

**Form Six Mock Examination 2018-2019**

**DSE BIOLOGY PAPER 2**

Date: 14<sup>th</sup> Feb. 2019

11:25 am – 12:25 am (1 hour)

This paper must be answered in English

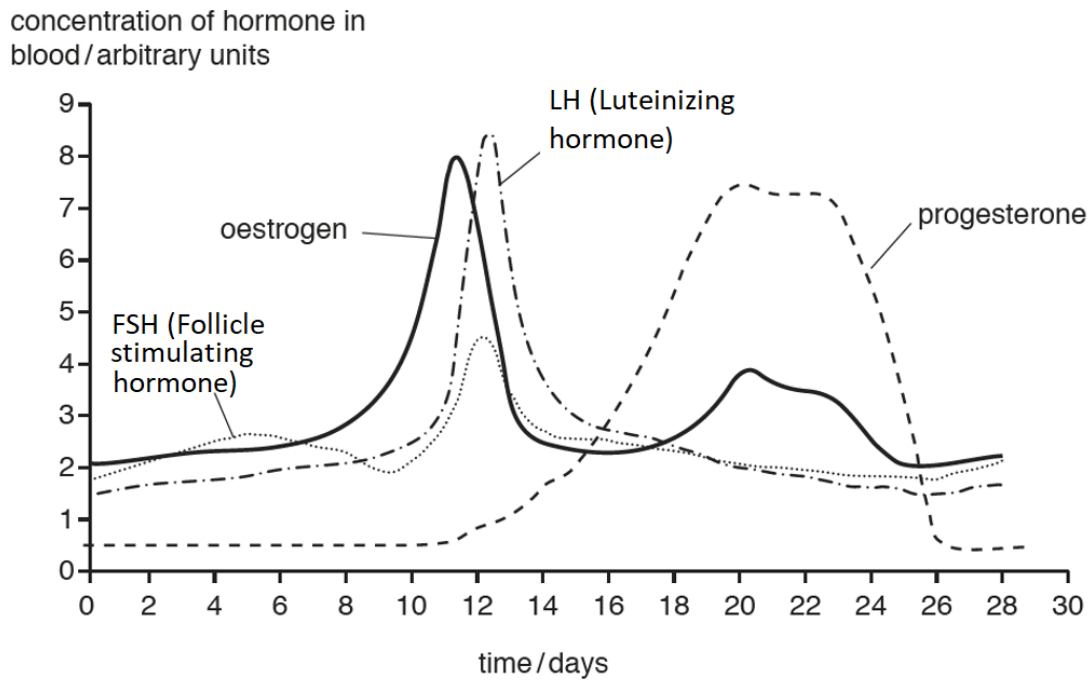
**INSTRUCTIONS**

1. There are **TWO** sections, A and B in this Paper. Attempt **ALL** questions in these **TWO** sections.
2. Write your answers in the Answer Book provided. Start each question (not part of a question) on a new page.
3. Present your answers in paragraphs wherever appropriate.
4. Illustrate your answers with diagrams wherever appropriate.
5. The diagrams in this paper are **NOT** necessarily drawn to scale.

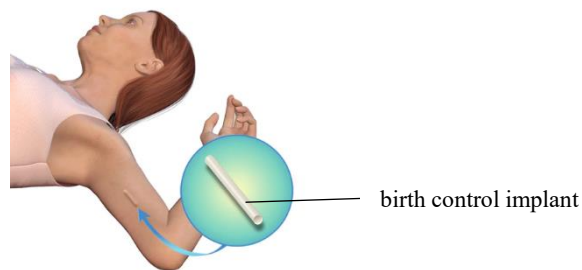
## Section A Human Physiology: Regulation and Control

Answer ALL questions

- 1(a) The figure below shows the concentration of four hormones in a woman's blood during one menstrual cycle.



- (i) With reference to the above figure, suggest evidence that
- (1) oestrogen causes the increase in LH secretion at around day 12. (1 mark)
  - (2) the woman did not become pregnant during this cycle. (1 mark)
- (ii) Some women have a birth control implant inserted under the skin. This releases progesterone into the blood and can last for up to three years.



- (1) Explain how such implant works to prevent pregnancy. (5 marks)
- (2) Suggest one advantage of using the birth control implant over an oral contraceptive. (1 mark)

- 1(b) Diving response is a set of reflexes activated in human when the face is in contact with cold water. It causes breath holding, changes in heart rate and blood pressure. Vasoconstriction of arterioles near skin surface will cause an increase in arterial blood pressure.

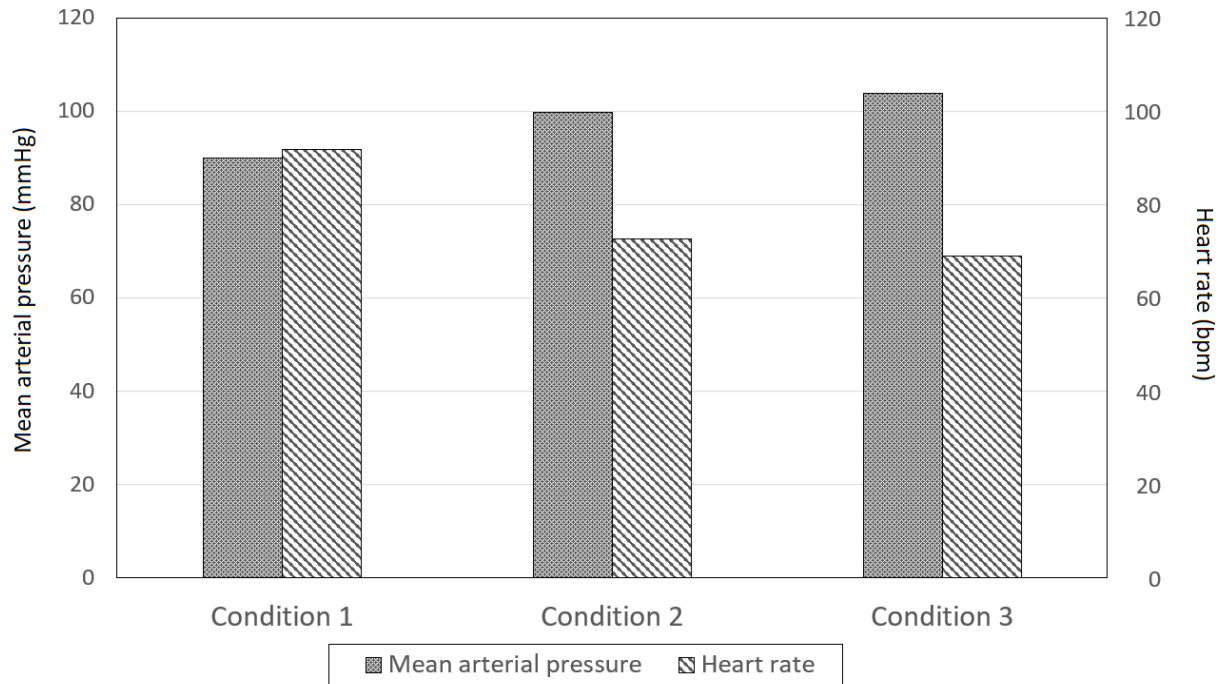
In a study, the diving responses under 3 different conditions were investigated:

Condition 1 – breathing in air

Condition 2 – face immersion in cold water

Condition 3 – whole body immersion in cold water (diving)

The mean arterial pressure and heart rate were measured and results are shown in the graph below:

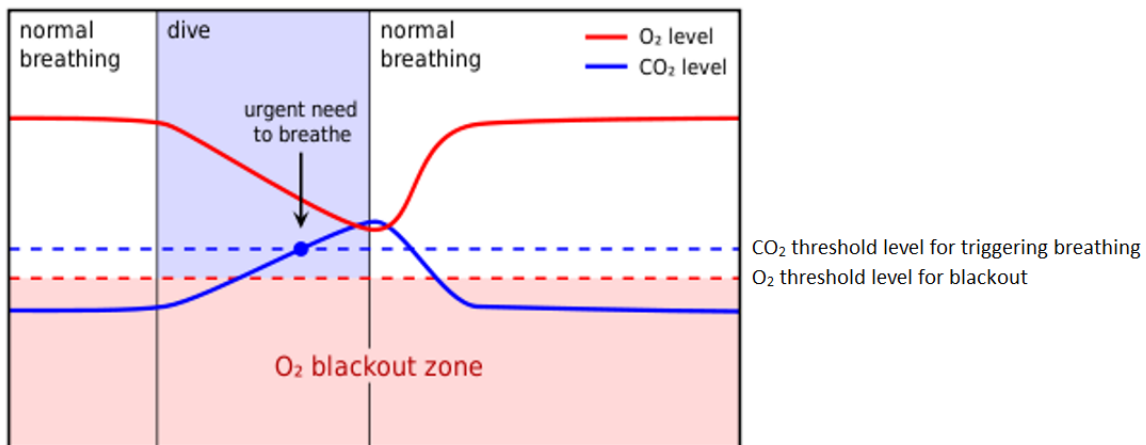


- (i) With reference to the experimental results, state the effect of immersion (conditions 2 and 3) on mean arterial pressure and their effects on heart rate. (1 mark)
- (ii) Compare the change in mean arterial blood pressure of subjects in conditions 2 and 3. Suggest reasons for such difference. (3 marks)
- (iii) After diving, the subjects returned to water surface and breathed rapidly and heavily. Describe the nervous coordination leading to this response. (5 marks)

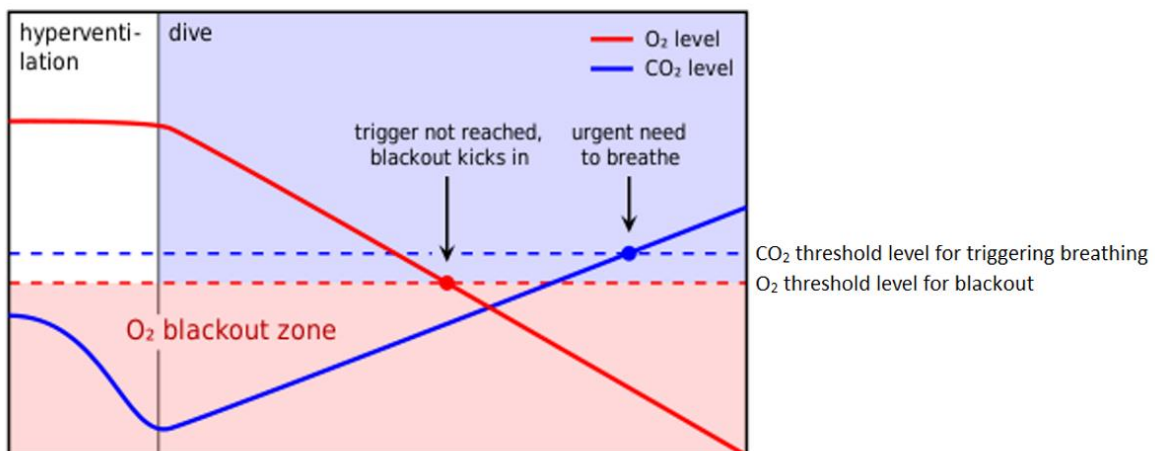
Sometimes, diver may hyperventilate (taking many voluntary deep breaths in rapid succession) before diving as this could increase their time of diving. However, this practice is very dangerous as blackout may occur, during which the diver will lose consciousness in water and drown.

The diagrams below show the changes in oxygen and carbon dioxide level in blood with and without hyperventilation before diving:

**Normal dive**



**Hyperventilation before diving**

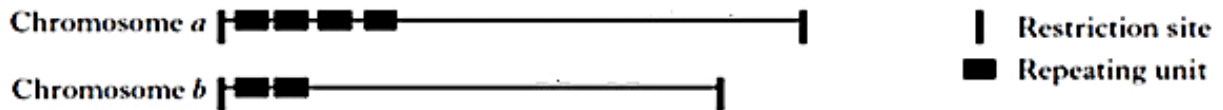


- (iv) Explain why hyperventilation would increase the diver's risk of blackout. (3 marks)

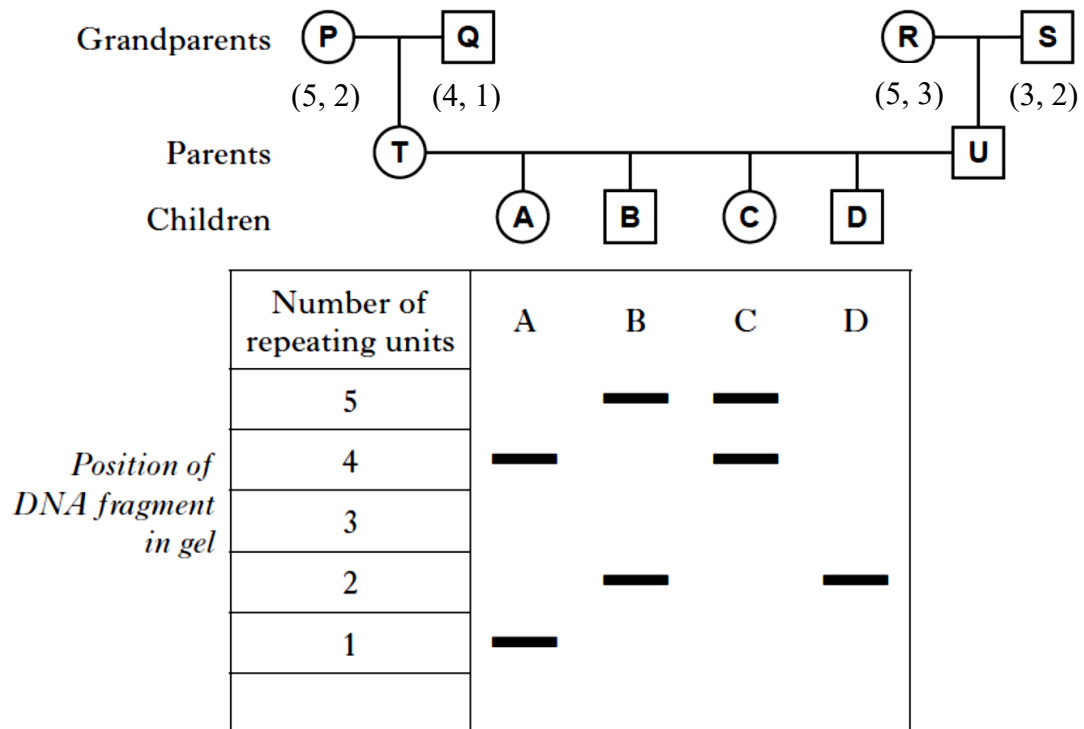
**Section B Biotechnology**

Answer ALL questions.

- 2.(a) Fragments of DNA between restriction sites can vary in length depending on the number of repeating units present. DNA fingerprinting can be used to identify the number of repeating units between the restriction sites on each chromosome. The diagram below shows fragments from a pair of homologous chromosomes for an individual with four repeating units on one chromosome and two on the other chromosome. The genotype for this individual at this locus is described as (4, 2).



Orphans (A, B, C, D) from a war zone, believed to be from the same family, were being relocated back to grandparents. DNA fingerprinting was used to check their family tree. The results are shown below.

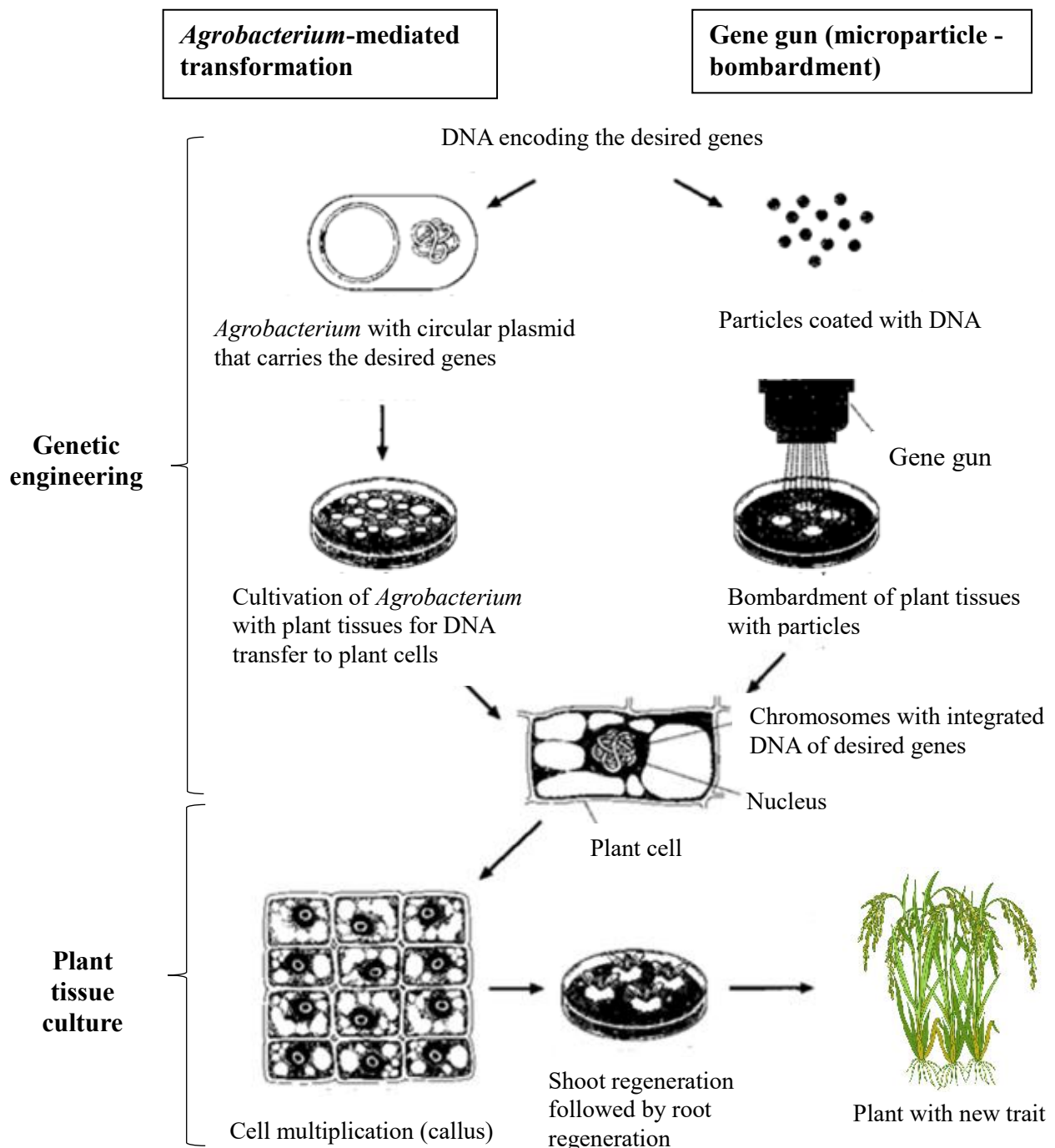


- (i) Explain why only one DNA band is formed for child D. (1 mark)
- (ii) Based on the information given, deduce, with reasons, which child is not biologically related to both pairs of grandparents. (2 marks)
- (iii) Other than parentage testing, scientists also use DNA fingerprinting to identify the evolutionary relationship among different groups of living organisms. What is the assumption involved in this application of DNA fingerprinting? (1 mark)

(iv) Polymerase chain reaction (PCR) is used to amplify DNA for DNA fingerprinting. Both PCR and DNA replication in human require primers to start the processes. Suggest two differences between DNA replication in humans and PCR. (2 marks)

(v) Explain why short tandem repeat (STR) profiling, compare with restriction fragment length polymorphism (RFLP) analysis, is a more commonly used method for DNA fingerprinting nowadays. (3 marks)

2(b) In 1990s, scientists successfully transferred the genes coding for  $\beta$ -carotene from maize and a soil bacteria to rice plants so as to develop rice that produces  $\beta$ -carotene, which is a precursor of vitamin A. The genetically modified (GM) rice produced is known as golden rice due to its distinctive yellow colour. The diagram below shows the procedures of two methods, the *Agrobacterium* - mediated transformation and the gene gun method, by which the golden rice can be produced.



- (i) Shoot apical bud is usually used for tissue culture. Explain why apical tissue is suitable for tissue culture. (3 marks)
- (ii) Plant tissue culture is applied in the production of golden rice after genetic engineering. Explain two advantages of using plant tissue culture in the production of golden rice.(4 marks)
- (iii) *Agrobacterium* is known as a natural genetic engineer. Explain why it is widely used in modifying plants. (2 marks)
- (iv) Compared with *Agrobacterium*-mediated transformation, suggest one advantage and one disadvantage of using gene gun for transforming plants. (2 marks)

**END OF PAPER**