



St Mark's
ANGLICAN COMMUNITY SCHOOL

HUMAN BIOLOGY

Year 11 Unit 1&2

Semester Two Exam 2018

Short Answer Question/Answer Booklet

Extended Answer Questions

Number: _____

Teacher: _____

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: Ten minutes

Working time for the paper: Three hours.

MATERIALS REQUIRED/RECOMMENDED FOR THIS PAPER

To be provided by the supervisor:

- Multiple Choice Question Booklet
- Short Answer Question/Answer
- Extended Answer Question Sheet
- Multiple Choice Answer Sheet
- Blank lined booklet

To be provided by the candidate:

- Standard items: Pens, pencils, eraser or correction fluid, ruler, highlighter, ruler.
- Special items: Calculators satisfying the conditions set by the Schools Curriculum and standards authority for this subject.

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.

Structure of this paper

Section	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	30	30	40	30	30
Section Two Short answers	9	9	90	103	50
Section Three Extended answers	3	2	50	40	20
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian examinations are detailed in the *Year 12 Information Handbook 2018*. 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.

Section Two: Write your answers in this Question/Answer booklet. Wherever possible, confine your answers to the line spaces provided.

Section Three: Consists of three questions. You must answer two questions. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Section Two: Short answer**50% (103 Marks)**

This section has **nine (9)** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 31**(14 marks)**

An investigation was undertaken to determine the effect of temperature on the ability of freshly activated sperm to fertilise freshly extracted eggs. 5 mL samples of eggs were added to a sperm suspension and, after 5 minutes, the eggs were removed and incubated. Samples were then viewed under 200X magnification, with 300 eggs counted and the proportion of 4+ cell embryos recorded.

At the same time, three replicates of 1mL samples of sperm were incubated for 2 hours at the same temperatures and standardised to a concentration of 10^7 sperm/mL⁻¹. Sperm samples were transferred to a microscope slide and videotaped under 200X magnification. The velocity (measure of speed and direction) of the sperm was calculated using the same motion analysis system.

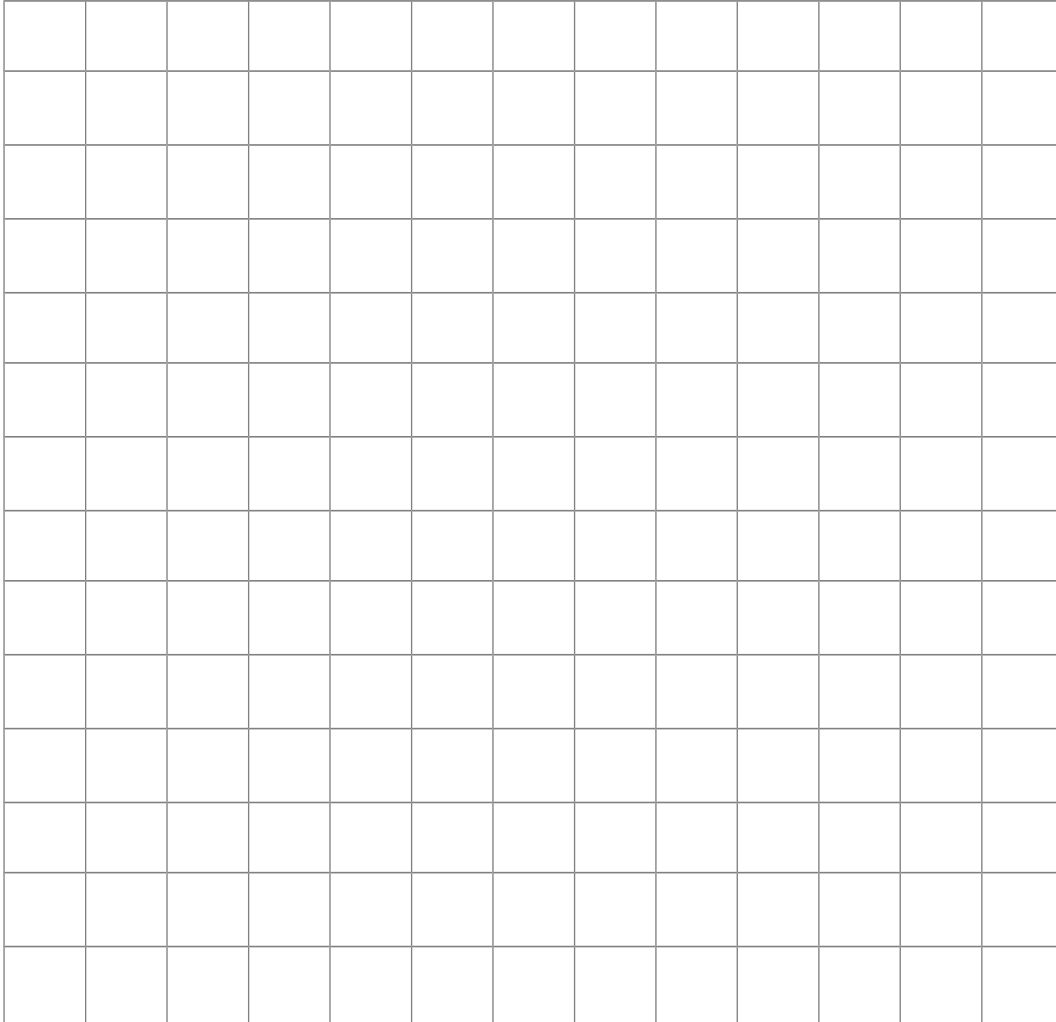
The results from the investigation are shown below.

Temperature (°C)	15	20	25	30	35	40
Fertilisation Success (%)	19.4	21.6	58.5	87.2	39.4	23.6
Sperm Velocity (µm/sec ⁻¹)	45	50	89	150	45	38

(a) Graph these results on the grid provided below.

(6 marks)

A spare grid can be found on page 42.



(b) Identify **two** variables, **not** indicated in the information for the fertilisation success investigation, that needed to be maintained/controlled across all temperatures to ensure a fair test was conducted. (2 marks)

(c) For **one** of the variables identified in part (b), state how it may have affected the results therefore why it needed to be controlled.

(1 mark)

(d) Using the results from the table, suggest what may have caused the observed effect of increased fertilisation success.

(2 marks)

(e) Considering that sperm require enzymes for movement to occur, state one reason why there was the drastic drop in sperm velocity after 30°C.

(1 mark)

(f) Men planning to have children are often encouraged by fertility experts to avoid wearing tight fitting underwear to increase the chance of fertilisation occurring. Explain how the results of this experiment support this suggestion.

(2 marks)

Question 32**(10 marks)**

A married couple, intending on starting their own family, were advised to attend a local genetic counselling clinic to discuss the risks of producing offspring with phenylketonuria (PKU), which is present in the mother's family.

(a) Describe how the genetic counsellor may have explained the relationship between genes and chromosomes to the couple. (2 marks)

(b) Suggest a reason as to why the genetic counsellor would create a pedigree chart for this disease to show the couple. (1 mark)

Upon receiving this advice, the couple then attended a fertility clinic to get information on how to increase their chances of pregnancy. The clinician described the structure and function of the human reproductive system and explained the reproductive cycles.

(c) State the differences between the female and male gametes with regard to their size, structure and relative number. (3 marks)

(d) Describe one factor that the woman could **monitor**, over a period of time, that could be used to increase the couple's chances of falling pregnant. (2 marks)

(e) (i) Unfortunately, the couple struggled to fall pregnant. Identify **one** Assisted Reproductive Technology (ART) that the couple could use. (1 mark)

(ii) State **one** common complication associated with the ART identified in part (e)(i) above. (1 mark)

Question 33

(12 marks)

For many hundreds of years, experiments with blood transfusions have been undertaken. However, it was in 1901, when Karl Landsteiner discovered human blood groups, that they became safer.

(a) State the name of **one** type of blood transfusion. (1 mark)

(b) Explain why it is important to determine the blood groups of both the recipient and donor in blood transfusions. (4 marks)

(c) Describe the mode/modes of inheritance of ABO blood groups. (3 marks)

(d) Using a Punnett square, explain if it is possible for an O-type child to be born to a B-type father and AB-type mother. (4 marks)

Question 34

(12 marks)

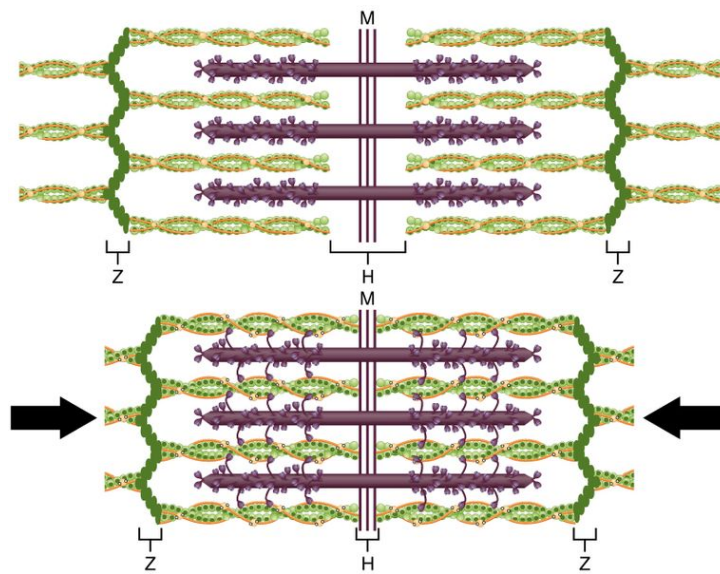
(a) There are two types of bone found in the human body. Name these types of bone and describe **two** structural differences between the two.

(4 marks)

(b) Muscles work in pairs to provide the skeletal system with motion. Explain why synergists are important in enabling the movement of a joint.

(3 marks)

The diagrams below show one sarcomere in its fully relaxed state and when it is contracted fully.



(c) When a sarcomere contracts, the myosin filaments pull the actin filaments towards the M-line. Explain how calcium and ATP enable this movement to occur. (4 marks)

(d) Suggest why a ball-and-socket joint at the knee would create problems for upright walking. (1 mark)

Question 35

(12 marks)

(a) The Atkins Diet is based on high protein foods.

(i) Briefly describe what happens to these proteins after the food reaches the stomach and then enters the small intestine. (4 marks)

(ii) State the name given to the type of digestion of protein that would have occurred in the mouth prior to swallowing. (1 mark)

(iii) Suggest a reason why high protein diets are recommended for weight loss. (1 mark)

(b) Type 1 Diabetes is a genetic disorder that inhibits an individual from taking up glucose into their cells. Blood glucose monitoring, using a glucose biosensor, is therefore very important for individuals with Type 1 Diabetes.

(i) A glucose biosensor uses the enzyme "glucose oxidase". Using your understanding of enzymes, briefly explain why the biosensor is specific for glucose. (2 marks)

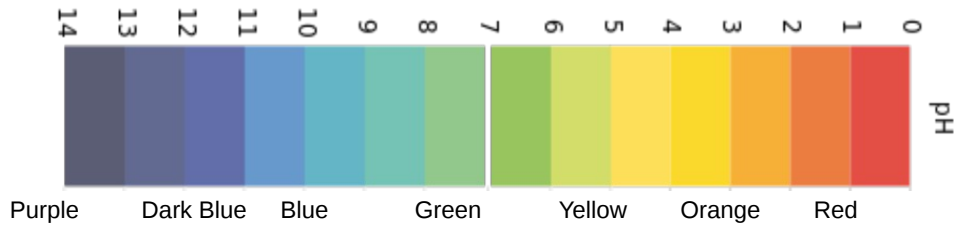
(ii) State the names and locations of the steps involved in the complete breakdown of glucose within the cell to produce energy for the cell. (3 marks)

(iii) Identify **one** product that differs between aerobic and anaerobic respiration in human cells. (1 mark)

Question 36

(8 marks)

An investigation on the effect of physical activity on respiration rate was undertaken. Immediately after completing an activity, each individual breathed into a container of pH indicator solution. The time it took for the pH indicator to change from blue to red was recorded.



- (a)** Identify the gas that would have been present in larger amounts after the activity and explain why its presence would have caused the change in colour. (2 marks)

Whilst performing one of the activities, one of the individuals fell over and cut their knee.

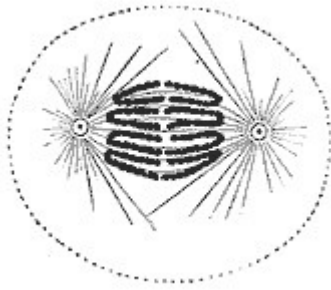
- (b)** (i) State which two elements of the blood would be expected to increase in concentration following this injury and explain why this would have occurred. (4 marks)

(ii) Name and describe the type of tissue that blood is categorised as. (2 marks)

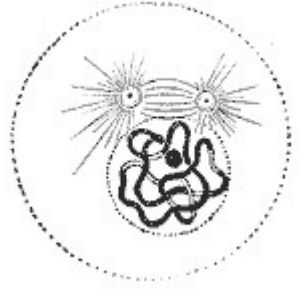
Question 37

(11 marks)

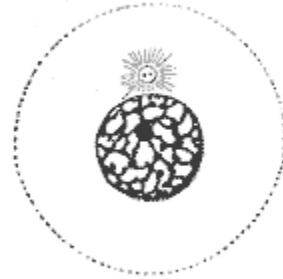
(a) The following diagrams represent a selection of the five (5) different stages of mitosis.



A



B



C

(i) List the diagrams (A, B, C) in the correct order for the process of mitosis. (1 mark)

(ii) Identify the two missing stages and draw diagrams to show what would be occurring in each of the missing stages. (4 marks)

Stage:	Stage:
Diagram:	Diagram:

(b) During the synthesis stage of mitosis, the DNA within a cell is replicated to allow for the production of identical daughter cells.

State the role of the following enzymes in the process of DNA replication.

(3 marks)

(i) Helicase

(ii) DNA Polymerase

(iii) DNA Ligase

Occasionally cells can become abnormal, invading and damaging the tissues of the body. These diseases can be diagnosed as cancer.

(c) Describe how cancer develops and suggest one way it can spread throughout the body (metastasise). (3 marks)

Question 38

(12 marks)

(a) A sample of tissue was extracted from a crime scene. DNA profiling was undertaken and the respective banding patterns produced. These are shown in the diagram below.



(i) Identify which suspect was most likely the perpetrator of this crime.

(1 mark)

(ii) Explain how you arrived at your answer in part (a)(i).

(1 mark)

DNA profiling utilises the biotechnology of Polymerase Chain Reaction (PCR). PCR mimics the steps of DNA replication.

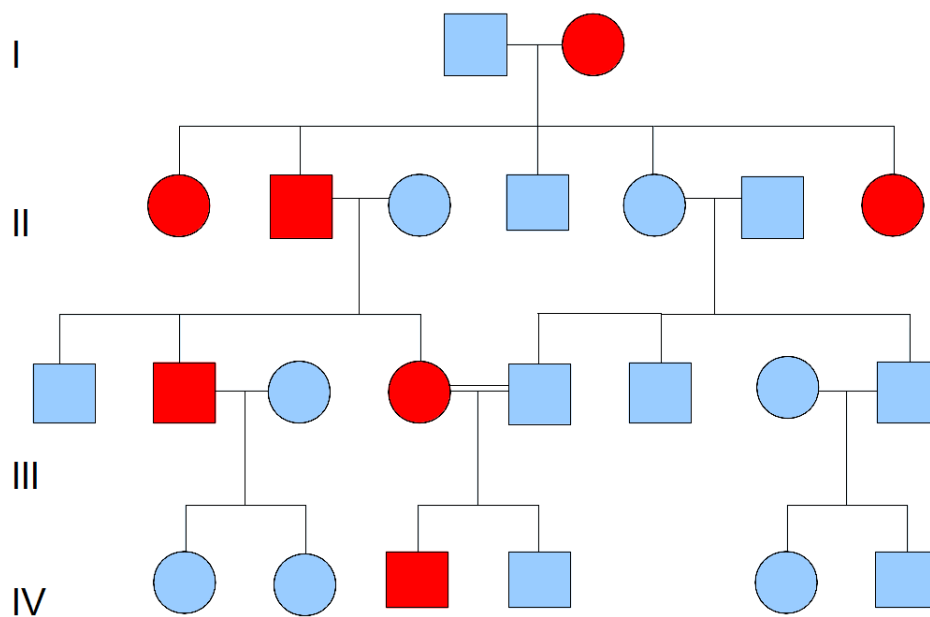
(b) Identify **three** structural properties of DNA that allow it to be replicated.

(3 marks)

(c) DNA profiling can also be used for the screening of embryonic stem cells. Discuss an ethical issue that may arise in stem cell research for people with religious beliefs. (2 marks)

(d) Where are pluripotent embryonic stem cells harvested from? (1 mark)

Below is a pedigree of a human skin disease that was created using the information attained from DNA profiling of a family. Use this pedigree chart to answer part (e) on the next page.



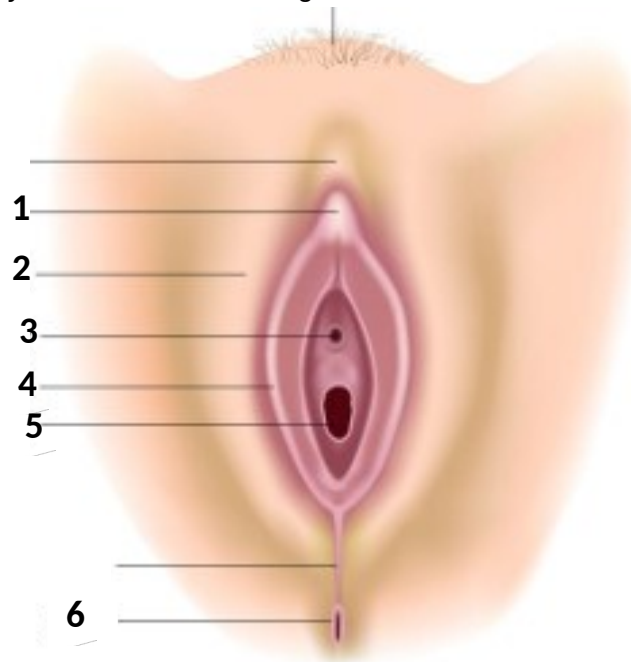
(e) (i) Identify the relationship identified by the double horizontal lines connecting individuals III-4 and III-5. (1 mark)

(ii) Is this disease X-linked or Autosomal? Use individual III-2 to justify your answer. (3 marks)

Question 39

(12 marks)

The female reproductive system is designed to both produce gametes and provide for the development of an embryo and foetus. The diagram below shows the external female genitalia.



(a) Identify the structures identified at position: (2 marks)

1: _____

4: _____

(b) State **one** function of the organ labelled by the number 5. (1 mark)

(c) In 90% of births, the foetus's head is facing downward. Describe **one** reason why it is better for the foetus to be in this position. (2 marks)

(d) Explain why a large number of sperm is required for fertilisation to take place.

(3 marks)

(e) Describe **one** hormonal contraception method for women that could be used to prevent fertilisation. Identify **one** risk and **one** benefit of this method as a contraceptive.

(4 marks)

Section Three: Extended answer

20% (40 Marks)

This section has **three (3)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided.

Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

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

Suggested working time: 50 minutes.

Answer any **two (2)** questions from Questions 40 to 42.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on the pages that follow.

Question 40

(20 marks)

- (a) Hormones released from the pituitary gland and ovaries regulate the menstrual and ovarian cycles. State the name of **two** of these hormones, their target organs or structures and describe the effect they have on the reproductive cycles. (6 marks)
- (b) Prolactin, a lactogenic hormone, is a protein that has a direct effect on the breasts of pregnant women to produce and maintain milk.

Describe the process of protein synthesis that would result in the production of the hormone prolactin. (14 marks)

Question 41

(20 marks)

- (a) The probability of any one person being born has been calculated to be approximately 1 in 400,000,000,000. Explain how the genetic (DNA) variation seen in humans can arise due to meiosis and reproduction. (8 marks)
- (b) Explain how the lungs are both specifically structured and function to ensure that cells are constantly supplied with oxygen and have their waste product, carbon dioxide, removed. (12 marks)

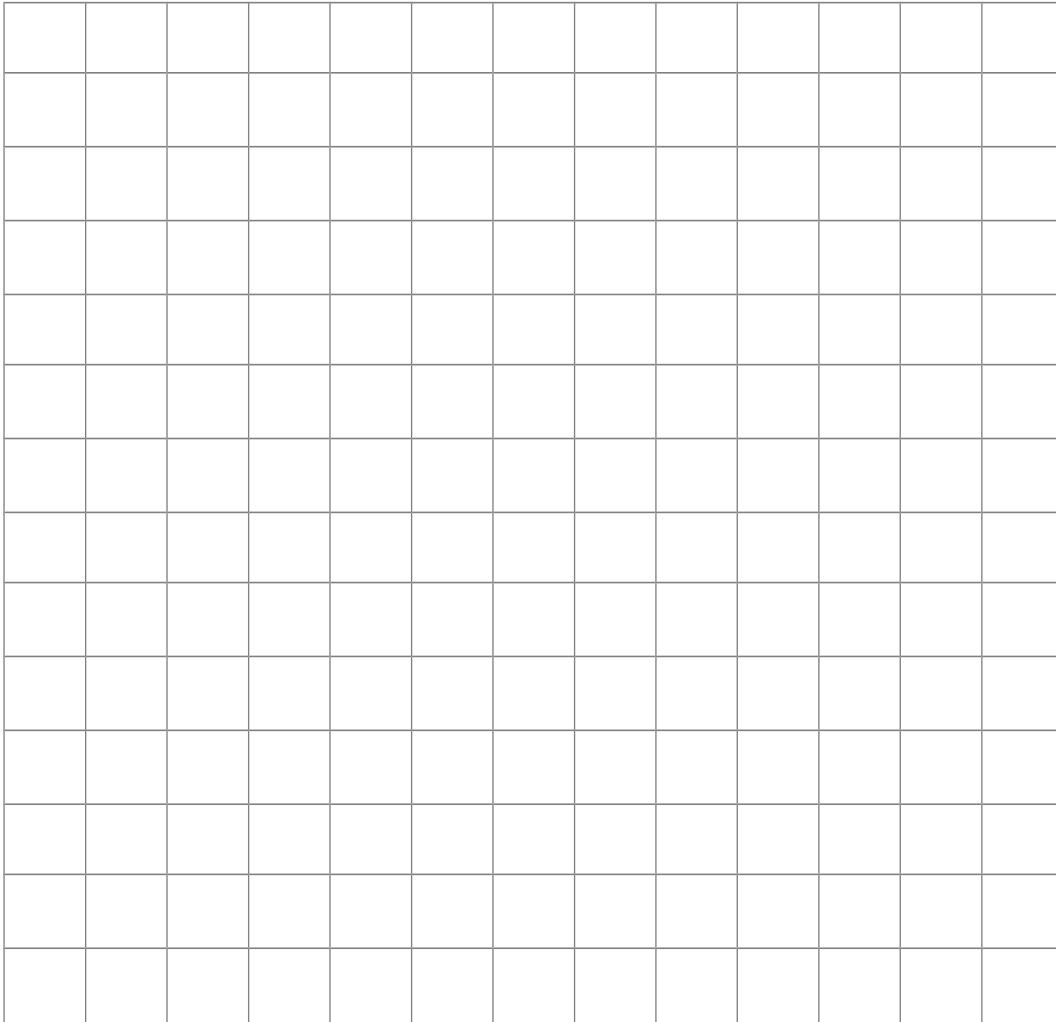


Question 42

(20 marks)

- (a) For the cells of a body to function normally, they must remain in a stable environment. Describe the structure of the cell membrane and explain three ways in which it allows the exchange of molecules to occur. (14 marks)
- (b) Some chemical processes occurring in the body produce toxic waste products, such as urea. The excretory system is involved in removing metabolic wastes. Name and briefly describe the three main processes involved in the production of urine by the kidneys. (6 marks)

Spare Grid



ACKNOWLEDGMENTS

- Question 7-8** DataBase Center for Life Science (DBCLS) [Generalised Cell Organelle Image]. (n.d.) Retrieved November, 2017, from: [https://commons.wikimedia.org/wiki/File%3A201601\[...\]](https://commons.wikimedia.org/wiki/File%3A201601[...])
- Question 13** Adapted from: Gal m (Own work). (2007) Graph of Enzyme Activity [Image]. Retrieved November, 2017, from: <https://commons.wikimedia.org/wiki/File%3AEnzyme-ph.png>
- Question 17-18** Adapted from:山口大輔. (2009). Pedigree Chart [Image]. Retrieved November, 2017, from: <https://commons.wikimedia.org/wiki/File%3APedigree.png>
- Question 20** Everkinetic. (2010) Hip Movement [Images]. Retrieved November, 2017, from: <https://commons.wikimedia.org/w/index.php?curid=47435431> and [https://upload.wikimedia.org/wikipedia/commons/8/89/\[...\].png](https://upload.wikimedia.org/wikipedia/commons/8/89/[...].png)
- Question 24** Sheldahl. (2016) Unlabeled cartoon of human neurula stage embryo [Image]. Retrieved November, 2017, from: https://commons.wikimedia.org/wiki/File%3ANeurula_human.png
- Question 28** Sunshineconnelly at English Wikibooks. (2007). Wall of Small Intestine. Retrieved November, 2017, from: [https://commons.wikimedia.org/wiki/File%3AAnatomy_and_physiology_of_animals_Wall_of_small_intestine_showing_\[...\].jpg](https://commons.wikimedia.org/wiki/File%3AAnatomy_and_physiology_of_animals_Wall_of_small_intestine_showing_[...].jpg)
- Question 34(b)** OpenStax. (2016). Sliding Filament Model [Image]. Retrieved November, 2017, from: https://commons.wikimedia.org/wiki/File%3A1006_Sliding_Filament_Model_of_Muscle_Contraction.jpg
- Question 36(a)** Hans Kirkendoll. (2009). Power of Hydrogen (pH) chart [Image]. Retrieved November, 2017 from: [https://commons.wikimedia.org/wiki/File%3APower_of_Hydrogen_\(pH\)_chart.svg](https://commons.wikimedia.org/wiki/File%3APower_of_Hydrogen_(pH)_chart.svg)
- Question 37(a)** Henry Gray's Anatomy of the Human Body. (n.d.) [Generalised Mitosis Stages]. Retrieved November, 2017, from: The original uploader was D. Wu at English Wikipedia (Transferred from en.wikipedia to Commons.) [Public domain or Public domain], via Wikimedia Commons
- Question 38(e)** Caulton, S. (2013). Pedigree chart of the inheritance of an [...] [Image]. Retrieved December, 2017, from: [https://commons.wikimedia.org/wiki/File:\[...\].png](https://commons.wikimedia.org/wiki/File:[...].png)