Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2012

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 2

Please place your student identification label in this box

Student Number: In figures | | | | | | | | |

In words _____

_____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet

Number of additional answer booklets used (if applicable): ☐

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction tape/fluid, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in the WACE examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

2013/2492
Web version of 2012/33183

Ref: 12-064

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of total exam
Section One: Multiple-choice	30	30	40	30	30
Section Two: Short answer	8	8	90	100	50
Section Three: Extended answer	4	2	50	40	20
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2012*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Sections Two and Three: Write answers in this Question/Answer Booklet.

3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

See next page

Section One: Multiple-choice **30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided.

For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

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1. The corpus luteum is active in which phase of the ovarian cycle?

   (a) preovulation days 5–12
   (b) secretion days 16–20
   (c) premenstruation days 21–28
   (d) menstruation days 1–4

2. An individual who is heterozygous for a genetic trait will

   (a) not physically show the dominant trait.
   (b) be a carrier for the recessive trait.
   (c) not pass the recessive allele to their offspring.
   (d) only have offspring who are also heterozygous.

3. Urine produced under normal conditions should contain

   (a) water, urea and uric acid.
   (b) glucose, water and protein.
   (c) water, sodium and protein.
   (d) glucose, urea and water.

4. During childbirth, there are a number of key events:

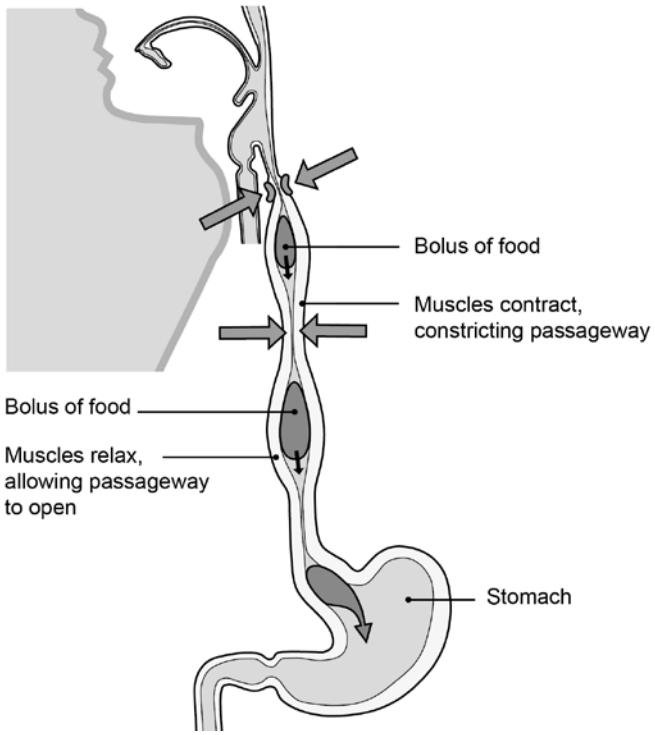
   i. dilation of the cervix
   ii. crowning
   iii. delivery of the placenta
   iv. breaking of the waters
   v. contractions of the uterus
   vi. secretion of oxytocin
   vii. delivery of the baby

   Using the list above, the normal sequence of events is

   (a) vi, i, v, ii, iv, iii and vii.
   (b) vi, v, i, iv, ii, vii and iii.
   (c) i, ii, iv, vi, v, vii and iii.
   (d) v, vi, i, ii, iv, vii and iii.

See next page

Questions 5–6 refer to the diagram shown below.



5. The name given to the process shown in the diagram is

(a) mastication.
(b) churning.
(c) segmentation.
(d) peristalsis.

6. The purpose of the process shown in the diagram is to

(a) enable chemical digestion to occur.
(b) break the food into smaller pieces.
(c) push the food along the canal.
(d) enable absorption of nutrients.

7. The umbilical vein

(a) carries blood from the placenta to the foetus.
(b) carries blood to the placenta from the foetus.
(c) transports carbon dioxide and other wastes.
(d) mixes blood from the embryo with maternal blood.

8. Treating a disease with gene therapy means

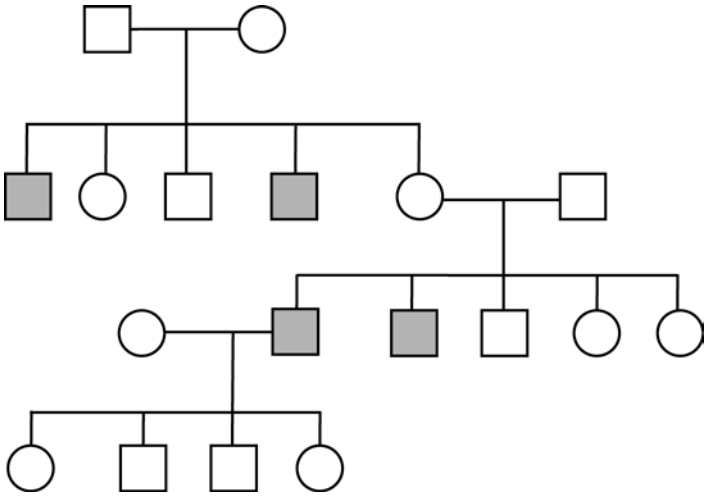
(a) replacing a missing protein with a functioning protein.
(b) replacing faulty genes in body cells with healthy ones.
(c) injecting a hormone to replace one that is lacking.
(d) inserting extra genes into the DNA structure.

See next page

9. The hollow sphere of cells that results from division of the fertilised egg is called the

(a) zygote.
(b) blastocyst.
(c) primary germ layer.
(d) foetus.

Questions 10–11 refer to the pedigree chart shown below.



10. What type of inheritance is **best** represented by the pedigree?

(a) autosomal dominant
(b) autosomal recessive
(c) sex-linked recessive
(d) sex-linked dominant

11. Which of the following diseases would you expect to display a similar pedigree to the one shown in the diagram?

(a) ABO blood groups
(b) Huntington's disease
(c) Phenylketonuria
(d) Haemophilia

12. After conception, the main organs are established by the end of the

(a) third day.
(b) second week.
(c) eighth week.
(d) fourth month.

See next page

Questions 13–14 refer to the diagram shown below.

For copyright reasons the image cannot be reproduced in the online version of this document.

13. Which of the following birth control methods offers protection against sexually transmitted infections (STIs)?

    (a) spermicide
    (b) female sterilisation
    (c) diaphragm
    (d) female condom

14. Which of the following lists of contraceptives contains **only** barrier methods?

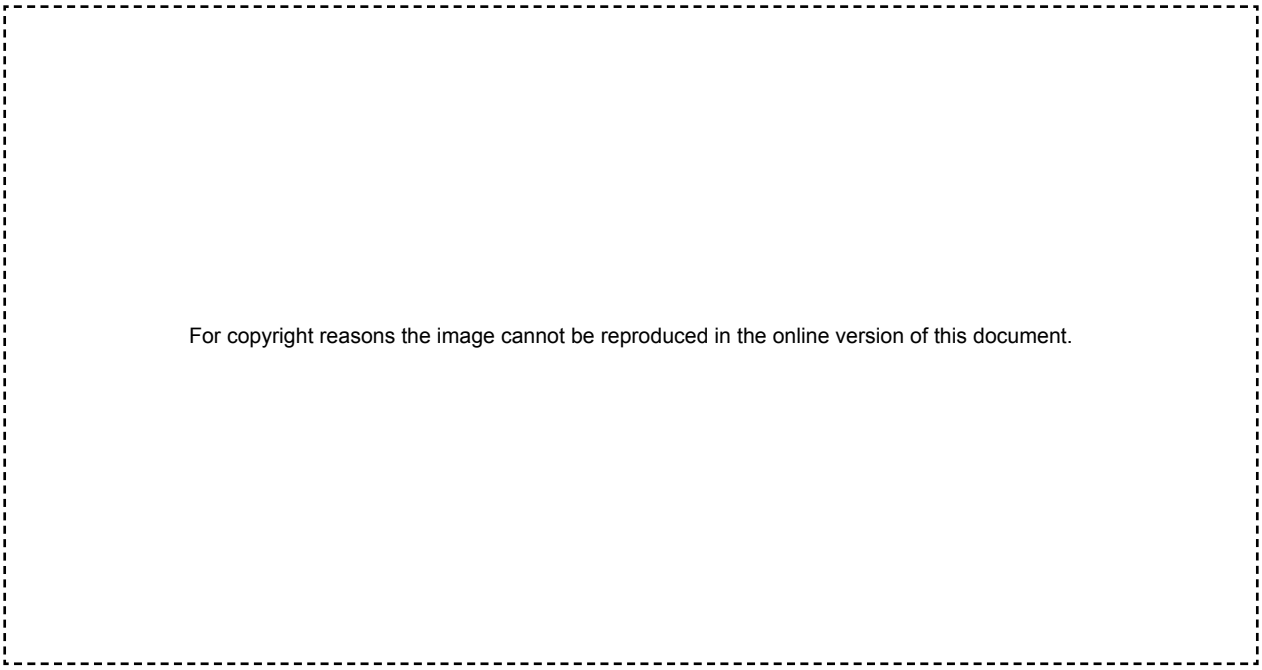
    (a) diaphragm, male condom, spermicide
    (b) diaphragm, female condom, IUD
    (c) implants, female condom, male condom
    (d) female condom, male condom, diaphragm

15. Milk secretions in the breast are stimulated by the production of which hormone?

    (a) prolactin
    (b) oestrogen
    (c) progesterone
    (d) oxytocin

See next page

Questions 16–17 refer to the diagram below of the kidney and nephron.



16. Which of the following is correct?

(a) C represents the structure that carries urine to the bladder.
(b) A represents the renal medulla and B represents the renal cortex.
(c) H represents the location of tubular secretion and urine formation.
(d) J represents the descending limb of the loop of Henle.

17. Reabsorption of water occurs at

(a) F, G and H only.
(b) G, H, I and J only.
(c) I and J only.
(d) G and H only.

18. Sex selection can be used to reduce the chances of inheriting a genetic condition. Which of the following techniques is the **most** effective method of achieving sex selection?

(a) timing of sexual intercourse in relation to ovulation
(b) manipulating body temperature of males and females
(c) choosing a diet that increases the chance of a particular sex being selected
(d) testing an embryo resulting from in-vitro fertilisation (IVF) before implantation

19. In which of the following situations would sex selection **not** be ethically recommended?

(a) There is a history of Duchenne muscular dystrophy in a family.
(b) The mother is a known carrier of haemophilia.
(c) The family already has five children of the same sex.
(d) The father is a haemophiliac.

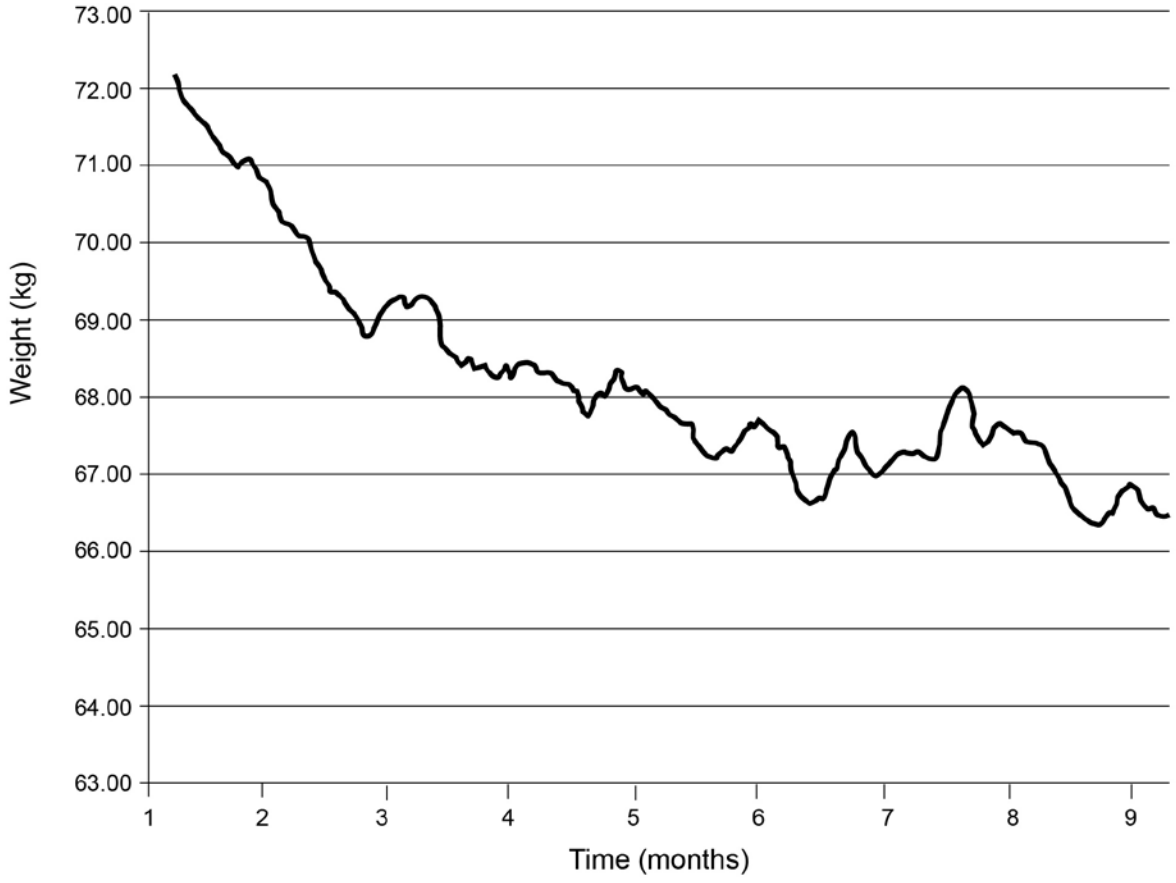
See next page

20. The combined female oral contraceptive pill is similar in its action to the hormone(s)

(a) oestrogen and progesterone.
(b) follicle stimulating hormone.
(c) oestrogen.
(d) follicle stimulating hormone and luteinising hormone.

Questions 21–22 refer to the graph and information shown below.

Weight loss of an individual over a nine month period



The graph shows the results for an individual taking part in a study researching the effects of walking 45 minutes every day on weight loss.

21. Which of the following was **not** a controlled variable that researchers needed to consider?

(a) if the individuals were walking on flat surfaces or walking up hills
(b) genetic factors and previous medical history of individuals
(c) the total number of individuals in the sample size
(d) if the individuals were smokers or non-smokers

See next page

22. The graph shows that the individual experienced weight fluctuations throughout the nine month period. A reasonable conclusion that could be drawn is that

(a) incorrect measurements were regularly taken and recorded.
(b) the person exercised less or consumed more kilojoules at certain times.
(c) the person gained weight even though they exercised every day.
(d) 45 minutes is not enough time to exercise and lose weight.

23. During mitosis, cells

(a) divide once to produce two identical cells.
(b) divide once to produce two new cells that show some variation.
(c) are able to unite with other cells that are produced.
(d) divide twice to produce four new cells.

24. The role of histamine in the inflammatory response is to

(a) prevent clotting.
(b) attract phagocytes to the area.
(c) produce pus.
(d) increase blood flow to the area.

25. The table below presents data obtained by measuring the concentration of a variety of salts in the brain tissue of elderly patients. Values are given in mg/L.

	Extracellular	**Intracellular**
Sodium	137	10
Potassium	5	141
Calcium	5	2
Chloride	103	44
Sulfate	15	25
Glucose	90	20

Which of the following statements is correct?

(a) glucose will diffuse into the cells
(b) chloride will diffuse out of the cells
(c) potassium will diffuse into the cells
(d) sulfate will diffuse into the cells

26. The sickle cell trait occurs in a relatively high frequency in some African countries. The reason for this is that the sickle cell trait

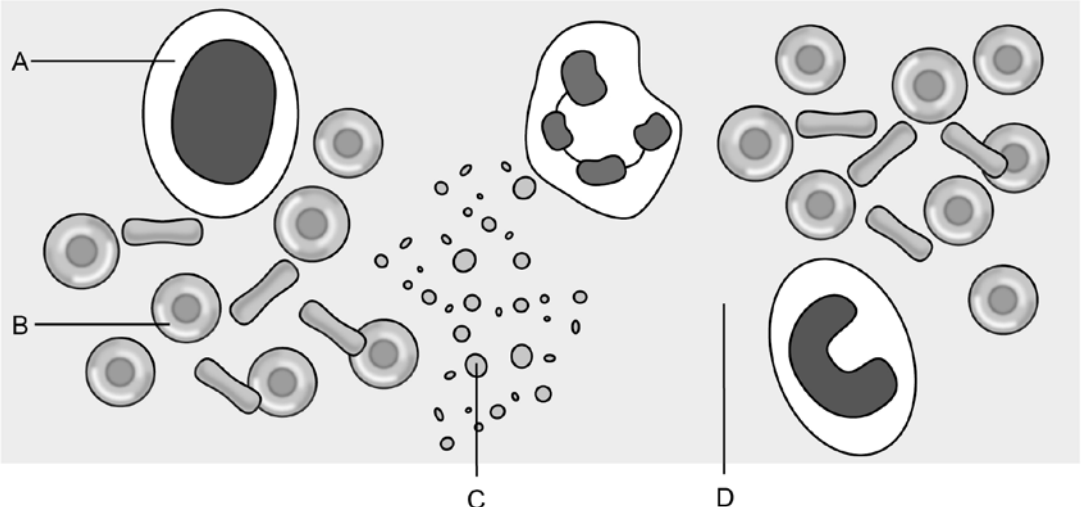
(a) provides a survival advantage in areas of malaria.
(b) increases the oxygen carrying capacity of blood at altitude.
(c) increases the fertility of individuals.
(d) helps fight bacterial infections.

See next page

27. At the conclusion of the Human Genome Project

(a) scientists had developed the ability to manipulate and alter human DNA.
(b) all proteins in the human body had been identified and named.
(c) the differences in DNA between human populations had been established.
(d) the entire sequence of bases in human DNA had been established.

Questions 28–29 refer to the diagram below, which shows the components of blood.



28. Which of the following statements is correct?

(a) A contains haemoglobin.
(b) B carries oxygen around the body.
(c) C is part of the immune system.
(d) D is mainly made of proteins.

29. Which component transports about 75% of carbon dioxide in the body?

(a) A
(b) B
(c) C
(d) D

30. During the phases of mitosis, different events occur. Which event is matched correctly to a phase?

	Event	Phase
(a)	Chromosomes replicate.	Metaphase
(b)	Cell membrane pinches in and cell divides.	Interphase
(c)	Chromatids are pulled apart.	Anaphase
(d)	Chromatids line up across the middle of cell.	Telophase

End of Section One

See next page

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See next page

Section Two: Short answer **50% (100 Marks)**

This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.

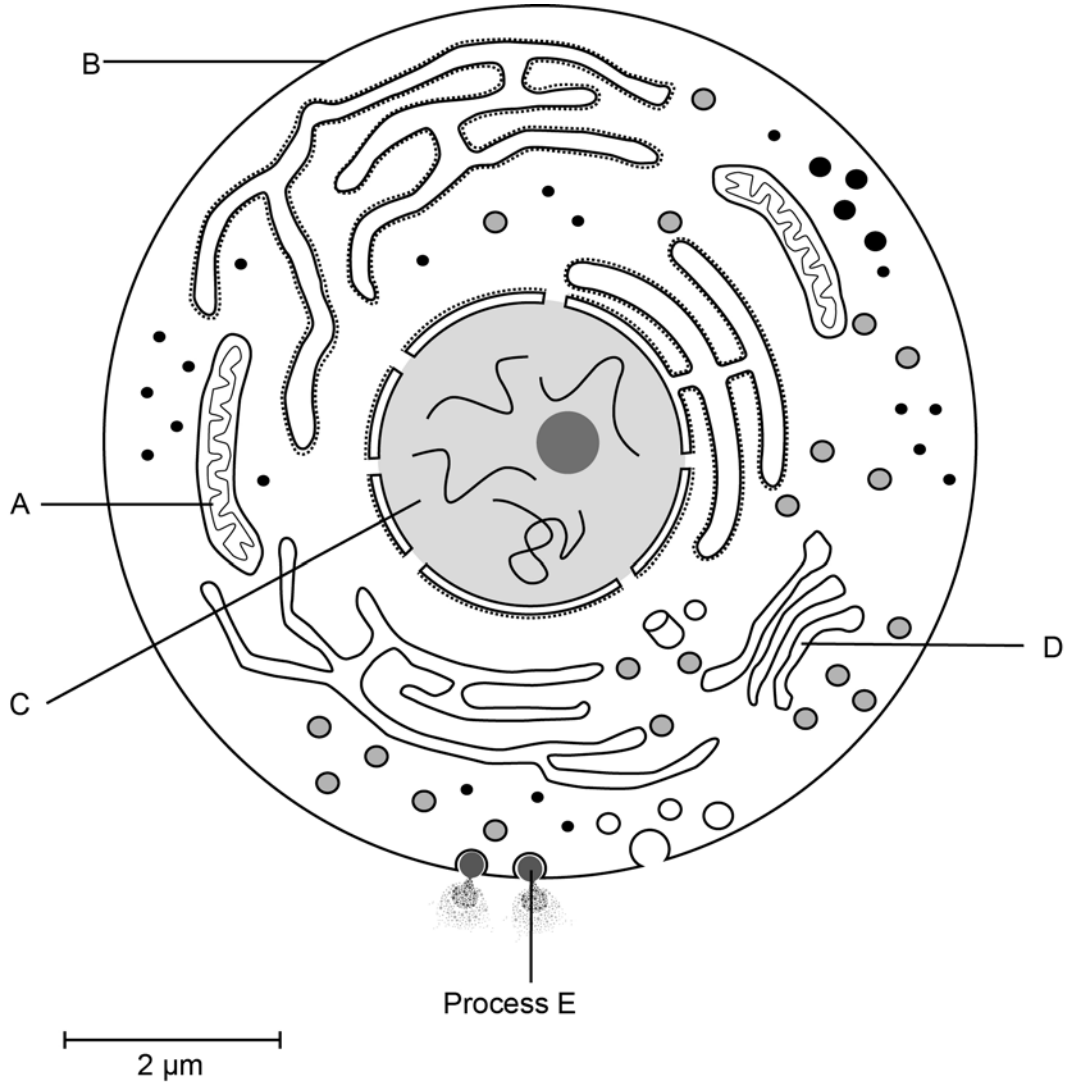
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare page for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 31 **(15 marks)**

Parts (a) and (b) of this question refer to the diagram below, which shows a generalised cell.



(a) Complete the following table. (8 marks)

Organelle	Name	Function
A		
B		
C		
D		

(b) Process E as labelled on the diagram shows the movement of a substance out of the cell via a vesicle. What name is given to this process? (1 mark)

(c) Name and describe **two** processes other than the process identified in Part (b) that transport materials in or out of the cell. (4 marks)

Process	Name	Description
One		
Two		

(d) Why are cells so small in size? (2 marks)

See next page

Question 32 **(12 marks)**

(a) Describe **three** healthy diet choices a pregnant woman should make to ensure the best care is given to her unborn child. (3 marks)

One: _____

_____

Two: _____

_____

Three: _____

_____

(b) Immunity is resistance to infection from invading micro-organisms.

Complete the table below, naming and explaining **two** ways in which a parent can increase the immunity of their infant (birth to two years old). (4 marks)

Name of strategy that can increase infant immunity	**How it can improve infant immunity**

(c) The human body has many protective mechanisms that help to prevent disease-causing micro-organisms from entering the body and causing infections.

(i) What is the name given to a disease-causing micro-organism? (1 mark)

(ii) Sneezing, coughing and vomiting are protective reflexes intended to prevent infection from occurring. How do these reflexes achieve this? (1 mark)

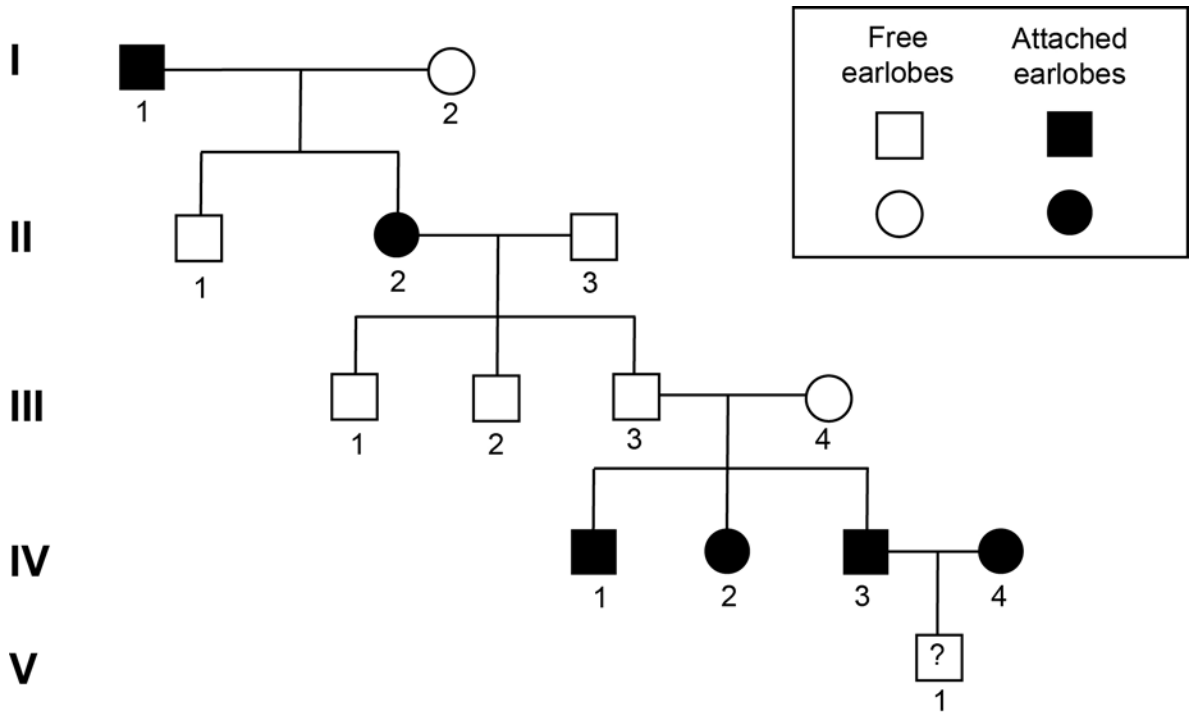
(iii) Complete the table below to explain how each of the structures listed provides external protection against infection. (3 marks)

Structure	How it provides external protection against infection
Eye	
Skin	
Stomach	

See next page

Question 33 **(12 marks)**

Parts (a), (b) and (c) of this question refer to the pedigree diagram below, which shows the inheritance of free and attached earlobes.



(a) Given the information in the pedigree, name the type of inheritance attached earlobes display. (2 marks)

(b) Using a punnet square, predict the genotype and phenotype of Individual V–1. (3 marks)

(c) Select the symbol used in the pedigree chart to indicate that the sex of an individual is male. (1 mark)

See next page

(d) Name the chromosomes that determine whether an individual is male or female.
(1 mark)

(e) Using a punnet square, explain how the sex of a child is determined. Include in your answer an explanation of the different types of gametes and possible combinations that can occur at fertilisation. (5 marks)

See next page

Question 34 **(11 marks)**

A national football league carried out a three year trial of hair testing, which can expose the use of illicit performance-enhancing drugs. The study compared the number of positive tests recorded by players offered counselling sessions with those of a group who were not given counselling. Counselling sessions were conducted once a week for one hour. Each group consisted of 100 players who were based in Melbourne and had played at the national level for one year before they began the study.

The results of the study are shown in the table below.

	Number of positive hair tests			
	Season 1	Season 2	Season 3	**Average**
Group A Counselling	14	10	6	
Group B No counselling	16	17	18	

(a) Define a performance-enhancing drug. (1 mark)

(b) Calculate the averages for Group A and Group B and write the answers in the table above. (2 marks)

(c) Write a suitable hypothesis for this study. (1 mark)

See next page

(d) In this study, identify the: (4 marks)

independent variable

dependent variable

two variables that were controlled in this study.

(e) Based on the data in the table: (3 marks)

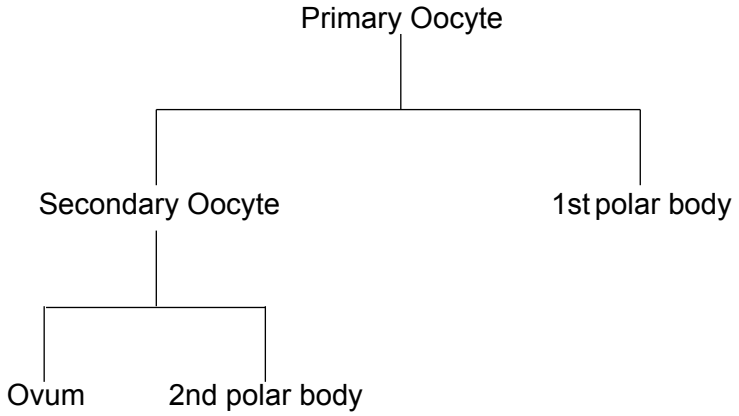
write a suitable conclusion for this study

state how it relates to your hypothesis

scientific investigations are usually repeated at least once. Give a reason for this.

Question 35 **(15 marks)**

Parts (a) and (b) of this question refer to the diagram below, indicating some stages involved in the formation of human egg cells or ova.



(a) How many chromosomes would you find in: (3 marks)

Primary oocyte	
Secondary oocyte	
Zygote (Ovum after fertilisation)	

(b) State **two** important differences between the formation or characteristics of spermatozoa and ova. (4 marks)

Difference	Spermatozoa	Ova
One		
Two		

See next page

(c) Define meiosis. (2 marks)

(d) How does the process of meiosis produce genetic variation in sperm? (2 marks)

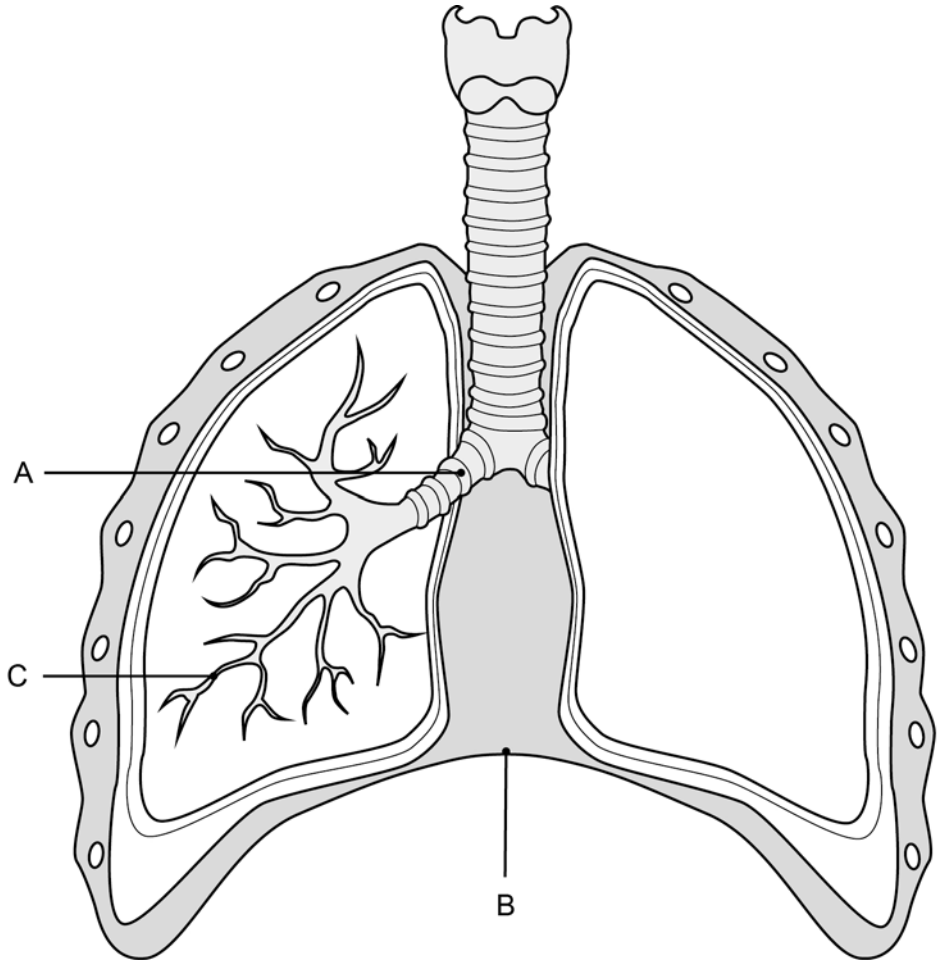
(e) Describe how a vasectomy works as a contraceptive. (2 marks)

(f) Is it possible for a man who has had a vasectomy to pass on HIV to his partner? Explain your answer. (2 marks)

See next page

Question 36 **(13 marks)**

Parts (a), (b) and (c) of this question refer to the diagram below, which represents the respiratory system.

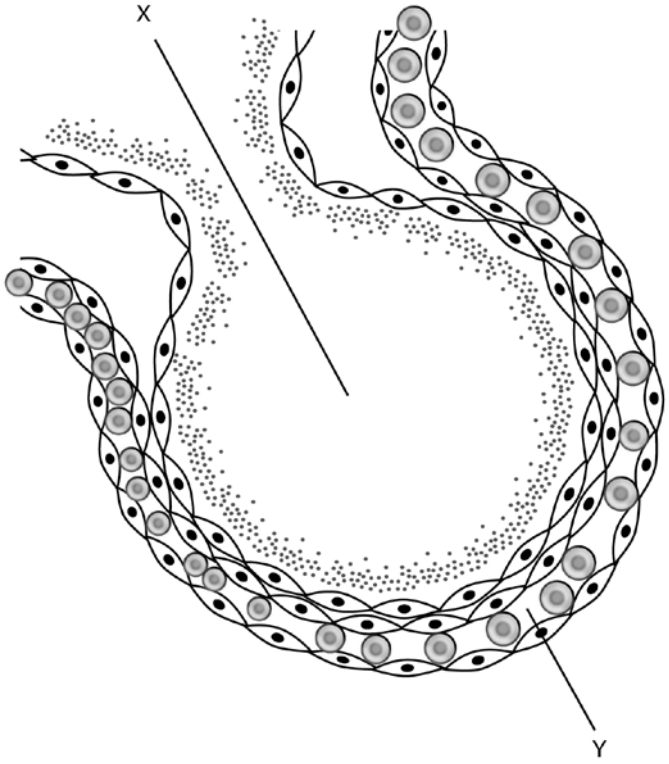


(a) Identify the structure labelled ‘A’ and state its function. (2 marks)

(b) The structure labelled ‘B’ assists in the process of inspiration. Describe how Structure B assists the movement of air into the lungs. (4 marks)

See next page

The diagram below illustrates the structure that lies at the end of Structure C.



(c) Complete the table below, identifying the name and function of the structures shown in the diagram. (4 marks)

	Name of structure	Function
X		
Y		

(d) List **three** structural features that assist Structure X in achieving its function in the body. (3 marks)

One: _____

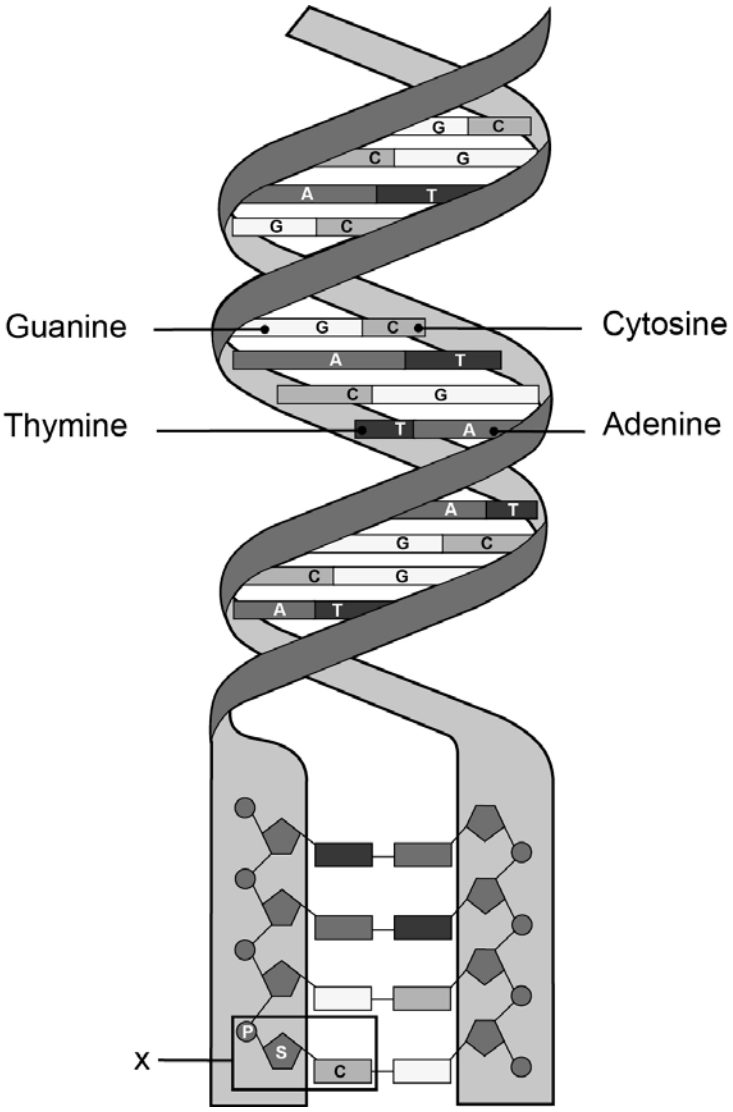
Two: _____

Three: _____

See next page

Question 37 **(12 marks)**

Parts (a) and (b) of this question refer to the diagram below.



(a) Using the diagram above, complete the following: (3 marks)

Structures labelled as Guanine, Cytosine, Adenine and Thymine are all known as:

_____

What name is given to the region highlighted by the box marked X?

_____

Where is this type of DNA found?

_____

See next page

(b) The diagram shows one type of DNA. The other type is mitochondrial DNA.

(i) Describe **one** structural difference between mitochondrial DNA and the DNA in the diagram. (1 mark)

(ii) Explain why mitochondrial DNA is inherited only from the mother. (2 marks)

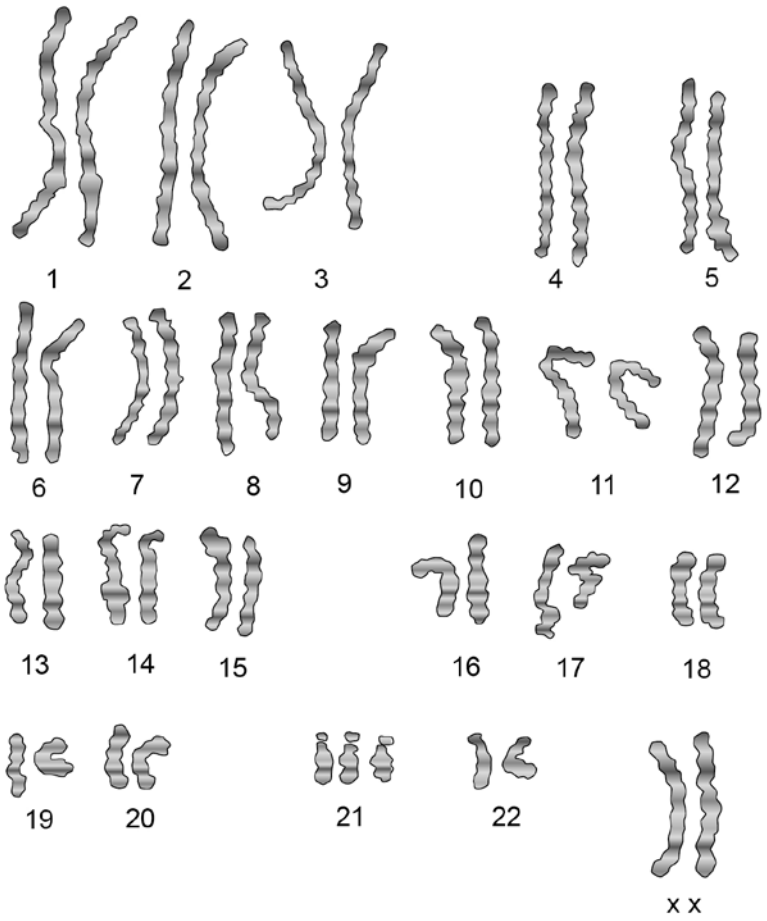
(c) Sudden changes in DNA are often called mutations.

(i) Name the type of mutation that occurs in reproductive cells and will be passed onto offspring. (1 mark)

(ii) Mutagens are agents that increase the rate at which mutations occur. Name **two** specific mutagens. (2 marks)

One: _____

Two: _____



Chromosomal mutations involve all or part of a chromosome. Down syndrome is an example of a type of chromosomal mutation. The image above is a karyotype analysis of an individual with Down syndrome.

(d) (i) Describe the way in which the DNA of an individual with Down syndrome is different from that of a normal individual. (1 mark)

(ii) This type of chromosomal mutation is classed as a 'non-disjunction' or 'aneuploidy'. Explain how it can occur. (2 marks)

See next page

Question 38 **(10 marks)**

(a) Identify the role of ATP in cell metabolism. (1 mark)

_____

(b) Complete the chemical equation below, which represents the breakdown of ATP. (2 marks)

ATP ⟶ (i) _____ + (ii) _____ + Energy

(c) List **three** cellular uses for energy. (3 marks)

One: _____

Two: _____

Three: _____

(d) Using examples, describe the difference between a catabolic reaction and an anabolic reaction. (4 marks)

	Catabolic reaction	**Anabolic reaction**
Description		
Example		

End of Section Two

Section Three: Extended answer **20% (40 Marks)**

This section contains **four (4)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided.

Spare pages are included at the end of this booklet. They can be used for planning your answers and/or as additional space if required to continue an answer.

- Planning: If you use the spare page for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Responses may include clearly-labelled diagrams with explanatory notes; lists of points with linking sentences; clearly-labelled tables and graphs; or annotated flow diagrams with introductory notes.

Suggested working time: 50 minutes.

Question 39 **(20 marks)**

(a) Outline the pathway taken by a red blood cell through the heart. Start at the point where blood returns to the heart via the vena cava and finish where blood leaves the heart via the aorta. Include in your answer the events that occur along the pathway. (12 marks)

(b) Describe **four** key structural or functional features of arteries and describe **four** key structural or functional features of veins. (8 marks)

Question 40 **(20 marks)**

(a) Outline the pathway of a sperm from its formation in the testis to its release in semen from the body. Include in your answer the major events that occur along the pathway. (8 marks)

(b) Infertility refers to the biological inability of a person to contribute to conception.

(i) List **five** causes of infertility. (5 marks)

(ii) Some types of infertility can be overcome with in-vitro fertilisation (IVF). Explain the procedure used in IVF. (7 marks)

See next page

Question 41 **(20 marks)**

(a) Describe **three** key features of embryonic stem cells and describe **three** key features of adult stem cells. (6 marks)

(b) Pregnant women are advised not to consume alcohol, as it is a teratogen.

(i) List **four** negative effects alcohol can have on a foetus. (4 marks)

(ii) Name and describe the effects of **two** other types of teratogens. (4 marks)

(c) Outline the patterns and milestones of development in a normal infant from birth to age two years under the following headings: (6 marks)

(i) physical development
(ii) motor development
(iii) social development.

Question 42 **(20 marks)**

(a) Describe the chemical composition of the major organic nutrients: (6 marks)

(i) carbohydrates
(ii) proteins
(iii) lipids.

(b) Enzymes play an important role in the breakdown of food so that absorption can occur.

Using the 'Lock and Key' model, describe the action of enzymes and list **two** factors that can affect their action. (7 marks)

(c) Describe the mechanical and chemical digestion of lipids in the body. Include an explanation of how the body absorbs them. (7 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

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Question number: _____

Additional working space

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ACKNOWLEDGEMENTS

Section One

Questions 5–6 Adapted from: *Movement in the digestive tract* [Illustration]. Retrieved February 2012, from http://mycozynook.com/.

Questions 10–11 Adapted from: *Pedigree chart*. Retrieved, January 2012, from www.mansfield.ohio-state.edu/~sabedon/biol1125.htm.

Questions 13–14 Adapted from: *Birth control methods* [Illustration]. Retrieved March, 2012, from http://edu.glogster.com/.

Questions 16–17 Adapted from: *Kidney and nephron* [Illustration]. Retrieved January, 2012, from http://zyumed.com/modules/com_ccboard/kidney-nephron-1399.html.

Questions 21–22 Adapted from: Brice, A. (2011, October 30). *Weight loss of an individual* [Graph]. Retrieved March, 2012, from http://successfulsoftware.net/2011/10/30/losing-weight-with-a-minimum-of-willpower/.

Questions 28–29 Diagram of blood components by courtesy of the examining panel.

Section Two

Question 31 Adapted from: *Cell structure* [Diagram]. Retrieved January, 2012, from http://cronodon.com/BioTech/Cell_structure.html.

Question 33 Adapted from: *Pedigree chart 2*. Retrieved January, 2012, from http://lsnhs.leesummit.k12.mo.us/cgerding/PreIBBiology/Genetics/chapter12practicetest.htm.

Question 36 Diagram of the respiratory system by courtesy of the examining panel.

Question 36(c) Diagram of a respiratory system component by courtesy of the examining panel.

Questions 37(a) and (b)
Adapted from: The structure of DNA [Diagram]. National Institute of General Medical Sciences. (2010). *The new genetics*, p. 7. Retrieved January, 2012, from http://publications.nigms.nih.gov/thenewgenetics/chapter1.html.

Question 37(d) Adapted from: *Karyotype analysis of an individual with Down syndrome* [Diagram]. Retrieved January, 2012, from www.ucl.ac.uk/~ucbhjow/bmsi/bmsi_7.html.

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