OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE **2805/01**

BIOLOGY

Growth, Development and Reproduction

MONDAY 29 JANUARY 2007 Morning

Time: 1 hour 30 minutes

Additional materials: Electronic calculator
Ruler (cm/mm)

Candidate Name

Centre Number | | | | | |

Candidate Number | | | | |

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	9	
2	20	
3	12	
4	14	
5	15	
6	20	
TOTAL	90	

This document consists of **18** printed pages, **2** blank pages and an insert.

[Turn over

Answer **all** the questions.

1 Double fertilisation in the ovule of a flowering plant, such as the sunflower, *Helianthus annuus,* results in the formation of a zygote and an endosperm nucleus.

(a) The endosperm nucleus of *H. annuus* contains 51 chromosomes.

State the number of chromosomes in a male gamete **and** in a zygote of *H. annuus.*

male gamete .....

zygote ..... [2]

(b) Describe the development of the **zygote** until just before germination of a seed.

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(c) Many seeds contain food stores, including starch, proteins and lipids. A fully developed seed of *H. annuus* contains between 40% and 50% of unsaturated fatty acids, including oleic acid and linoleic acid. These fatty acids can be used as respiratory substrates for the production of ATP.

(i) Explain why seeds need ATP.

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..... [2]

(ii) Explain the **advantages** of storing lipid for use as a respiratory substrate in seeds.

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..... [2]

[Total: 9]

2 **(a)** The structure of a human sperm is adapted to allow it to move through the female reproductive tract in order to penetrate and fertilise a secondary oocyte.

Fig. 2.1, on the insert, shows a **longitudinal section** through part of the middle piece of a human sperm.

(i) In the space below draw a labelled diagram of a **transverse section** through the middle piece shown in Fig. 2.1.

[3]

(ii) Explain how the structures shown in Fig. 2.1 assist the sperm in moving through the female reproductive tract.

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(b) In this question, one mark is available for the quality of the use and organisation of scientific terms.

Fig. 2.2, on the insert, shows human spermatozoa on the surface of a secondary oocyte. One sperm may eventually succeed in penetrating and fertilising the oocyte.

Describe how a sperm penetrates the oocyte **and** explain how penetration by more than one sperm is prevented.

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Quality of Written Communication [1]

(c) Contraceptives work in different ways. Some methods prevent either spermatozoa or oocytes from reaching the oviduct (fallopian tube).

Complete the table below by inserting a tick (✓) or a cross (✗) in each box.

method of contraception	spermatozoa prevented from reaching oviduct	oocytes prevented from reaching oviduct
condom		
vasectomy (male sterilisation)		
diaphragm		
combined pill		

[4]

(d) At fertilisation, the nuclei of the sperm and ovum fuse. The endoplasmic reticulum (ER) of the ovum releases calcium ions to activate development into an embryo.

Research has shown that a protein produced by the sperm may cause the release of calcium ions from the ER in the ovum.

Suggest how this protein causes the release of calcium ions from the ER.

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..... [2]

[Total: 20]

3 **(a)** Most flowering plants are adapted for pollination by wind or insects.

(i) Define the term *pollination.*

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..... [1]

(ii) Complete the table below to show **one** way that each structure in flowering plants is adapted for wind and insect pollination.

structure	adaptation for wind pollination	adaptation for insect pollination
petals		
stigma		
stamens		
pollen		

[4]

The coconut palm, Cocos nucifera, has large inflorescences (flowering heads). Fig. 3.1, on the insert, shows part of one inflorescence.

An extract has been removed due to third party copyright restrictions

Information about the flowering heads of Cocos nucifera

(b) Explain how the following features of C. nucifera help to ensure cross-pollination.

(i) The male flowers mature and wither before the female flowers.

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..... [1]

(ii) Most of the male flowers are found towards the tips of the inflorescence.

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..... [1]

(iii) Each inflorescence has separate male and female flowers.

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(c) State two advantages of cross-pollination to a flowering plant, rather than self-pollination.

1 .....

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2 .....

..... [2]

(d) After pollination a pollen tube grows through the carpel of the flower.

Fig. 3.2 shows a longitudinal section through a carpel.

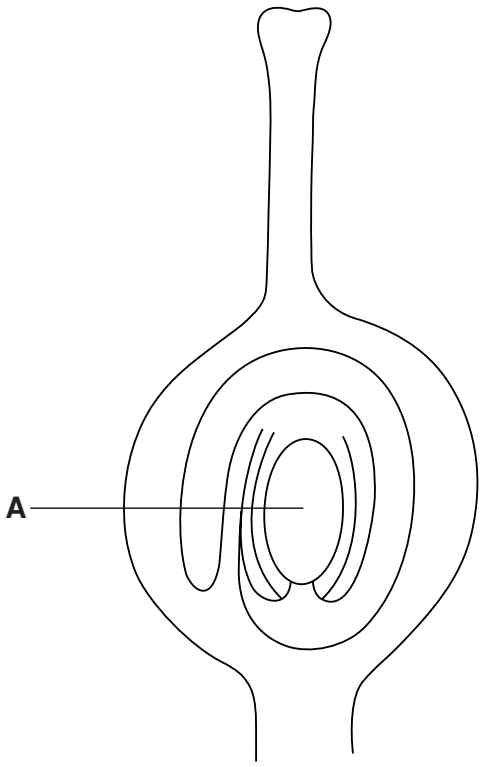

Fig. 3.2

(i) Name structure **A** shown on Fig. 3.2.

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(ii) **Draw a line on Fig. 3.2** to show the route of growth of a pollen tube through the carpel to structure **A**. [1]

[Total: 12]

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4 During the menopause in women, menstruation becomes irregular and finally ceases. Changes in the concentration of some hormones occur during the menopause.

As part of a study, the following information about a group of women was collected:

- their ages
- whether they were pre-menopausal or post-menopausal
- their mean blood concentration of follicle stimulating hormone (FSH).

The results are shown in Table 4.1.

Table 4.1

A table has been removed due to third party copyright restrictions

Details:

A table of data about women who are both pre-menopausal or post-menopausal and the concentration of FSH in their blood

Source: NYU Women's Health Study

(a) Comment on the age of onset of menopause in the women in the study.

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(b) In another study, the mean blood oestrogen concentration was measured in women from four years before the menopause to two years after the menopause.

The results are shown in Fig. 4.1.

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Details:

A graph showing the blood oestrogen concentration in women from four years before the menopause to two years after the menopause

Fig. 4.1

Using the data shown in Table 4.1 and Fig. 4.1, explain the relationship between FSH and oestrogen during and after the menopause.

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(c) After the menopause, women are more likely to suffer from osteoporosis.

Explain how hormonal changes during the menopause may cause osteoporosis.

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(d) Menopausal women may be prescribed hormone replacement therapy (HRT). In one form of HRT, oestrogen is prescribed. A possible side effect of this treatment is an increased risk of blood clots.

Explain why women who smoke are advised **not** to use this treatment.

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[Total: 14]

5 A human zygote divides to produce stem cells. Stem cells have the ability to develop into any cell type, in a similar way to meristematic cells in plants.

(a) State **one** way in which the structure of human stem cells is **different** from the structure of meristematic cells.

..... [1]

(b) Fig. 5.1 shows development of three cell types from human stem cells.

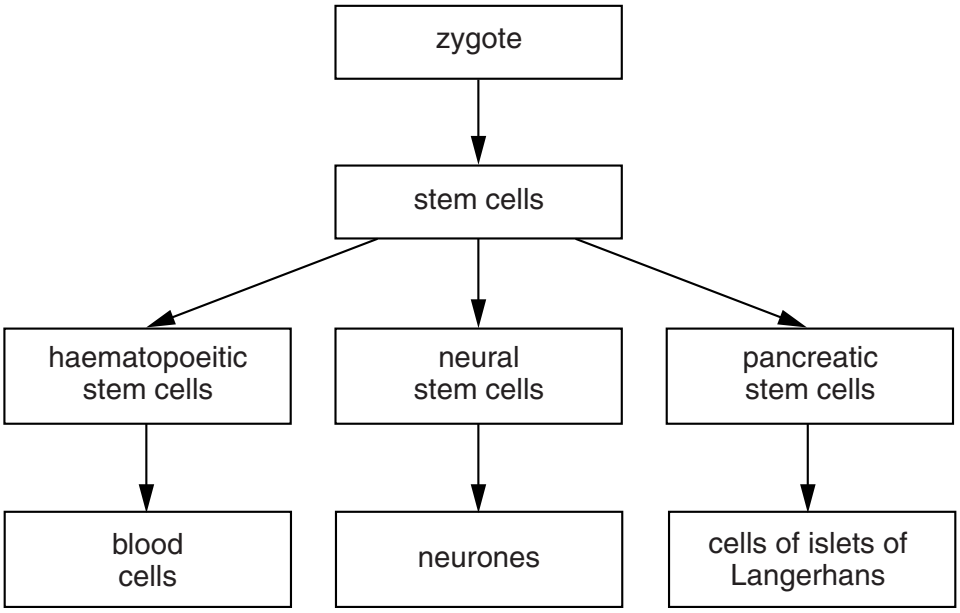

Fig. 5.1

There are many potential medical uses of stem cells from human embryos. One potential use is to make cells of the islets of Langerhans for transplantation, as a treatment for diabetes mellitus.

(i) Suggest **one** ethical objection to the use of stem cells from human embryos.

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..... [1]

(ii) Suggest **two** other medical conditions which could be treated using the embryonic stem cells shown in Fig. 5.1.

1 .....

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2 .....

..... [2]

(c) Monozygotic twins develop from one zygote. At an early stage of development, two separate groups of cells form. Each group of cells develops into a separate individual.

A pair of monozygotic twins:

- can be described as clones of each other
- either share a placenta or each have their own placenta
- may have different birth masses.

(i) State why a pair of monozygotic twins can be described as *clones* of each other.

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..... [1]

(ii) Suggest **two** reasons for a pair of monozygotic twins having different birth masses.

1 .....

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2 .....

..... [2]

(d) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Actions of the mother during pregnancy can affect the development of the fetus.

Describe the possible effects **on the fetus** if, during pregnancy, the mother consumes excessive alcohol **and** has a diet deficient in vitamins.

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Quality of Written Communication [1]

[Total: 15]

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6 Malaria is caused by the parasite *Plasmodium* which is a single-celled protoctist. At one stage in the life cycle the parasites reproduce asexually within human red blood cells.

(a) (i) Describe how *Plasmodium* reproduces asexually.

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(ii) State **two** advantages of asexual reproduction to a parasite such as *Plasmodium*.

1 .....

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2 .....

..... [2]

(b) In order to reproduce asexually, *Plasmodium* needs to obtain amino acids from red blood cells of its host.

Suggest how *Plasmodium* obtains amino acids from haemoglobin within red blood cells.

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The information below refers to the deficiency of the enzyme, glucose-6-phosphate dehydrogenase (G6PD) in humans:

- a deficiency of G6PD is an inherited condition
- G6PD is necessary for the production of ribose
- ribose is a nutrient needed by Plasmodium falciparum
- individuals with G6PD deficiency may be resistant to the parasite P. falciparum
- G6PD deficiency is more common in areas where malaria occurs regularly.

In an experiment, red blood cells were collected from individuals deficient in G6PD and from individuals without this deficiency. The cells were collected in a solution containing an anticoagulant, as well as solutes used to maintain a suitable water potential. The red blood cells were used as a growth medium for P. falciparum .

The percentage of red blood cells infected by P. falciparum was determined over a five day period and the mean calculated. The results obtained are shown in Fig. 6.1.

A graph has been removed due to third party copyright restrictions

Details:

A graph to show the average number of red blood cells infected by P.falciparum over a five day period

Fig. 6.1

(c) Using the information in Fig. 6.1,

(i) suggest why error bars have been included;

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(ii) describe **and** explain the results obtained between day 1 and day 2;

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(iii) describe **and** explain the differences between the results for **A** and **B** between days 2 and 5.

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Question 6 continues on page 20

(d) Explain why it is important that red blood cells are stored in a solution with a suitable water potential.

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(e) Explain why G6PD deficiency is more common in areas where malaria occurs regularly.

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[Total: 20]

END OF QUESTION PAPER