



HSC Trial Examination 2019

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- For questions in Section II, show all relevant working in questions involving calculations
- NESA approved calculators may be used

Total marks: 100

Section I – 20 marks (pages 2–7)

- Attempt Questions 1–20
- Allow about 35 minutes for this section

Section II – 80 marks (pages 8–19)

- Attempt Questions 21–36
- Allow about 2 hours and 25 minutes for this section

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2019 HSC Biology Examination.

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Section I

20 marks

Attempt Questions 1–20

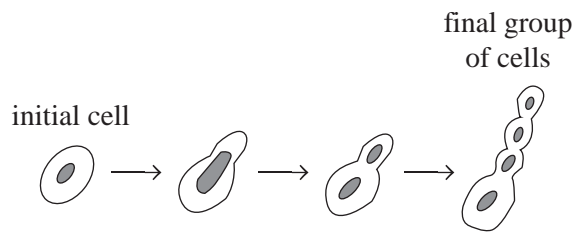
Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1–20.

1. Which of the following is an advantage of sexual reproduction over asexual reproduction?

- (A) Sexual reproduction requires two different parents.
- (B) Sexual reproduction gives genetic variation among offspring.
- (C) Sexual reproduction is less complex than asexual reproduction.
- (D) Sexual reproduction usually produces fewer offspring than asexual reproduction.

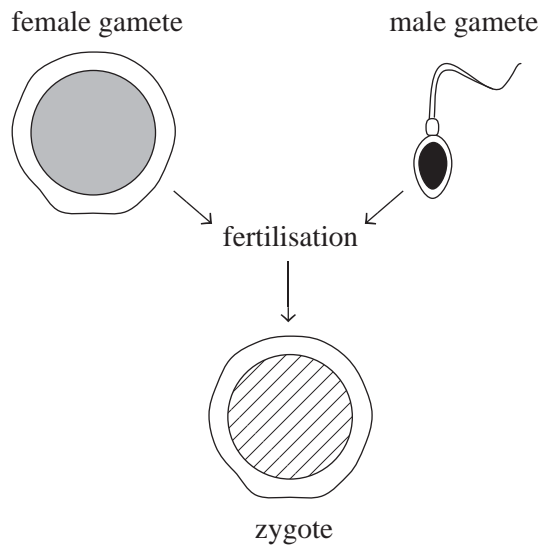
2. Consider the diagram.



Which type of reproduction in cells is shown in the diagram?

- (A) budding
 - (B) sporulation
 - (C) binary fission
 - (D) fertilisation
3. Which of the following statements about single nucleotide polymorphisms (SNPs) is correct?
- (A) SNPs ensure genetic similarity between related individuals.
 - (B) SNPs always result in differences in phenotypes.
 - (C) SNPs are variations in the DNA sequence at particular locations.
 - (D) SNPs are not passed down to an individual's offspring.

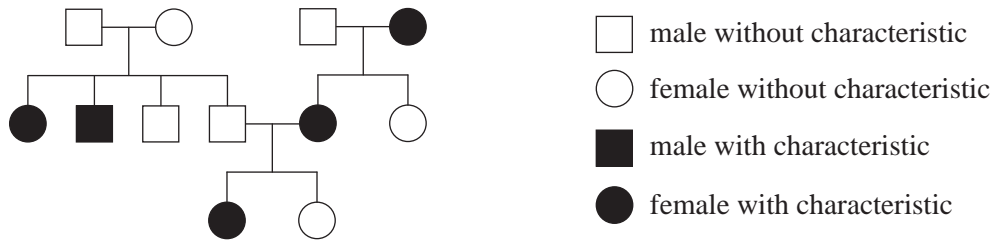
4. Consider the diagram.



Which statement about these cells is correct?

- (A) No genetic information is passed to the zygote from either gamete.
- (B) The genetic information carried in the nuclei of both of the gametes is the same.
- (C) The zygote contains all the genetic information from both gametes.
- (D) The gametes lose some of their genetic information when they combine to form the zygote.

5. The pedigree shows the presence or absence of a particular characteristic.



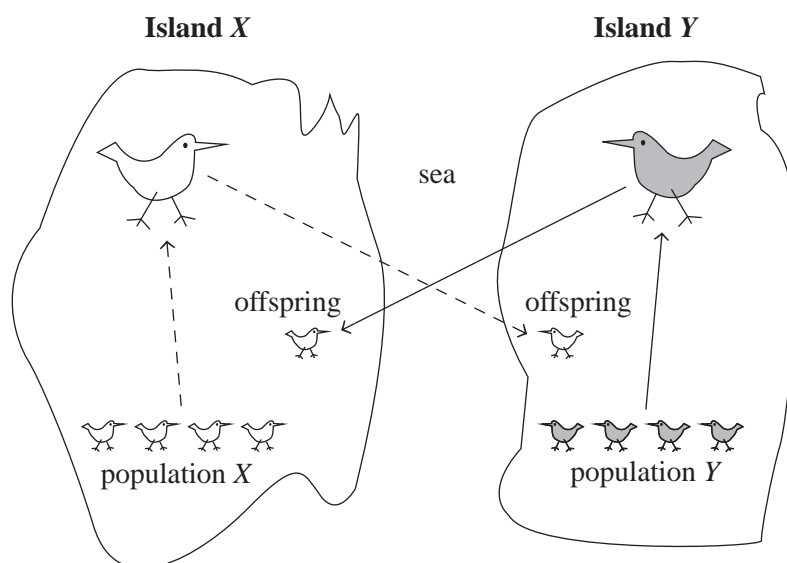
Which of the following is the most likely type of inheritance for this characteristic?

	<i>Dominant or recessive</i>	<i>Sex-linked or not sex-linked</i>
(A)	dominant	sex-linked
(B)	recessive	sex-linked
(C)	dominant	not sex-linked
(D)	recessive	not sex-linked

6. Canola is an oilseed crop grown for its edible oil and seed meal (the fibre left after the oil pressing process). It is often used as stock feed. Glyphosate is a herbicide that kills 'normal' canola. A type of canola has been developed to be resistant to this herbicide. This was done by an agrochemical company introducing genetic material from two types of bacterium into the canola's genome.

This is an example of

- (A) selective breeding.
(B) genetic modification.
(C) natural genetic change.
(D) replicating an extended DNA sequence that occurs in nature.
7. Which statement about germ-line mutations is correct?
- (A) They are always harmful.
(B) They occur in somatic cells.
(C) They are not carried onto the offspring of the affected organism.
(D) They are incorporated into the DNA of the offspring of the affected organism.
8. The diagram shows the populations of birds of the same species on two islands (X and Y) that have become geographically separated.



Population X has homozygous alleles for a particular characteristic and population Y has different homozygous alleles for the same characteristic. Heterozygous offspring arose when there was some movement of birds between the two islands.

The occurrence of these offspring is an example of

- (A) gene flow.
(B) gene drift.
(C) asexual reproduction.
(D) evolution.

9. Which of the following statements about meiosis is correct?
- (A) It makes exact copies of body cells.
 - (B) It gives two daughter cells after replication.
 - (C) It forms new combinations of genotypes.
 - (D) It maintains genetic uniformity between generations.
10. Which of the following statements about 'non-coding' DNA segments is correct?
- (A) They are less common than 'coding' DNA segments.
 - (B) They have some functions.
 - (C) They are structural mirror images of 'coding' DNA.
 - (D) They only occur in the DNA of humans.
11. Hormones are chemicals that are released by which type of effector?
- (A) muscles
 - (B) glands
 - (C) peripheral nerves
 - (D) ovaries
12. Blood oxygen levels fall and carbon dioxide levels increase when a person exercises. The increase in carbon dioxide causes the blood to become more acidic. This change in pH is detected and the response is to contract and relax the diaphragm at a faster rate, causing more oxygen to be inhaled and carbon dioxide to be exhaled.
- Which of the following is the correct description of the above situation?
- (A) Chemoreceptors detect the change in pH and the diaphragm is the effector that responds.
 - (B) Mechanoreceptors cause the diaphragm to contract, resulting in a decrease in pH.
 - (C) Photoreceptors detect the change in oxygen and the diaphragm is the effector that releases hormones.
 - (D) Thermoreceptors detect the change in body temperature and glands release hormones to increase sweating.
13. What is the process that occurs in the glomerulus?
- (A) secretion
 - (B) absorption
 - (C) filtration
 - (D) dilution

Refer to the following information to answer Questions 14 and 15.

For many years, health professionals have been concerned about the increase in new cases of childhood obesity. Recent policies to educate pre-school children about nutrition and exercise have had some impact and the rate of new cases diagnosed each year has stabilised.

- 14.** The data above relates to the
- (A) incidence of childhood obesity.
 - (B) prevalence of childhood obesity.
 - (C) mortality of childhood obesity.
 - (D) frequency of childhood obesity.
- 15.** The strategy to address childhood obesity was
- (A) public policies in hospitals.
 - (B) genetic engineering.
 - (C) drug trials.
 - (D) education campaigns.
- 16.** Which of the following gives the best description of innate immunity?
- (A) non-specific barriers to prevent entry of a pathogen
 - (B) specific barriers to prevent entry of a macroorganism
 - (C) non-specific responses that produce antibodies to fight infection
 - (D) individual factors that fight pathogens
- 17.** ‘Herd immunity’ describes a population where the vast majority of people are immunised.
- Herd immunity is an effective way to control the spread of infection as
- (A) there are less potential carriers in the population.
 - (B) even those who are not immunised will be protected from the pathogen.
 - (C) diseases that originated in cows cannot spread.
 - (D) everyone has already had the disease.

18. Which row of the table correctly attributes the scientists to their scientific contributions?

	<i>Koch</i>	<i>Pasteur</i>
(A)	experiments to find a cure for smallpox	experiments to test if boiled broth contained any microbes
(B)	experiments to determine how dead pathogens could trigger the immune response	experiments to see if microbes could be captured in a glass tube
(C)	experiments to develop vaccines for specific pathogens	experiments to test if broth could support microbial life
(D)	experiments to determine a set of criteria to see if a specific microbe caused a particular disease	experiments to test if microbes existed in the air

19. Transmission of a pathogen by a vector means

- (A) an organism or object transports the pathogen from one infected individual to another.
- (B) the pathogen is a virus that can become a vector as it moves between organisms.
- (C) the pathogen must be a prion that formed from a protein.
- (D) the pathogen can live outside a cell for extended periods of time.

20. Patients receiving organ transplants take medication to suppress their immune system. While this presents a greater risk of infection for the patients, it is essential.

Which part of the immune response would be dangerous to the patient?

- (A) T cells reproducing when exposed to an antigen
- (B) cytotoxic T cells recognising and killing foreign cells
- (C) memory T cells being stored for future exposure to the antigen
- (D) helper B cells stimulating production of T cells

Section II

80 marks

Attempt Questions 21–36

Allow about 2 hours and 25 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculations.

Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Question 21 (4 marks)

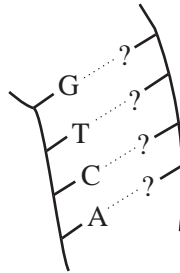
Knowledge of reproduction of plants and animals is important.

4

Draw a table that shows the main features of fertilisation, implantation and hormonal control of pregnancy and birth in mammals.

Question 22 (5 marks)

- (a) The diagram shows an incomplete short segment of DNA. The complementary bases for the sequence GTCA on the left-hand strand are represented by '?' on the right-hand strand. **2**



Complete the complementary base pair sequence in the table below.

<i>Base</i>	guanine	thymine	cytosine	adenine
<i>Complementary base</i>				

- (b) Describe the process of DNA replication using the Watson and Crick model. **3**

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Question 23 (6 marks)

DNA sequencing and profiling are technologies used in investigations into genetics.

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Compare these two technologies.

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Question 24 (5 marks)

Assess how genes and environment affect phenotypic expression.

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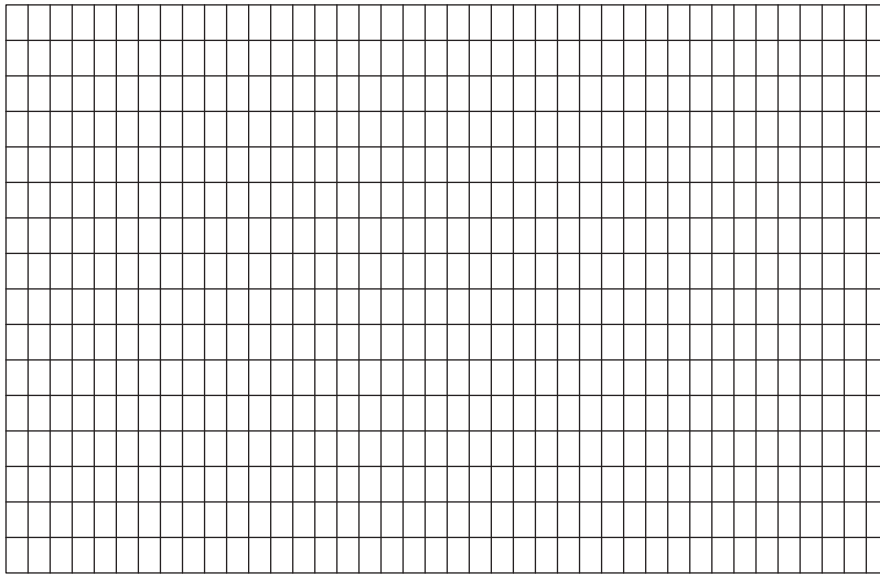
Question 25 (6 marks)

Achondroplasia (dwarfism) is a genetic disorder that occurs in approximately 1 in 20 000–30 000 live births. It is caused by a spontaneous genetic mutation in approximately 80 percent of patients. In the remaining cases, it is inherited from a parent. Typically, the torso and head of the affected individuals are of normal size, but the arms and legs are short.

- (a) The table shows the fold increase (how many times more likely) of the occurrence of achondroplasia related to the age range of the parents. **3**

<i>Age range (years)</i>	24 and under	25–29	30–34	35–39	40–44	45–49	50–54
<i>Fold increase</i>	1.0	1.4	3.0	5.2	7.9	8.3	11.5

Using these figures, construct a line of best fit on the grid provided.



- (b) Give a hypothesis that would be supported by the statistics. **1**

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- (c) (i) What is the general name for external factors that increase the chances of mutation in organisms? **1**

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- (ii) Name TWO specific external factors that increase the chances of mutation in organisms. **1**

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Question 26 (7 marks)

As part of your course you investigated the uses and applications of biotechnology.

- (a) How did you ensure that your investigation collected valid information? **2**

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- (b) Analyse the ethical uses of biotechnology. Include examples in your answer. **5**

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Question 27 (7 marks)

Humans have many processes that regulate a relatively constant internal environment in a changing external environment.

- (a) Construct a diagram to show how the human body responds to consumption of sugar-rich foods. **4**

- (b) Explain how the process given in part (a) is a negative feedback mechanism that helps maintain homeostasis. **3**

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Question 28 (4 marks)

You have a friend who is ten years old and has just been diagnosed with myopia (short-sightedness). Her parents are considering glasses, contact lenses or laser surgery and have asked for your opinion.

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State TWO questions you would ask about the ten-year-old friend, and explain why each of these questions are relevant to the decision about which technology to select.

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Question 29 (6 marks)

Some diseases are caused by exposure to substances in the environment.

- (a) Identify ONE harmful substance and state the disease it causes. **2**

- (b) Discuss the incidence and mortality rates of the disease identified in part (a). **2**

- (c) Suggest ONE strategy that may reduce the incidence of the disease identified in part (a). **1**

- (d) State ONE advantage of using epidemiology to study the disease identified in part (a), or another disease you have studied. **1**

Question 30 (3 marks)

Non-infectious diseases in humans can be caused by a range of factors.

- (a) Name ONE nutritional disease and outline ONE impact of the disease. **2**

- (b) Describe ONE way to treat the nutritional disease named in part (a). **1**

Question 31 (7 marks)

Cells are the building blocks of living things. Some pathogens are non-cellular.

(a) Identify ONE example of a non-cellular pathogen. **1**

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(b) Explain why the pathogen identified in part (a) is classified as non-cellular. **2**

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(c) Describe how the pathogen identified in part (a) is transmitted. **2**

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(d) Outline ONE adaptation of the pathogen identified in part (a), or another named pathogen, to facilitate its entry into a host. **2**

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Question 32 (3 marks)

Using an example, describe evidence of an infection by a fungal pathogen in an Australian plant. **3**

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Question 33 (4 marks)

Describe ONE historical strategy used to control the spread of disease, and evaluate its effectiveness in preventing the spread of disease. You may **not** use an example previously given in other questions.

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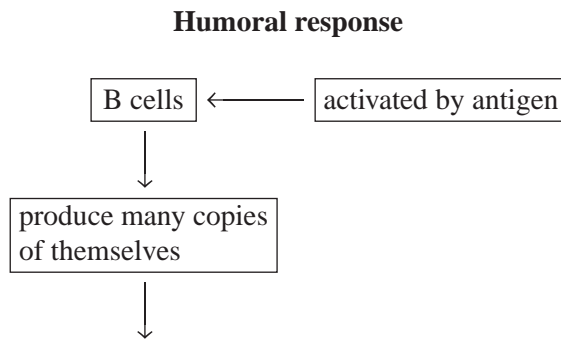
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Question 34 (4 marks)

The diagram shows details of the humoral response that occurs when B cells respond in the presence of antigens.

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Describe how the human body would respond after these steps and explain how this would reduce the impact of the pathogen.

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Question 35 (2 marks)

The use of pharmaceuticals is a treatment strategy for infectious disease.

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Using an example, describe how ONE pharmaceutical strategy works and assess its effectiveness.

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Question 36 (7 marks)

Artificial insemination, artificial pollination and whole organism cloning are examples of reproductive technologies.

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Compare these processes and their outcomes.

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SECTION I

MULTIPLE-CHOICE ANSWER SHEET

DIRECTIONS:

Write your name in the space provided.

Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.

Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark **only one** oval per question.

A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows.

A B *correct* C D

STUDENT NAME: _____

STUDENT NUMBER:

1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0

1. A B C D
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17. A B C D
18. A B C D
19. A B C D
20. A B C D

**STUDENTS SHOULD NOW CONTINUE
WITH SECTION II**