

Queen's College
Mock Examination 2020 – 2021
Biology Paper 2

Secondary 6
Blocks 1 & 2

Date: 2 – 2– 2021
Time: 11:45 am – 12:45 pm



This paper must be answered in English.

Maximum mark: 40

GENERAL INSTRUCTIONS

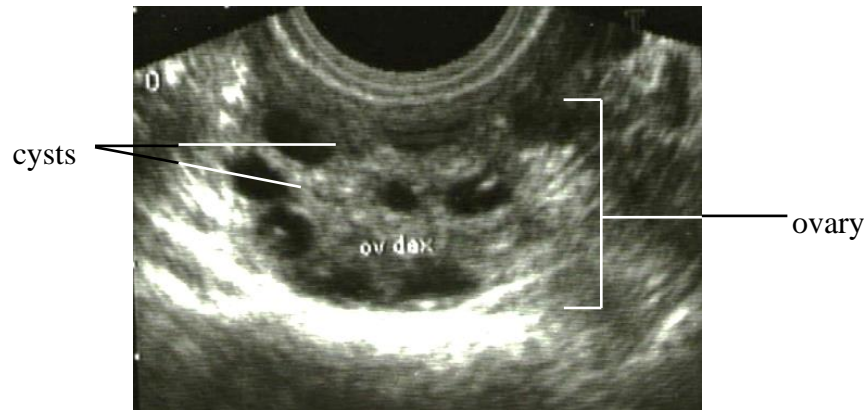
- (1) There are **TWO** sections, A and D, in this Paper. Attempt **ALL** questions in the **TWO** sections.
- (2) Write your answers in the Answer Book provided. Start each question (not part of a question) on a new page.
- (3) Present your answers in paragraphs wherever appropriate.
- (4) Illustrate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

Not to be taken away before the
end of the examination session

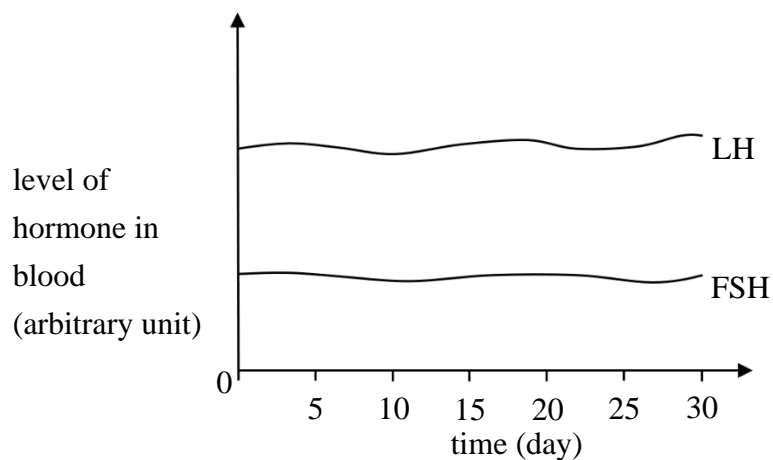
SECTION A Human Physiology: Regulation and Control

Answer ALL parts of the question.

1. (a) Mary had irregular menstrual cycles and each cycle usually lasted over 40 days. Her doctor performed an ultrasound scan of her ovaries. The doctor told Mary that a number of cysts had developed in Mary's ovaries, and each cyst was formed from a mature follicle which failed to ovulate. The ultrasound image below showed the cysts in Mary's ovaries:



- (i) The doctor measured the levels of follicle stimulating hormone (FSH) and luteinising hormone (LH) in Mary's blood over 30 days. The graph below shows the results:



Based on the graph above, suggest reasons why the mature follicles in Mary's ovaries did not ovulate. (2 marks)

- (ii) Besides irregular menstrual cycles, Mary sometimes experienced heavy menstrual bleeding. Give a possible reason for the heavy bleeding. (3 marks)
- (iii) The doctor prescribed oral contraceptive pills containing oestrogen and progesterone to reduce the formation of cysts in Mary's ovaries. Explain the biological principle behind this treatment. (3 marks)

1. (b) A scientist carried out an investigation to study the change in body temperature and the rate of sweat production in males and females during exercise. A group of male athletes and a group of female athletes were asked to perform the same cycling exercise for 30 minutes. Their body temperatures and rates of sweat production were recorded throughout the study. The table below shows the results:

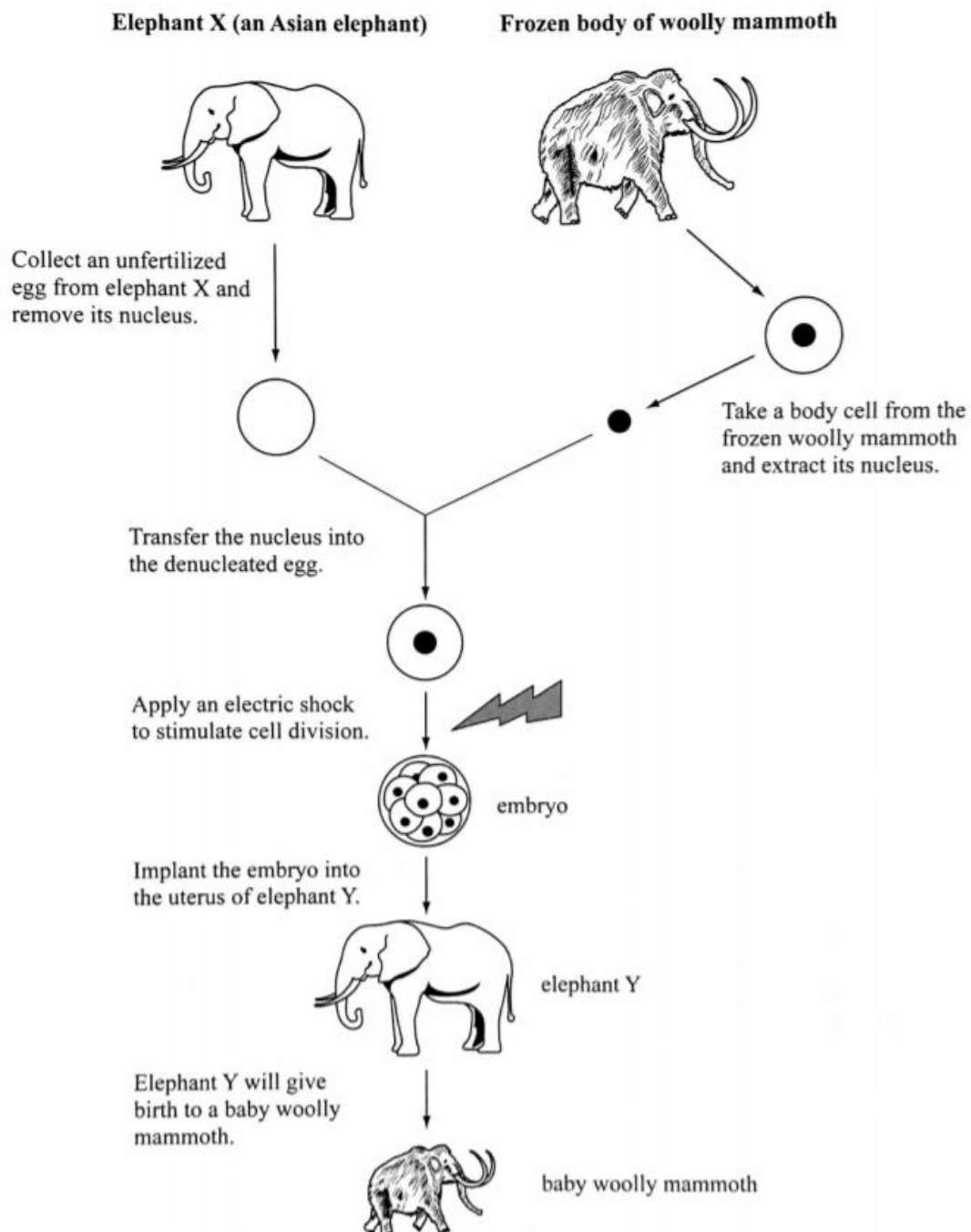
Time (min)	Mean body temperature (°C)	Mean rate of sweat production (mg min ⁻¹ cm ²)	
		Male	Female
0	37.05	0.08	0.07
5	37.40	0.12	0.09
10	37.70	0.32	0.20
15	38.15	0.64	0.39
20	38.40	0.95	0.58
25	38.65	1.16	0.82
30	38.75	1.24	0.90

- (i) Describe and explain the change in body temperature during exercise. (3 marks)
- (ii) (1) With reference to the table, compare the changes in the rate of sweat production in males and females during exercise. (2 marks)
- (2) Males usually have a larger body size than females. Based on this information, suggest reasons for the difference you answered in (ii) (1). (4 marks)
- (iii) When doing exercise, the heart beats faster and more strongly. Explain how a person's nervous system brings about these changes during exercise and state *one* importance of these changes. (3 marks)

SECTION D Biotechnology

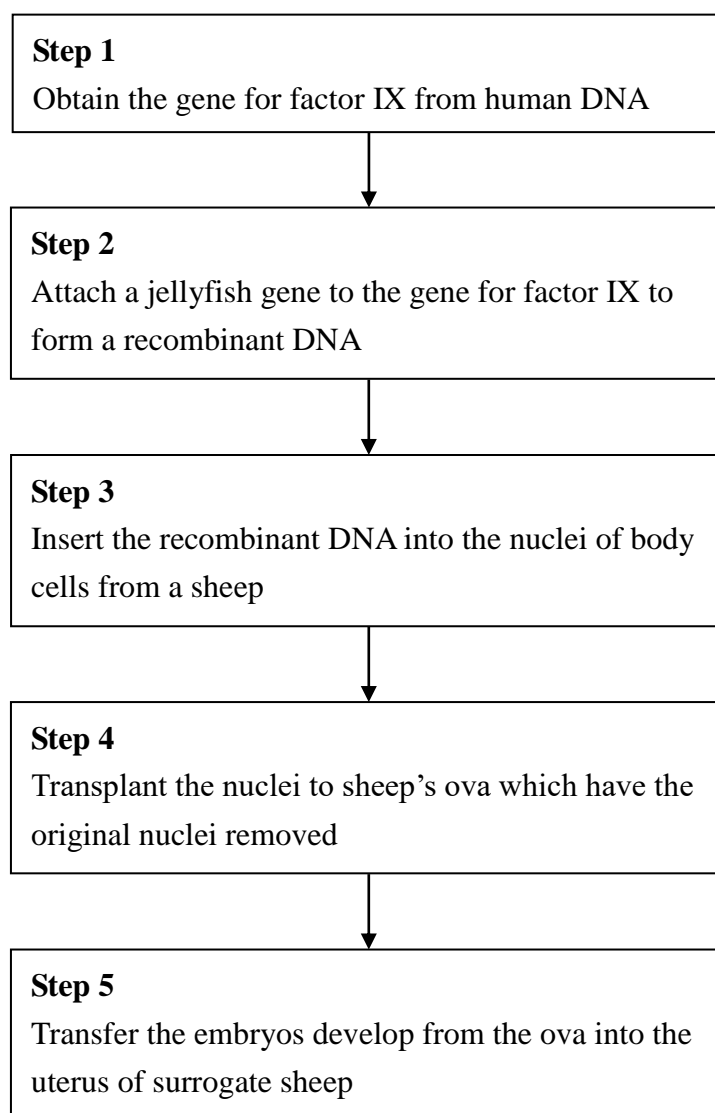
Answer **ALL** parts of the question.

4. (a) The woolly mammoth (*Mammuthus primigenius*) is a species of mammoth that was well adapted to the cold environment during the last ice age. It first appeared on the Earth around 400 000 years ago but is extinct nowadays.
- In 2013, the dead body of an adult female woolly mammoth was found frozen in ice in Siberia. As the body was well preserved, scientists may make use of its genetic materials to clone a woolly mammoth. The diagram below outlines how a baby woolly mammoth might be produced by using a method similar to that used to clone Dolly the sheep:



4. (a) (i) Under what conditions could the dead body of a woolly mammoth be well preserved? Explain your answers. (2 marks)
- (ii) Dolly the sheep was the world's first cloned mammal from an adult body cells.
- (1) How is the method described above different from the method used to clone Dolly? (2 marks)
- (2) Compare the genetic make-up of the woolly mammoth clone with that of the frozen woolly mammoth. Give a reason for your answer. (2 marks)
- (3) Explain *one* ethical problem that might be faced by the woolly mammoth clone. (2 marks)
- (iii) In another research, scientists inserted woolly mammoth genes that control ear size, hair colour and hair length into Asian elephant skin cells, aiming to create a mammoth-elephant hybrid that can live in colder climate, where it will face fewer threats from humans. Do you think the research to produce the mammoth-elephant hybrid should be continued or banned? Give *two* reasons for your answer. (2 marks)

4. (b) Haemophiliacs whose blood fails to clot can be treated with factor IX extracted from the milk of genetically modified (GM) sheep. The flow chart below shows the process of producing the GM sheep:



- (i) The jellyfish gene used in step 2 codes for a protein which glows green under ultraviolet light. What is the purpose of attaching this jellyfish gene to the gene for factor IX? (2 marks)
- (ii) Describe how enzymes are used in producing the recombinant DNA in the process. (2 marks)
- (iii) In this process, only a few live births result from the many embryos implanted into the uterus of surrogate sheep. Suggest *two* reasons for this low success rate. (2 marks)

4. (b) (iv) After a GM sheep which can secrete factor IX in its milk is produced, the following two methods are considered to produce more sheep with this characteristic:

Method	Description
I	Transplant each nucleus from a body cell of the GM sheep into another sheep's ova which have their original nuclei removed. Then implant the embryos developed from the ova into the uterus of surrogate sheep.
II	Remove an ovum from the GM sheep and fertilize it with a sperm from a male sheep. Allow the zygote to develop into an embryo at the 8-cell stage. Split the embryo into individual cells and allow each cell to grow into an embryo. Then implant the embryos into the uterus of surrogate sheep.

- (1) In method II, if a blastocyst instead of an 8-celled embryo was split into individual cells, the cells would not develop into embryos. Give an account for this. (1 mark)
- (2) Compare the offspring produced in methods I and II, then decide which method is more suitable for use. (3 marks)

END OF PAPER