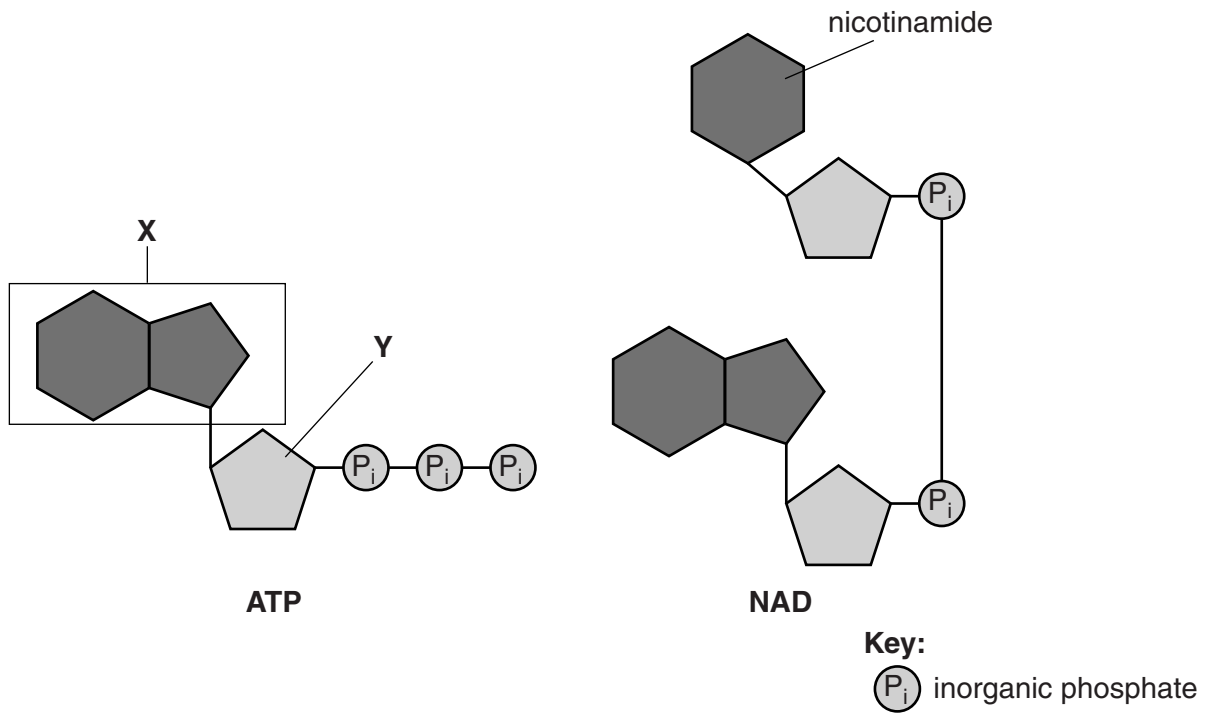


Fig. 2.1

- (i) Identify the parts labelled X and Y on Fig. 2.1.

X

Y

[2]

(ii) Using Fig. 2.1, comment on the **differences** between the molecular structure of ATP and NAD.

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(iii) Suggest why ATP is able to provide an immediate and a continuous source of energy for metabolic processes in cells.

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..... [2]

(b) It is difficult to measure the actual yield of ATP obtained from the complete metabolism of a molecule of glucose in aerobic respiration. Some scientists have, however, calculated the theoretical maximum yield to be 34 molecules of ATP.

Explain why the actual yield of ATP from the complete metabolism of glucose **in a living cell** is likely to be less than the theoretical maximum yield.

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..... [2]

(c) Lipids can be metabolised to provide energy in the form of ATP.

- Firstly they are broken down to glycerol and fatty acids by the enzyme lipase.
- The hydrocarbon chain of the fatty acid is further broken down into smaller, **two-carbon compounds**, which become molecules of acetyl coenzyme A.
- Acetyl coenzyme A molecules then enter the mitochondria and part of each molecule enters the Krebs cycle.

(i) Name the **type** of bond in the lipid molecule that is broken by lipase.

..... [1]

(ii) Suggest the mechanism by which molecules of acetyl coenzyme A may enter the mitochondria.

..... [1]

(iii) Table 2.1 shows the theoretical yield of ATP for each molecule of acetyl coenzyme A that enters a mitochondrion and is metabolised.

ATP Yield	Metabolic process
1	substrate level phosphorylation
9	reduced NAD followed by oxidative phosphorylation
2	reduced FAD followed by oxidative phosphorylation

Table 2.1

Linoleic acid is an essential unsaturated fatty acid with a hydrocarbon chain of 18 carbon atoms.

Using the information in the introduction to part (c) and Table 2.1, calculate the theoretical number of ATP molecules that could be produced from the metabolism of one molecule of linoleic acid.

Show your working.

Answer = molecules of ATP [2]

(d) The breakdown of fatty acids can act as a source of water molecules in cells.

Suggest why more water is produced from the breakdown of saturated fatty acids than from unsaturated fatty acids.

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..... [2]

[Total: 15]

(b) During the formation of haemoglobin in the immature erythrocytes, prosthetic groups are added to the polypeptide chains synthesised at the ribosomes.

(i) State precisely where in the immature erythrocyte the prosthetic groups are added to the polypeptide chains.

..... [1]

(ii) Discuss the importance of the prosthetic groups in the transport of oxygen by the haemoglobin molecule.

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..... [3]

[Total: 10]

4 Human beings are completely dependent on green plants and the process of photosynthesis for their food supply.

(a) Table 4.1 lists some of the important molecules that are either used or produced in the **light independent** stage of photosynthesis.

Complete Table 4.1 by stating whether each molecule is used or produced.

One example has been completed for you.

Molecule	Used or produced?
ATP	USED
Reduced NADP (NADPH)	
Carbon dioxide (CO ₂)	
ADP	

Table 4.1 [3]

(b) It was estimated that in October 2011 the global human population reached 7 billion for the first time. The continual rise in the global population has led to a need to produce more food. Food production has an impact on ecosystems.

(i) Explain what is meant by the term *ecosystem*.

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..... [2]

(ii) Intensive farming methods are used to increase food production.

Discuss **two** negative effects that intensive farming methods have on ecosystems.



In your answer you should use the appropriate technical terms, spelled correctly.

1

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2

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[4]

- (c) The United Nations Food and Agricultural Organisation (FAO) forecasts that global food production will need to increase by over 40% by 2030 and 70% by 2050.

Rising sea levels may mean that there will be less land available for food production in the future.

Fig. 4.1 shows the rise in the sea level and the change in the mean concentration of carbon dioxide, CO₂, in the atmosphere between 1970 and 2010.

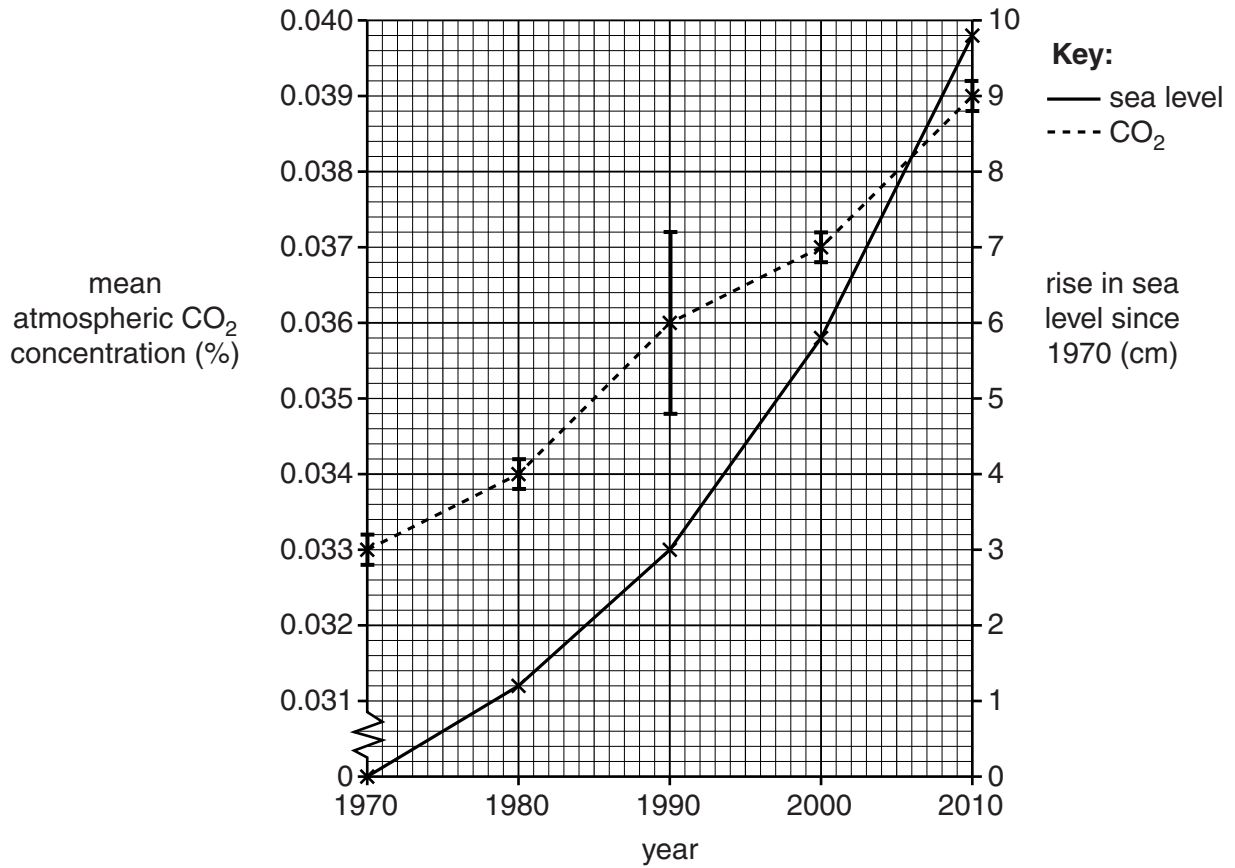


Fig. 4.1

- (i) Many environmental scientists think that the increase in atmospheric carbon dioxide is the reason for the rise in sea levels.

What evidence is there in the data in Fig. 4.1 to support this idea?

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[2]

(ii) Outline why a rise in atmospheric carbon dioxide could lead to a rise in sea levels.

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..... [2]

(iii) An environmental scientist stated that

“The mean concentration of atmospheric carbon dioxide shows a significant rise between 1990 and 2000.”

What evidence in Fig. 4.1

- supports this statement?
- does not support this statement?

supports statement.....
.....
does **not** support statement.....
..... [2]

[Total: 15]

5 Embryo storage is usually carried out if IVF treatment results in several potentially viable embryos. The unused embryos are preserved for implantation at a later date. Embryos are stored using a process called cryopreservation, which uses liquid nitrogen to freeze the embryos at a temperature of -196°C .

(a) A chemical called a cryoprotectant allows freezing water to harden like glass without ice crystals forming.

Suggest the importance of using a cryoprotectant in embryo storage.

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..... [2]

(b) Embryos are stored by cryopreservation when they reach the developmental stage known as the blastocyst.

Suggest the approximate age of the embryo when it is stored.

..... [1]

(c) When an embryo is thawed out to room temperature it is examined for signs of 'cryodamage'. If at least 50% of the cells are intact then the embryo is considered viable and suitable for implantation.

Suggest why only 50% of the cells need to be intact for the embryo to be considered viable.

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..... [2]

(d) A thawed embryo is usually transferred directly into the uterus.

What feature of the uterus determines whether or not the embryo will implant successfully?

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..... [1]

(e) Suggest and explain why a woman, who has had an embryo implanted into her uterus by IVF, will be administered oestrogen and progesterone for the following eight weeks.

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..... [3]

[Total: 9]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page. The question number(s) must be clearly shown in the margin.

A large rectangular area with a vertical line on the left side and horizontal dotted lines across the page, providing space for writing answers.



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