



**Semester Two Examination, 2018
Question/Answer Booklet**

**HUMAN BIOLOGY
UNITS 1 AND 2**

Fix student label here

Student Name: _____ **SOLUTIONS** _____

Time allowed for this paper

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

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Multiple-choice answer sheet

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 this examination

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 answered | Suggested working time (minutes) | Marks available | Percentage of examination | Percentage achieved |
|--------------------------------|-------------------------------|------------------------------------|----------------------------------|-----------------|---------------------------|---------------------|
| Section One: Multiple-choice | 30 | 30 | 30 | 30 | 30 | |
| Section Two: Short answer | 7 | 7 | 90 | 104 | 50 | |
| Section Three: Extended answer | 3 | 2 | 40 | 40 | 20 | |
| | | | | | 100 | |

Instructions to candidates

- Write your answers in this Question / Answer booklet preferably using a blue / black pen. Do not use erasable or gel pens.
- 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. Do not use erasable or gel pens. 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.

- 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.
- Supplementary pages for planning / continuing your answers to questions are 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 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

1. The majority of cell processes are controlled by the

- (a) **nucleus.**
- (b) lysosome.
- (c) mitochondria.
- (d) endoplasmic reticulum.

Question 2 refers to the following diagram.



2. This organelle

- (a) produces ATP.
- (b) **packages molecules.**
- (c) detoxifies alcohol.
- (d) synthesises nucleic acids.

3. Cells that contain large amounts of smooth endoplasmic reticulum, Golgi bodies and vesicles would be found in the

- (a) liver and testes.
- (b) liver and alveoli.
- (c) **stomach and testes.**
- (d) alveoli and stomach.

4. The products of mitochondria include ATP and

- (a) **water.**
- (b) lipids.
- (c) oxygen.
- (d) glucose.

Questions 5 and 6 refer to the table below.

| | | | |
|--|---|--|---|
| AAU } AAC } Asparagine | CAU } CAC } Histidine | GAU } GAC } Asparatic acid | UAU } UAC } Tyrosine |
| AAA } AAG } Lysine | CAA } CAG } Glutamine | GAA } GAG } Glutamate | UAA } UAG } Stop |
| ACU } ACC } ACA } ACG } Threonine | CCU } CCC } CCA } CCG } Proline | GCU } GCC } GCA } GCG } Alanine | UCU } UCC } UCA } UCG } Serine |
| AGU } AGC } Serine | CGU } CGC } CGA } CGG } Arginine | GGU } GGC } GGA } GGG } Glycine | UGU } UGC } Cysteine |
| AGA } AGG } Arginine | | | UGA – Stop UGG – Tryptophan |
| AUU } AUC } AUA } Isoleucine | CUU } CUC } CUA } CUG } Leucine | GUU } GUC } GUA } GUG } Valine | UUU } UUC } Phenylalanine |
| AUG – Methionine | | | UUA } UUG } Leucine |

5. A single base mutation causes the amino acid tryptophan to be replaced by leucine in a protein chain. The base in the DNA that changes to cause this mutation would be
- (a) adenine.
 - (b) guanine.
 - (c) cytosine.
 - (d) thymine.
6. Which DNA code represents this polypeptide chain?

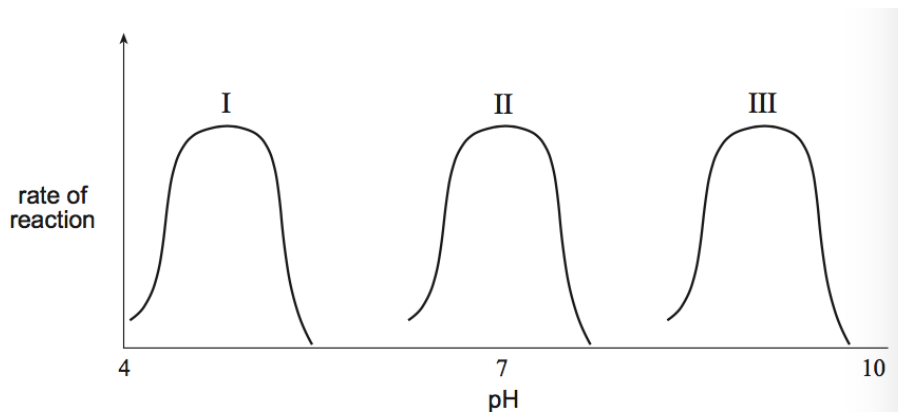


- (a) CTA GGT AGT
 - (b) GAC ACA CCA
 - (c) CAU UGA GGU
 - (d) CTG TGT GGT
7. At which of the following cell structures would adenine bond with thymine but not uracil?
- (a) nucleus
 - (b) ribosomes
 - (c) Golgi bodies
 - (d) endoplasmic reticulum

8. A solution of DNA contains 33% adenine. How much would be guanine?

- (a) 67%
- (b) 34%
- (c) 33%
- (d) 17%

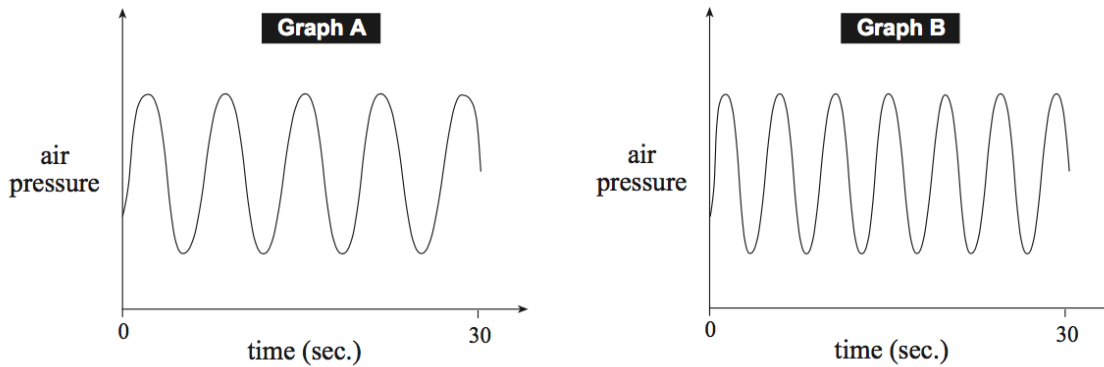
9. The graph shows the effect of pH on three different enzyme catalysed reactions.



Which one of the following would best describe the effect of pH on enzyme catalysed reactions?

- (a) Enzyme action increases as pH increases.
 - (b) Enzyme action decreases as pH increases.
 - (c) Enzymes work best in an acidic environment.
 - (d) Each enzyme works best within a specific pH range.
10. During inhalation
- (a) the diaphragm contracts and intercostals relax.
 - (b) the diaphragm relaxes and the volume of the thorax increases.
 - (c) air pressure in the lungs decreases and the volume of the thorax increases.
 - (d) the intercostals and diaphragm contract and the air pressure in the lungs increases.

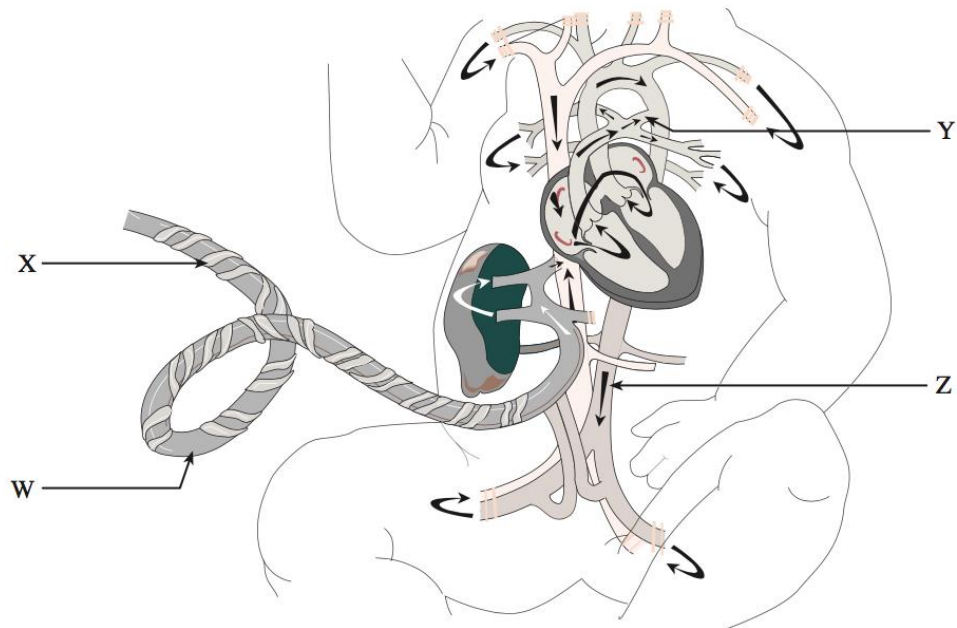
11. Graph A below shows the change in air pressure in the lungs over a 30 second period.



Which of the following would cause, over the same time period, the change shown in Graph B?

- (a) low concentration of hydrogen ions in the blood
 (b) high concentration of bicarbonate ions in the blood
 (c) decreased nerve impulses sent to the diaphragm from the brain
 (d) decreased nerve impulses from the stretch receptors in the lungs to the brain
12. The pH of blood is decreased because
- (a) water dissociates to form hydrogen ions.
 (b) hydrochloric acid is formed in the stomach.
 (c) of bicarbonate ions breaking down.
 (d) carbon dioxide dissolves in water.
13. Which of the following would result if the foramen ovale remained functional after birth?
- (a) higher than normal levels of oxyhaemoglobin in the aorta
 (b) higher than normal levels of bicarbonate ions in the aorta
 (c) higher than normal levels of pH in the aorta
 (d) lower than normal levels of carbaminohaemoglobin in the aorta

Questions 14 and 15 refer to the image below.



14. Which structure carries oxygenated blood from the mother to the foetus?

- (a) W
- (b) X
- (c) Y
- (d) Z

15. Which structure allows blood to bypass the lungs?

- (a) W
- (b) X
- (c) Y
- (d) Z

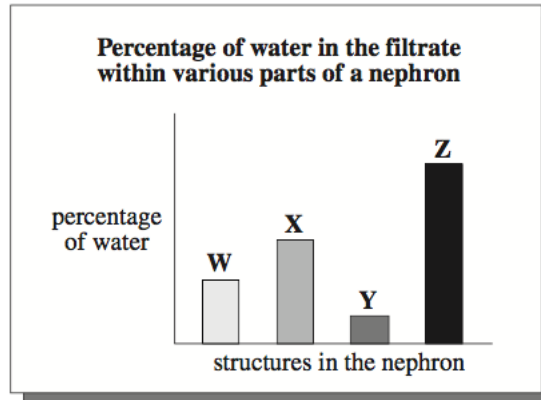
16. The table below shows the concentration of substance X in various body fluids.

| CONCENTRATIONS OF SUBSTANCE X IN mg PER 100 mL | | |
|---|------------------------|-------|
| PLASMA | GLOMERULAR FILTRATE | URINE |
| 26 | 26 | 1 820 |

Substance X is

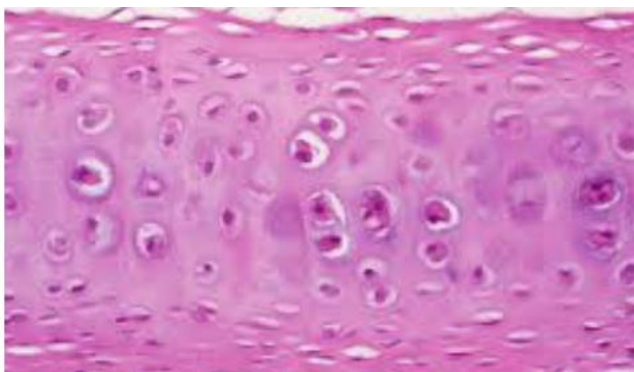
- (a) glucose.
- (b) urea.
- (c) protein.
- (d) water.

17. The graph below shows the percentage of water in the filtrate in various parts of the nephron.



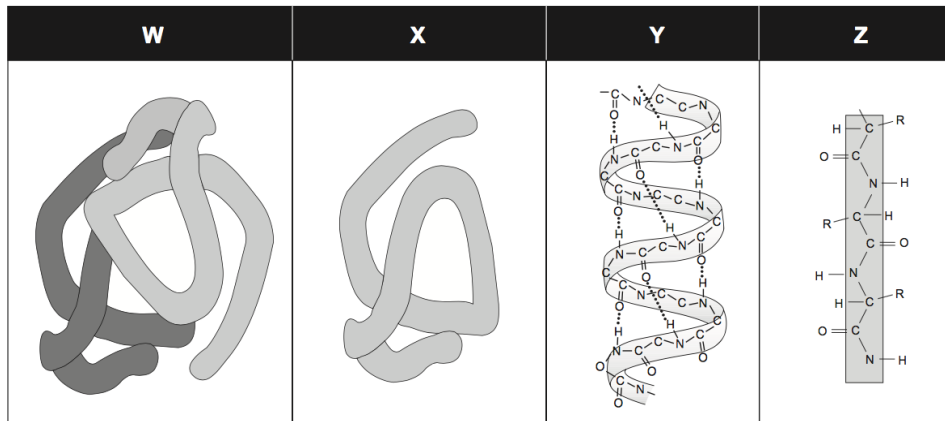
Which structure is most likely the collecting duct?

- (a) W
 - (b) X
 - (c) Y
 - (d) Z
18. When proteins are broken down, urea is produced which enters the blood plasma. Which of the following processes would account for the presence of urea in the nephron?
- (a) tubular excretion in the distal convoluted tubule
 - (b) active transport in the collecting duct
 - (c) facilitated transport in the proximal convoluted tubule
 - (d) glomerular filtration at the renal corpuscle
19. Which of the following is correct for this tissue?



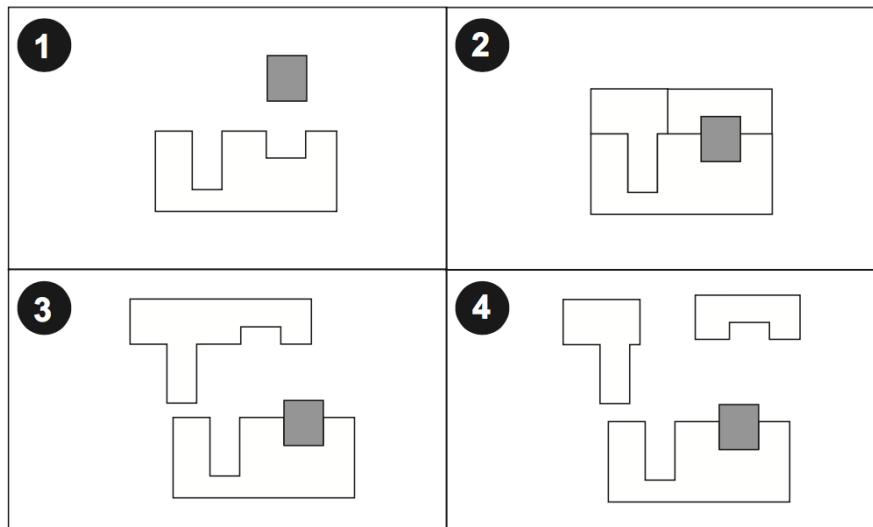
- (a) This compact bone would be found in the diaphysis.
- (b) This hyaline cartilage would be found in a synovial joint.
- (c) This elastic tissue would be found in the pinna of the ear.
- (d) This fibroelastic cartilage would be found in between the ribs and sternum.

Question 20 refers to the following diagram that shows a number of proteins.



20. Which statement is correct?
- A primary structure would be shown in image Y.
 - Haemoglobin, a tertiary structure, is shown in image W.
 - The protein shown in image Z would be formed at a ribosome.
 - Image X is made up of two different protein molecules.
21. Elevated levels of which hormone indicates that implantation has occurred?
- oestrogen
 - progesterone
 - testosterone
 - HCG
22. A steroid hormone that causes breast development is
- oestrogen.
 - progesterone.
 - LH.
 - FSH.
23. HCG
- stimulates the corpus luteum.
 - causes progesterone levels to decrease.
 - causes degeneration of the endometrium.
 - stimulates the secretion of FSH.

Questions 24 and 25 refer to the image below.



24. To represent the lock and key model of enzyme action, in which order would the diagrams have to be placed?
- (a) 1, 3, 2, 4
 (b) 1, 4, 2, 3
 (c) 2, 3, 4, 1
 (d) 2, 4, 3, 1
25. The dark shaded square would represent
- (a) an inhibitor.
 (b) a co-factor.
 (c) an active site.
 (d) a substrate.
26. Testosterone secretion is controlled through negative feedback due to increased amounts of which hormone?
- (a) oxytocin
 (b) testosterone
 (c) progesterone
 (d) FSH
27. Which of the following statements about sexually transmitted infections is correct?
- (a) Herpes is caused by a bacterium and can be cured.
 (b) Syphilis is caused by a virus and can cause death if left untreated.
 (c) Genital warts are caused by a virus and can be burnt off.
 (d) Gonorrhoea is caused by a bacterium and causes blisters and a yellow discharge.

28. Muscle tissue that is multi-nucleated and contains striations would be classified as
- (a) involuntary.
 - (b) smooth muscle.
 - (c) cardiac muscle.
 - (d) **skeletal muscle.**
29. A pregnant couple are concerned about the health of their unborn baby as the woman is 38 years of age. What test would NOT be able to detect Down Syndrome in their unborn baby?
- (a) amniocentesis
 - (b) chorion villi sampling
 - (c) **ultrasound**
 - (d) maternal blood test
30. All of the following events are correct, except one. Which one is INCORRECT?
- (a) Morning sickness is worst in the first trimester.
 - (b) **Mothers would feel their baby kicking in the 3th month of pregnancy.**
 - (c) Testes descend in the 7th month of pregnancy.
 - (d) Babies have a good chance of survival if born after 28 weeks of pregnancy.

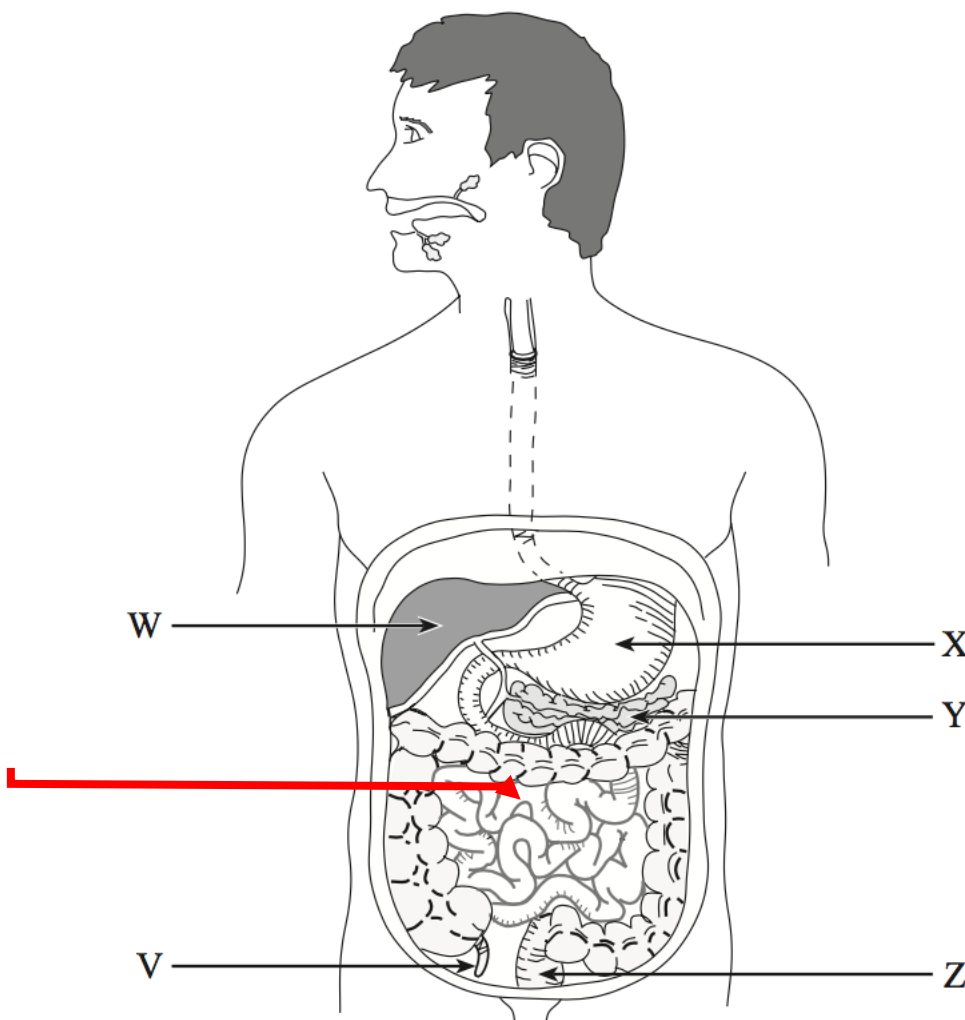
End of Section One

Section Two: Short answer**50% (104 Marks)**

This section has **seven (7)** 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**(24 marks)**

(a) State three functions of organ W. (3 marks)

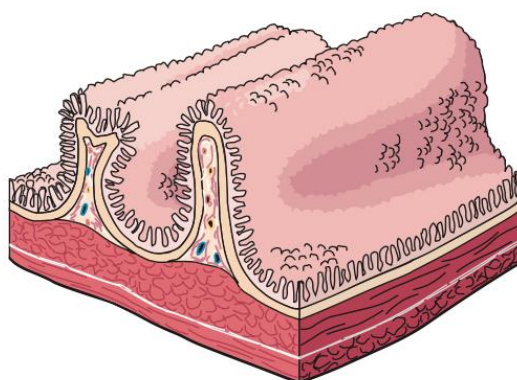
detoxification / produces bile / deamination / breaks down haemoglobin / stores glucose / generates heat / stores vitamins (Any 3, 1 mark each)

- (b) Describe how structure X is suited to the functions it performs. (4 marks)

three muscle layers / named muscle layers (1) – which enhances mechanical digestion (1)
 rugae (1) – which increase surface area for digestion (1)
 produces HCl (1) – which allows protein digestion by enzymes (1)
 (any 2, 1 mark each structure, 1 mark each description)

- (c) A sample of tissue A (shown below) was taken from part of the digestive system. Use an arrow to label the part of the digestive system in the body diagram on the previous page that tissue A was taken from. (1 mark)

(1 mark to show the ileum)



- (d) Polysaccharides are digested both chemically and physically in the digestive system.

- (i) Name two other functions of the digestive system, besides digestion. (2 marks)

Ingestion / peristalsis / absorption / elimination (Any 2, 1 mark each)

- (ii) State where polysaccharides are first broken down chemically. (1 mark)

mouth (1)

- (iii) Identify where and in what form polysaccharides enter Tissue A shown above. (2 marks)

glucose / monosaccharide (1)
 capillaries (1)

(e) A piece of living small intestine was placed in a solution containing maltose (a disaccharide), egg white and fats. In order to ensure the piece of intestine functioned normally, oxygen was bubbled through the solution and the pH was maintained at 8.2. After one hour, the solution was analysed.

(i) Explain why glucose was found in the solution. (2 marks)

small intestine produced enzymes / amylase (1)
that acted on the maltose / disaccharide to produce glucose (1)

(ii) Products from the breakdown of fat were not found. Explain why this would be the case. (2 marks)

No bile was present (1)
Surface area was too large for the chemical digestion to take place / no emulsification of lipids (1)

(iii) Why was the solution buffered to a pH of 8.2? (2 marks)

That is the optimal pH for intestine enzymes to act (1)
Outside of this optimal, enzymes denature (1)

(iv) In a variation of this experiment, pancreatic protease was also added to the original solution.

(a) Name two variables that should be controlled in this experiment. (2 marks)

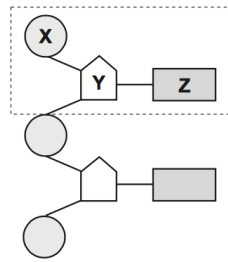
same tissue type / same substances added / same time left for / same oxygen / same pH / same temperature (Any 2, 1 mark each)

(b) Describe the results of this new experiment after one hour. (3 marks)

glucose would be found (1)
amino acids would be found (1)
peptides / peptones would be found (1)
no fatty acids / glycerol would be found (1)
(any 3, 1 mark each)

Question 32

(9 marks)



(a) Identify the structures from the diagram above: (2 marks)

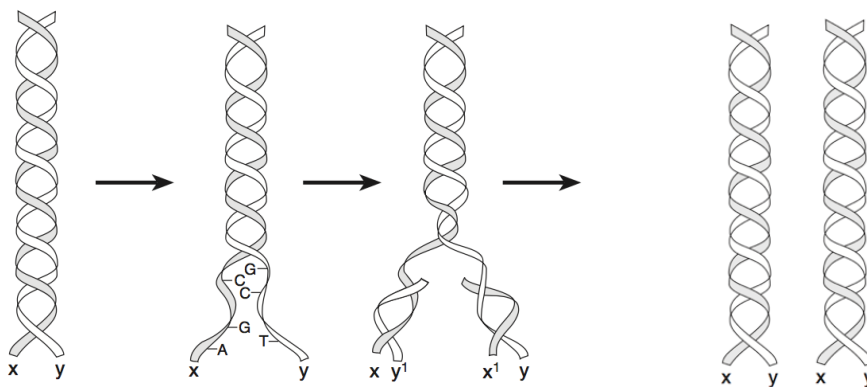
- X phosphate (1)
- Z nitrogen base (1)

(b) Name the structure identified by the dotted box in the diagram above and indicate how many different types of these can be found in DNA. (2 marks)

nucleotide (1)

4 (1)

(c) Stage 1 Stage 2 Stage 3 Stage 4



(i) What process does the diagram above depict? (1 mark)

DNA replication (1)

(ii) Where does this process take place? (1 mark)

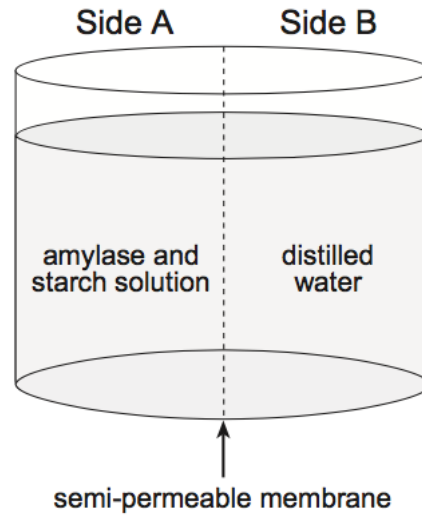
nucleus (1)

(iii) Complete the diagram by drawing in what would be present at stage 4. (1 mark)

two double helix strands (1)

(d) Tissue sample A was taken from a mole on the skin that showed abnormal growth while tissue sample B was composed of normal skin cells. Describe how the cells in tissue sample A are different from those in tissue sample B. (2 marks)

Tissue A has mutated DNA / more cells present / more cells at various stages of mitosis compared to Tissue B which has no mutations / less cells present / more cells at interphase (Any 1, compared, 1 mark each)

Question 33**(12 marks)**

A scientist set up the container shown above in his laboratory. Side A contained a solution of amylase and starch, while side B contained only distilled water. The two sides were separated by dialysis tubing, a semi-permeable membrane. The container was kept at a temperature of 37°C for one hour.

- (a) Explain how the dialysis tubing mimics a cell membrane. (2 marks)

allows some substances in and out of the cell (1)
 keeps environments compartmentalised (1)
 allows different environments on either side of it (1)
 allow diffusion / osmosis to take place (1)
 (Any 2, 1 mark each)

- (b) Identify how the dialysis tubing is different to a cell membrane. (2 marks)

Does not contain carrier proteins / can't do active transport / can't do exocytosis /
 can't do endocytosis / not a mosaic model / not fluid model / does not have receptors /
 does not have self antigens / does not contain phospholipids bilayer / does not
 contain cholesterol (Any 2, 1 mark each)

(c) After one hour, the scientist conducted a series of tests on the liquids found in both sides of the container. In side A he found starch and a disaccharide. In side B he found a disaccharide but no starch.

(i) What test would he have done to determine no starch was found on side B?

(1 mark)

iodine (1)

(ii) Account for the presence of the disaccharide on side A. (1 mark)

amylase has chemically digested starch into disaccharide (1)

(iii) Account for the presence of the disaccharide on side B. (2 marks)

disaccharide has moved through the dialysis tubing from side A (1)
by diffusion high concentration to low concentration (1)

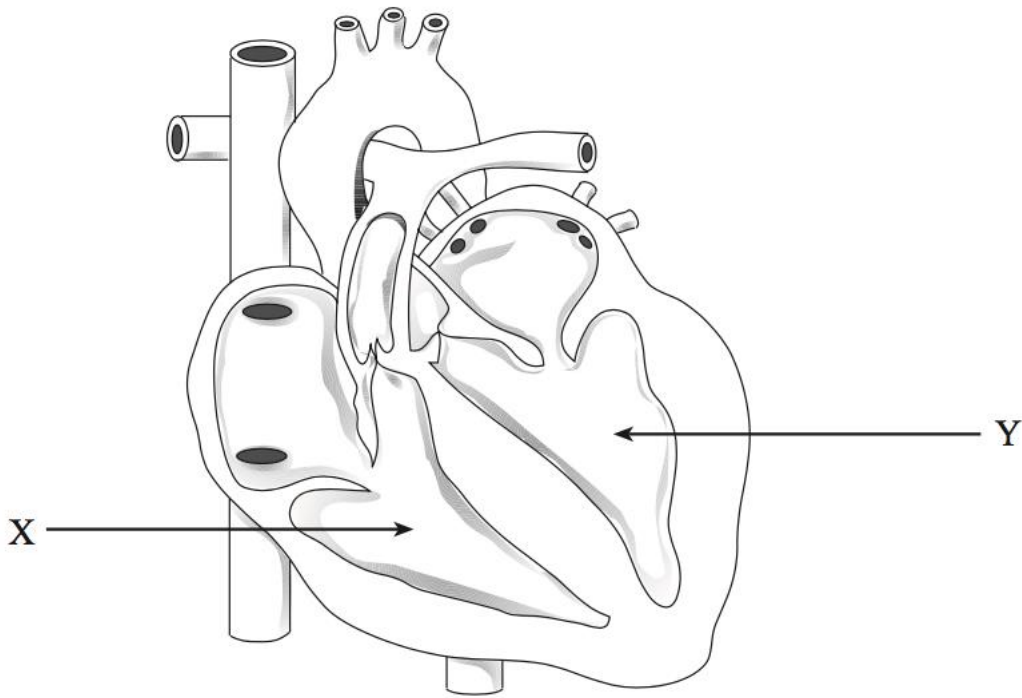
(iv) If the scientist left the container for another hour, explain what results you would expect him to find after that time on each side of the dialysis tubing. (4 marks)

Side A – little starch / no starch / amylase / disaccharide / some glucose
(Any 2 marks, 1 mark each)

Side B – no starch / no amylase / some disaccharide / some glucose
(Any 2 marks, 1 mark each)

Question 34

(17 marks)



- (a) Compare and contrast the blood found in structure X and structure Y. (4 marks)

| | Structure X | Structure Y |
|---|--|-----------------------|
| Compare (Max 2 marks) | Contain red blood cells / white blood cells / platelets / plasma / nutrients / hormones (Any 2, 1 mark each) | |
| Contrast (Max 2 marks) (any 1, contrasted, 1 mark each) | Low in oxygen | High in oxygen |
| | High in carbon dioxide | Low in carbon dioxide |

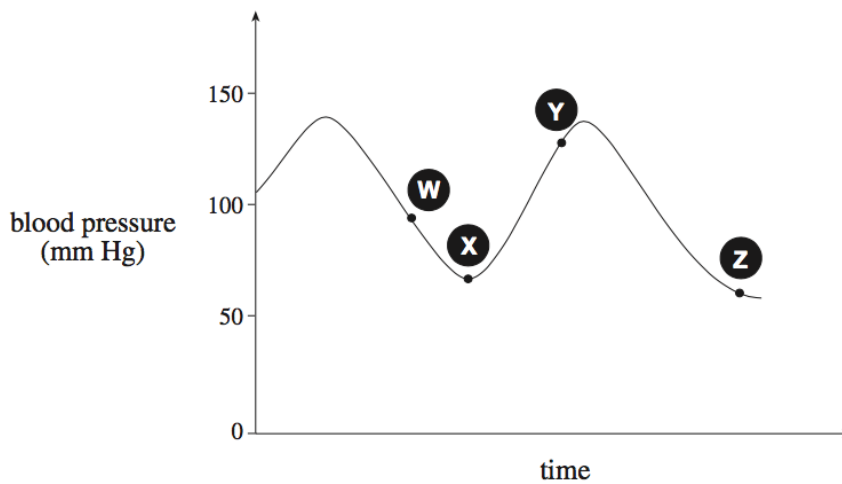
- (b) Relate the difference in the structure of X and Y to their functions. (2 marks)

X has thin muscle walls because it pumps blood to the lungs (1)
 Y has thick muscle walls because it pumps blood around the body (1)

- (c) Explain why it is important that blood flows very slowly in the capillaries. (1 mark)

Gives time for exchange of gases / nutrients / wastes between the capillary and the cells (1)

The graph below shows changes in blood pressure in the aorta over time.



- (d) Which letter on the graph above (W, X, Y or Z) would show when ventricular systole is occurring? Justify your decision. (2 marks)

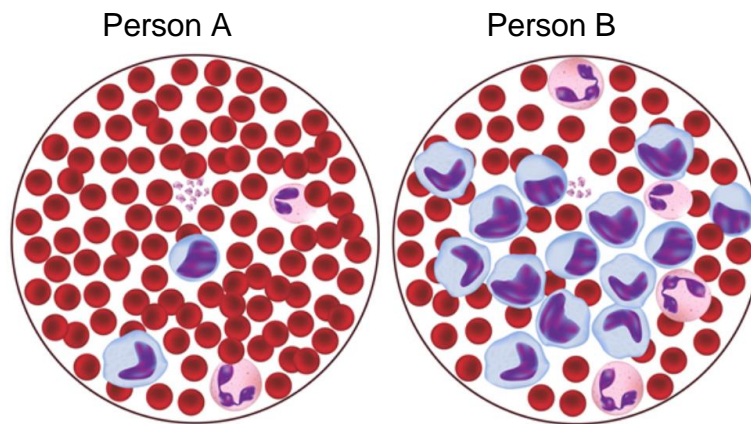
Y (1)

It is the highest point on the graph (1)

- (e) Complete the following table. (4 marks)

| Structure | Location in the heart | Function |
|-------------------------|-----------------------|---|
| Sinoatrial node | Right atrium (1) | Is the pacemaker of the heart (1) |
| Atrioventricular bundle | septum (1) | Sends nerve impulse to the purkinje fibres / to heart cells (1) |

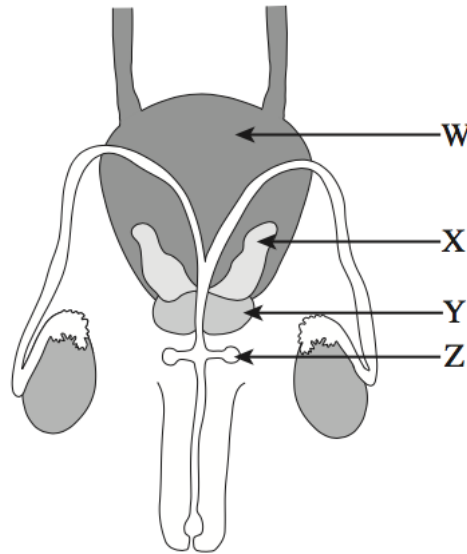
- (f) Two people were admitted to hospital and the doctor took blood from them and looked at it under the microscope. This is what she saw:



- (i) If the field of view of the blood of Person A is 1.1mm, what is the average diameter of the red blood cells? (1 mark)
- $1.1\text{mm}/14 \text{ cells} = 0.078 \text{ mm}$ (accept 0.075-0.085mm) (1)
- (ii) The doctor changed the magnification of the microscope to a higher powered objective. How would this change the image? (1 mark)
- See less cells / see more detail of the cells (Any 1, 1 mark)
- (iii) According to their blood test, which person appears to be unwell? Explain your answer. (2 marks)
- Person B (1)
Has a large number of white blood cells that fight disease (1)

Question 35

(10 marks)



- (a) Name the following structures and identify one function of each. (4 marks)

W bladder - (1) – stores urine (1)

Y prostate (1) – produces alkaline fluid to support sperm survival (1)

- (b) Give three characteristics of semen and describe how each of these characteristics facilitates the function of semen. (6 marks)

mucous (1) – makes it easier for sperm to move (1)

alkaline (1) – counteracts the acidity of the vagina / stops sperm being killed by the acidic nature of the vagina (1)

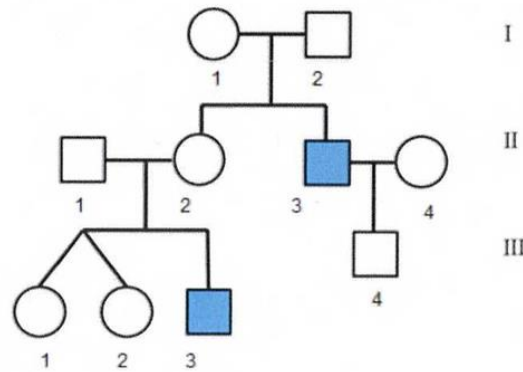
glucose (1) – provides energy for sperm motility (1)

sperm (1) – to fertilise the egg (1)

(any 3 characteristics, named and described, 1 mark each)

Question 36

(12 marks)



(a) What is the most likely mechanism of inheritance – dominant or recessive? Explain your answer. (2 marks)

recessive (1)
 I.1 and I.2 are not affected and their child II.3 is (1)

(b) If this condition was autosomal, what would be the genotypes of the following individuals? Use the letters A and a. (2 marks)

III.3 aa (1)
 I.1 Aa (1)

(c) If this condition was sex linked, what would be the chance of II.1 and II.2 having an affected girl as their fourth child? Show your working. Use the letters A and a. (3 marks)

Mum – $X^A X^a$ (1)
 Dad - $X^A Y$

| | | |
|-------|-----------|-----------|
| | X^A | X^a |
| X^A | $X^A X^A$ | $X^A X^a$ |
| Y | $X^A Y$ | $X^a Y$ |

(1)

0% (1)

- (d) ABO blood groups demonstrate two different mechanisms of inheritance. Identify these two different mechanisms and explain how a mother with A type blood and a father with B type blood can produce two children, one with AB type blood and the other with O type blood. (5 marks)

Codominance (1)

Multiple alleles (1)

Mum - $I^A i$

Dad - $I^B i$ (1)

| | | |
|-------|-----------|---------|
| | I^A | i |
| I^B | $I^A I^B$ | $I^B i$ |
| i | $I^A i$ | ii |

(1)

AB child gets A from mum and B from dad

O child gets O from mum and dad (1)

Question 37**(20 marks)**

A large pharmaceutical company conducted a trial on 40 mice to determine the effectiveness of their new drug, OA218, in reducing the symptoms associated with osteoporosis. Each group was made up 10 female mice aged 3 years. The average lifespan of laboratory mice is 3 – 4 years. Group 1 were given 10mg of OA218 mixed in with their daily diet of grain pellets. Group 2 were given 10mg of OA218 as a daily injection after they had been given their daily diet of grain pellets, while Group 3 were given 20mg of OA218 mixed in with their daily diet of grain pellets. Once the experiment began, density of the neck of the femur was calculated using scanning technology at one month, 7 months and 12 months after the trial began.

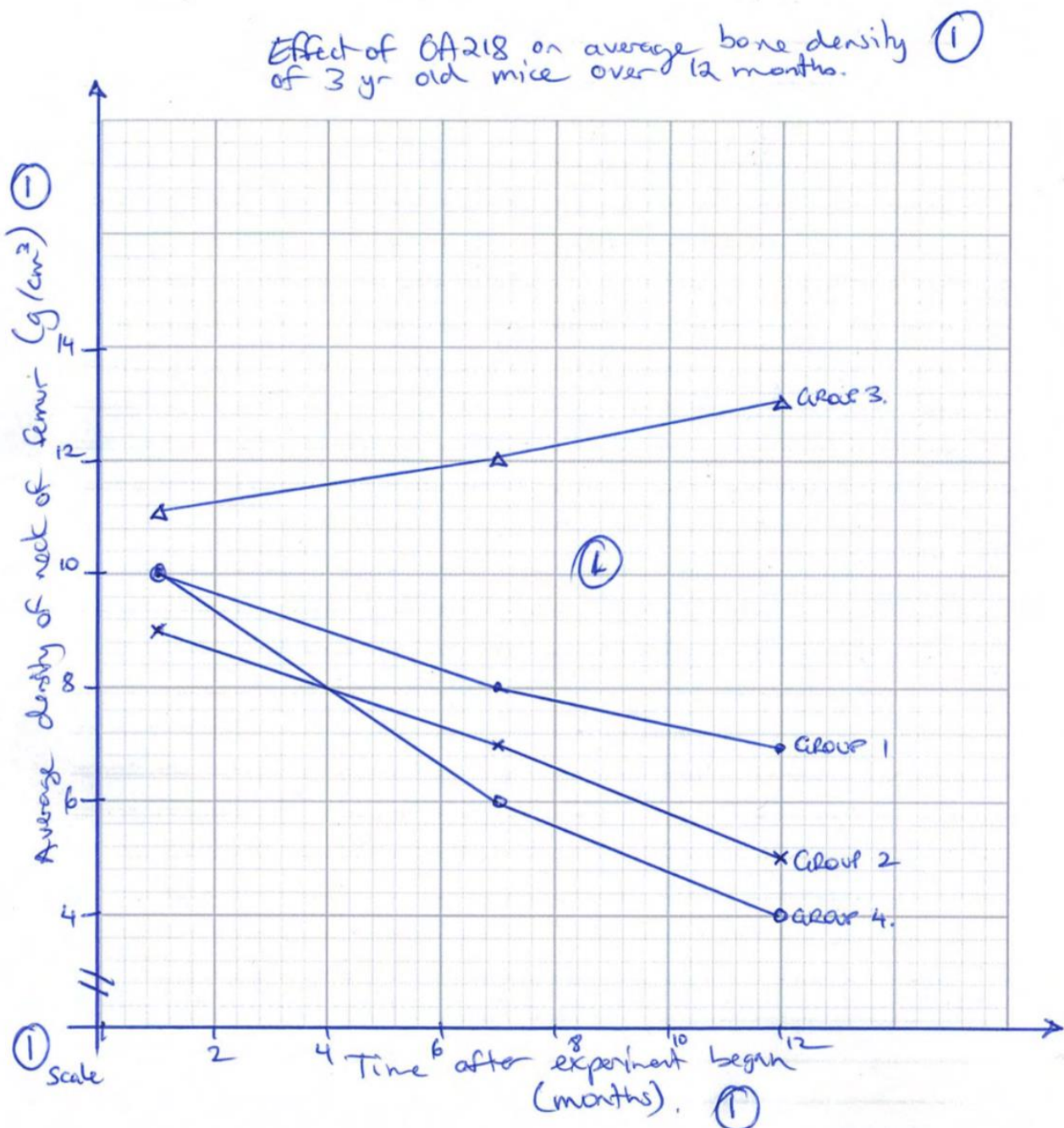
- (a) (i) State one hypothesis the company could have been testing in this trial. (2 marks)
If OA218 is consumed in the diet then density of neck of femur will be greater /
If OA218 is injected then density of neck of femur will be greater than if
consumed in the diet (2)
If no direction given (1)
- (ii) Identify the independent variable for this hypothesis. (1 mark)
OA218 injected / given (1)
- (b) Name two variables the company controlled in their trial. (2 marks)
females / 3 years old / diet of grain pellets / scanning technology / when tested / used
laboratory mice / density of neck of femur
(Any 2, 1 mark each)
- (c) Name one other variable the company should have controlled in this trial. (1 mark)
exercise / sunlight / other foods given / (Any 1, 1 mark)
- (d) Group 4 were the control group.
- (i) What is the term given for what all control groups should be given? (1 mark)
placebo (1)
- (ii) As the control group for this experiment, what should these mice be given? (1 mark)
grain pellets only (1)
- (e) This trial was done as a double blind trial. Explain what this term means and indicate the advantage of conducting this experiment in this way. (2 marks)
neither the subject nor the experimenter knows which subject is in which group (1)
prevent bias (1) – do not accept psychological impact as subjects are mice

The company collected the following results:

Title: Effect of OA218 on average bone density of three year old mice over 12 months

| Time after experiment began (months) | Average density of neck of femur (g/cm ³) | | | |
|--------------------------------------|---|---------|---------|---------|
| | Group 1 | Group 2 | Group 3 | Group 4 |
| 1 | 10 | 9 | 11 | 10 |
| 7 | 8 | 7 | 12 | 6 |
| 12 | 7 | 5 | 13 | 4 |

- (f) Graph the data to show the effect of OA218 on average density of the neck of the femur. A spare graph can be found on Page 39 if required. (5 marks)



- (g) According to the data, what conclusion can be made about the effect of OA218 on bone density? (1 mark)

OA218 slows osteoporosis / slows reduction in bone density
20 mg of OA218 in the diet has the best effect / increases bone density
(any 1, 1 mark)

- (h) The company wanted to know the average bone density for Group 2 at 15 months after the trial began, and 13 months after the trial began for Group 4. Which of these two results would provide the most reliable data? Explain your answer. (2 marks)

13 months for Group 4 (1)
Closest to the last known data point / 12 month point (1)

- (i) Based on their results from this trial, the company prepared to apply for human trials.

- (i) Name one ethical consideration that would be the same in the two trials. (1 mark)

reduce number of subjects / minimise adverse effects (1)

- (ii) Describe one ethical consideration that would only be required in a human trial. (1 mark)

right to withdraw / confidentiality / informed consent (any 1, 1 mark)

End of Section Two

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Section Three: Extended answer

20% (40 Marks)

This section has **three** questions. You must answer **two** questions. Write your answers on the pages following Question 40.

Supplementary pages for planning / continuing your answers to questions are 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: 50 minutes.

Answer any **two** questions from Questions 38 to 40.

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

Question 38

(20 marks)

- (a) Discuss how lifestyle choices, such as diet, alcohol, nicotine and chemicals may affect foetal development. (8 marks)

diet – increase folate to reduce neural tube defects / increased calcium intake for proper bone formation / increased protein for development (Any 2, 1 mark each)

nicotine – smoking reduces birthweight / increased risk of SIDS / respiratory diseases in first year (Any 2, 1 mark each)

alcohol – is a teratogen and causes changes in genetic material of sex cells / associated with foetal alcohol syndrome / low birth weight / slow growth / mental retardation / poor attention span / hyperactive (Any 2, 1 mark each)

chemical – thalidomide / lack of limb formation / illicit drug causes babies to be born addicted (Any 2, 1 mark each)

- (b) Use an example of each to compare and contrast the structure and function of synovial joints and slightly moveable joints. (6 marks)

| | Synovial joints | Slightly moveable joints |
|---------------------------------------|---|--|
| Structure – Compare (Any 1, 1 mark) | Where bones meet / have two or more bones coming together | |
| Structure – Contrast (any 1, 2 marks) | Synovial fluid / Hyaline cartilage | No synovial fluid / No hyaline cartilage |
| Function – Compare (Any 1, 1 mark) | Allow movement | |
| Function – Contrast (Any 1, 2 marks) | Large amount of movement / Wide variety of movements | Small / limited movement / Limited variety of movement |

Max 5 marks if no named examples used in their answer

- (c) Discuss how variation in the genotypes of offspring, including gender, arise as a result of the processes of meiosis and fertilisation. (6 marks)

(Any 2 of the following, 1 mark for name, 1 mark for discussion, max 4 marks)

Random assortment of chromosomes (1) - when the maternal and paternal chromosomes line up by chance on either side of the equator at metaphase (1)

Crossing over (1) – Homologous chromosomes exchange material at metaphase which occurs randomly (1)

Non-disjunction (1) – pairs of homologous chromosomes fail to separate at metaphase which alters the chromosome number in each gamete being formed (1)

Mutation / any named mutation (1) - changes the DNA so that different proteins are formed (1)

(Compulsory marks, 1 mark for name, 1 mark for discussion)

Random fertilisation (1) – which sperm fertilises the egg results in a random zygote being formed (1)



Question 39

(20 marks)

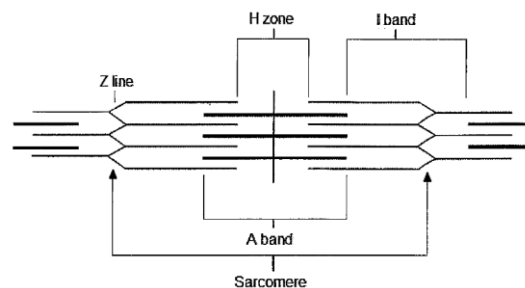
- (a) Using diagrams, outline how the sliding filament model can be used to explain muscle contraction. (12 marks)

Correctly labelled diagram: (3 marks)

actin and myosin (1)

Z line / H zone / I band (1)

sarcomere (1)



(Any 9 marks, 1 mark each)

acetylcholine moves across motor end plate / nervous stimulation (1)

causes release of calcium by sarcoplasm (1)

myosin acts as an enzyme (1)

to cause ATP to breakdown to ADP + P + energy (1)

calcium binds to troponin / exposes binding site for myosin (1)

myosin filaments on the cross bridge unite with the actin filaments (1)

actin slides over myosin (1)

sarcomere contracts / shortens / Z lines drawn closer together (1)

calcium returned to sarcoplasm (1)

actin and myosin separate (1)

sarcomere relaxes (1)

- (b) Describe the changes involved in the development of the zygote from conception to its implantation in the endometrium wall. (8 marks)

Zygote is the fertilised egg (1)
Undergoes mitosis / cleavage (1)
Forms a morula (1)
Which is a solid ball of cells (1)
Becomes a blastocyst (1)
Which is a hollow ball of cells (1)
Develops an inner cell mass (1)
Thickened at one end (1)
Surrounded by a cavity that contains fluid (1)



Question 40

(20 marks)

- (a) Infertility occurs in approximately 10% of couples. Describe two different treatments that couples may try in order to overcome male infertility. (6 marks)

(1 mark for name of method, any other 2 marks for each description)

| Name of Method | Description |
|---|--|
| Artificial insemination by donor / AID (1) | Not enough sperm / viable sperm are produced by the man (1) |
| | Sperm are collected from a donor and inserted into the female's vagina (1) |
| Intracytoplasmic sperm injection / ICSI (1) | Sperm count is very low (1) |
| | Single sperm is injected into a single egg (1) |
| | Resulting embryo is implanted into uterus (1) |

- (b) Compare and contrast spermatogenesis and oogenesis. (6 marks)

| | Spermatogenesis | Oogenesis |
|--|--|---------------------------------|
| Compare (Any 2, 1 mark each) | Produce gametes / undergo meiosis / 23 chromosomes in daughter cells / occur in gonads / produce haploid cells | |
| Contrast (First 2 contrasted points, 1 mark each point, max 4 marks) | Produces 4 viable daughter cells | Produces 1 viable daughter cell |
| | Does not produce polar bodies | Produces polar bodies |
| | Occur in testes / seminiferous tubules | Occur in ovaries |
| | Develop a tail | Remain tailless |
| | Begins at puberty | Begins at birth |
| | Never-ending | Ends at menopause |
| | Completed prior to release | Completed at ovulation |

- (c) Discuss how one named chemical and one named physical contraceptive prevent pregnancy from occurring. Include in your discussion what type of person would utilise these techniques, as well as any limitations of the named techniques.

(8 marks)

| | Description of how it prevents pregnancy (1 mark) | Type of person using this (1 mark) | Limitations (1 mark) |
|--|--|--|--|
| Chemical (first 1 named, 1 mark, description 1, person 1, limitation 1 – max 4 marks) | | | |
| Contraceptive pill | Tablet containing female hormones prevents ovulation | Women in relationships / one night stands | Clots / heart disease / nausea / bleeding / doctor visit / costly |
| Morning after pill | Pills taken after sex that prevent ovulation / implantation | One night stand / unprotected sex / raped | Nausea / bleeding / |
| Implanon / depoprovera / mini pill | Contain progesterone only and thickens cervical mucous to prevent sperm entering uterus | Long term relationships | Can be lost in body / need to be removed prior to pregnancy / doctor visit |
| Douche | Chemical wash of vagina to kill sperm inside it | Older women | Very ineffective / messy / must be done immediately after ejaculation doesn't prevent STIs |
| Spermicide | Chemicals that kill sperm / make sperm unable to penetrate cervical fluid | Older females | Must be used in conjunction with other contraceptives / doesn't prevent STIs |
| Physical (first 1 named, 1 mark, description 1, person 1, limitation 1 – max 4 marks) | | | |
| Rhythm Method | Take temperature / mucous secretion to determine when ovulation is occurring and not have sex at that time | Religious / women with regular cycles / established couples | Can't have sex / high degree of ineffectiveness |
| Withdrawal | Removal of penis prior to ejaculation so sperm don't enter vagina | Unprepared / young | Ineffective / some semen lost prior to ejaculation / doesn't prevent STIs |
| Condom/femidom | Rubber sheath put on penis/in vagina prevent semen entering vagina | Young males | Deteriorate in heat / not put on effectively / consent from opposite partner |
| Diaphragm | Rubber cap that fits over cervix and prevents sperm entering uterus/cervix | Older women / women who don't like chemical methods | Must be fitted by a doctor initially / doesn't prevent STIs / must be fitted prior to sex |
| IUD | Metal / plastic device inserted into uterus that prevents implantation | Older couples / established relationships / already had children | Intermittent bleeding / pain / infertility / doesn't prevent STIs |

End of questions

See next page