METHODIST LADIES' COLLEGE

Semester 1 Examination, 2015

Question/Answer Booklet

HUMAN BIOLOGY ATAR Year 11

Student Name: _____

Teacher: _____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: two and a half 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, pencils, eraser, correction fluid, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

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 exam
Section One: Multiple-choice	25	25	30	25	20
Section Two: Short answer	7	7	70	70	60
Section Three: Extended answer	3	2	50	40	20
					100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010.* 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, do not erase or use correction fluid, and shade your new answer. 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 your 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(s) that you are continuing to answer at the top of the page.

Section One: Multiple-choice **20% (25 Marks)**

This section has **25** 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, do not erase or use correction fluid, and shade your new answer. 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 for this section is 30 minutes.

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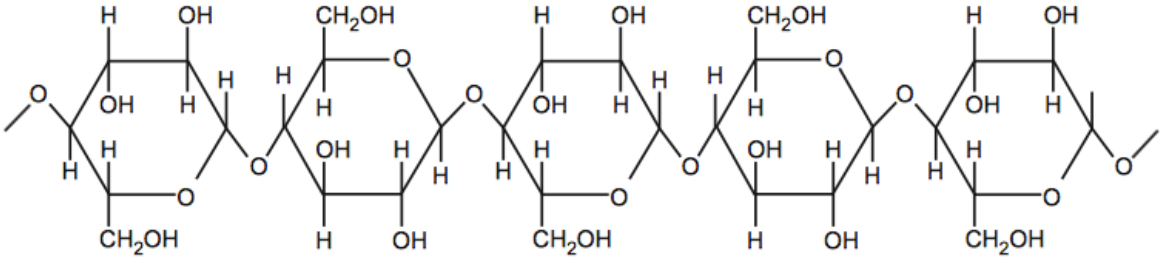
1. The body can be sequentially divided into units of increasing size. From the largest to the smallest units, the correct sequence is:

   (a) cells, organs, tissues, organ systems
   (b) organs, cells, tissues, organ systems
   (c) cells, tissues, organs, organ systems
   (d) organ systems, organs, tissues, cells

2. Resolution of an observed image on a microscope slide refers to the:

   (a) point when the object comes into focus.
   (b) best lighting achieved by correct alignment of the lenses.
   (c) highest magnification achieved without loss of focus.
   (d) minimum distance between two objects that are distinctly separate.

Question 3 refers to the diagram below. It is a part of a molecule found in cells.



3. In a cell, this molecule would:

   (a) act as an enzyme
   (b) contain genetic information
   (c) be synthesised from glucose molecules
   (d) transport information from the nucleus to the cytosol

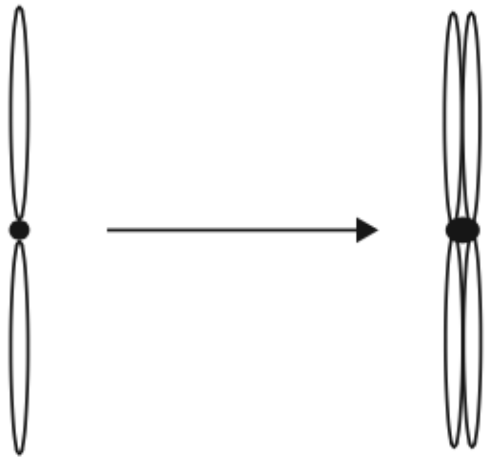
4. Three factors that would lead to the conclusion that muscle cells are amongst the most energetically active cells in the body, include the observations that

(a) they possess many nuclei, they can contract and they include a lot of endoplasmic reticulum
(b) they have many mitochondria, they store energy in the form of oxygen and they have many Golgi bodies
(c) they have many mitochondria, they produce excess heat in the body when in use and they store extra energy in forms that can be easily broken down to ATP
(d) they have many Golgi bodies, they have many endoplasmic reticulum and they can contract

5. The cell membrane is made up mostly of

(a) glycoprotein
(b) carbohydrate
(c) globular proteins
(d) phospholipids

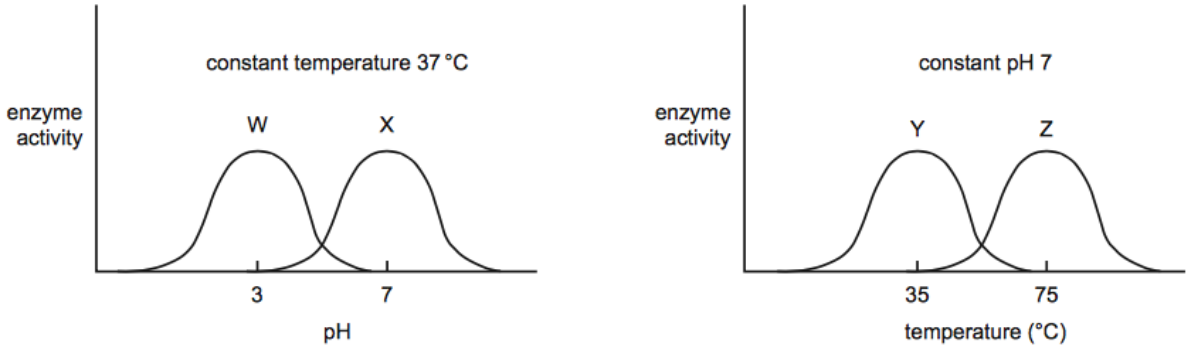
Consider the diagram below to answer question 6



6. The process shown above occurs

(a) In mitosis
(b) In meiosis
(c) In the synthesis or ‘s’ phase of the cell cycle
(d) Whenever DNA replicates itself, thus in a or b above

The following graphs show the way four enzymes, W, X, Y and Z, change their activity in different temperature situations.



7. Which of the student's suggestions are consistent with the data in the graphs?

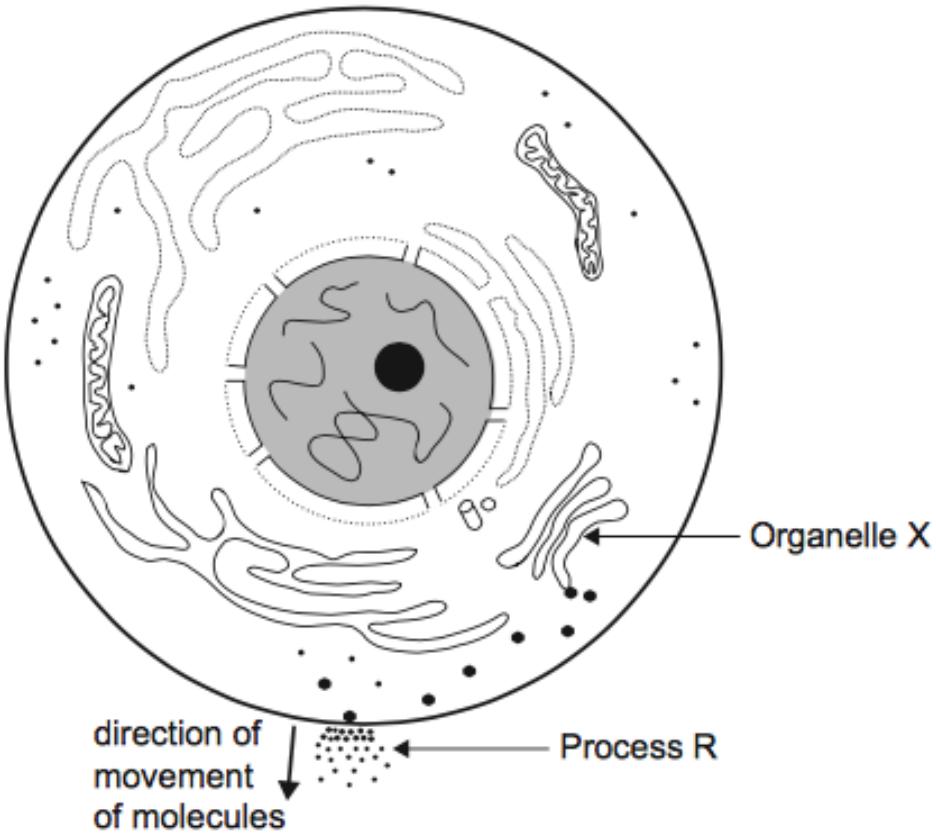
(a) At pH 7, enzyme Y is denatured at temperatures below 20°C
(b) Enzyme Z only functions optimally at pH 7
(c) At pH 3 and a temperature of 37°C, the active site of enzyme W bonds well with its substrate
(d) Enzyme X only functions at pH 3 and a temperature of 37°C

8. ATP is essential to every living cell because it:

(a) reacts with energy from glucose to form ADP
(b) speeds up digestion of carbohydrates
(c) stores energy in a form that is readily available in appropriately small amounts
(d) stores energy released during the breakdown of ADP

9. The part of a molecule referred to as a codon can be found in:

(a) DNA
(b) transfer RNA
(c) ribosomal RNA
(d) messenger RNA



Source: www.cronodon.com

10. Process 'R' shown in the diagram above is an example of

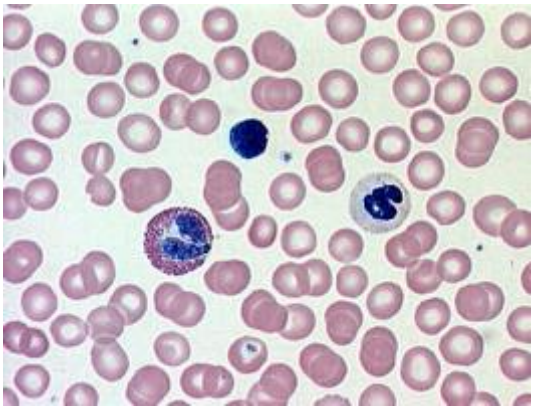
(a) exocytosis
(b) phagocytosis
(c) pinocytosis
(d) endocytosis

11. Organelle X

(a) is the site of protein synthesis
(b) packages protein molecules for export from the cell
(c) produces ribosomal RNA
(d) is the site of cellular respiration within the cell

12. A mutation is best described as:

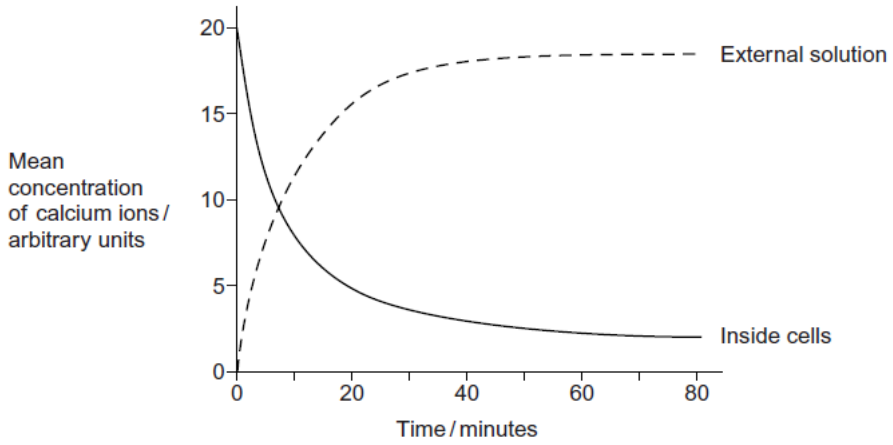
(a) A change to the genes that are beneficial to survival
(b) A change due to the gametes that increases genetic variation in a population
(c) A change in the nucleotide sequence in a cell
(d) A change to a nucleotide sequence that occurs only in somatic (body) cells



13. The diagram above is showing which tissue type?

(a) muscle
(b) connective
(c) epithelial
(d) nervous

Scientists placed human cells in a solution of Calcium ions. At regular intervals, they measured the concentration of calcium ions in the external solution and the concentration of calcium ions inside the cells. Their results are shown in the graph.



14. The best description of the transport process of Calcium ions across the cell membrane illustrated in the graph is?

(a) Passive Diffusion through a channel, because it happens rapidly
(b) Active transport by a carrier protein, as the Calcium ion is being transported against the concentration gradient
(c) Active transport by an enzyme, as the Calcium ion is being transported from regions of high concentration to low
(d) Facilitated diffusion via a carrier protein, as the Calcium ion needs do not bind to the carrier but simply move from one side of the membrane to the other.

15. The Endoplasmic reticulum

(a) is responsible for digestive activities in the cytoplasm of the cell
(b) provides a network of channels for transport around the cell
(c) produces sugars
(d) is site for cellular aerobic respiration

16. Which of the following statement about cancer is **INCORRECT?**

(a) cancer of muscle tissue is the most common type of cancer in Australia
(b) cancer results from uncontrolled mitosis
(c) the process by which cancer spreads in lymph or bone is metastasis
(d) cancers are most common in older people

17. A female patient at a Doctor's surgery presented with the following symptoms. She had two small hard circular, reddish brown and painless sores on her lips. The patient was 26 years old and had started a new relationship a few weeks prior to the appointment. Which of the following Sexually Transmitted Infections is she most likely to have?

(a) genital herpes
(b) chlamydia
(c) gonorrhoea
(d) syphilis

18. A woman who has heavy scarring to her uterus and has had an ectopic pregnancy that miscarried in the recent years wants to have a baby. Which reproductive technology would be best suited to her?

(a) Artificial insemination
(b) Donor embryo
(c) In vitro fertilisation(IVF)
(d) Surrogacy

19. The semen is made up of, in decreasing order of volume:

(a) sugary fluid, alkaline fluid, a lubricant and sperm
(b) hundreds of millions of sperm
(c) sperm, sugary fluid, acidic fluid
(d) enzymes, fructose and acids

20. Progesterone secretion decreases sharply near the end of the menstrual cycle because

(a) pregnancy results
(b) ovulation occurs
(c) a Graafian follicle develops
(d) the corpus luteum degenerates

21. A man is unsure of his parentage to a new born baby. What test can be done to determine his parentage with a high amount of certainity?

(a) Blood test
(b) amniocentesis
(c) DNA profiling
(d) Chorionic villus sampling

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

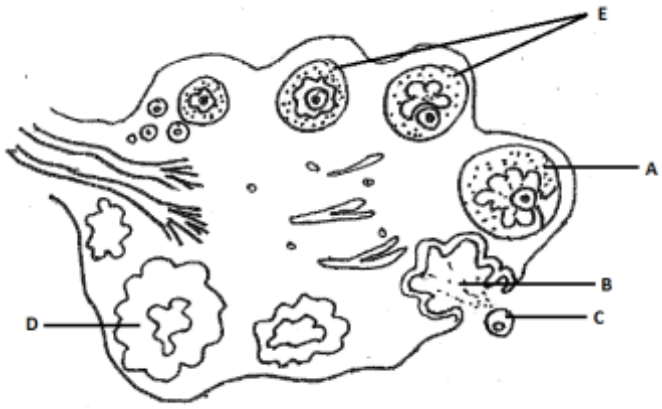
i. dilation of the cervix
ii. delivery of the placenta
iii. breaking of the waters
iv. contractions of the uterus
v. secretion of oxytocin
vi. delivery of the baby

Using the above, the normal sequence of events is

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

23. Three of the most reliable early symptoms of pregnancy are

(a) Increased hunger, weight gain and bloatedness
(b) Tender breasts, lack of menstruation, presence of Human Chorionic Gonadotrophin (HCG) in urine sample
(c) Increased size of abdomen, increased blood volume, increased weight gain
(d) Lack of menstruation, presence of HCG in blood sample, bloatedeness



24. Looking at the diagram above. The name of the part labelled D is?

(a) Graafian follicle
(b) Oviduct
(c) Ovary
(d) Corpus luteum

25. Two major changes that occur to a baby as they are born include?

(a) The babies lungs are covered in surfactant so that they can expand and the baby can breathe
(b) The foramen ovale closes as does the ductus arteriosis so that blood is forced to flow through the right side of the heart then to the lungs
(c) The blood flowing to the placenta is constricted at the belly button
(d) The babies brain starts to function and they cry

Section Two: **Short answer 60% (70 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the space provided.

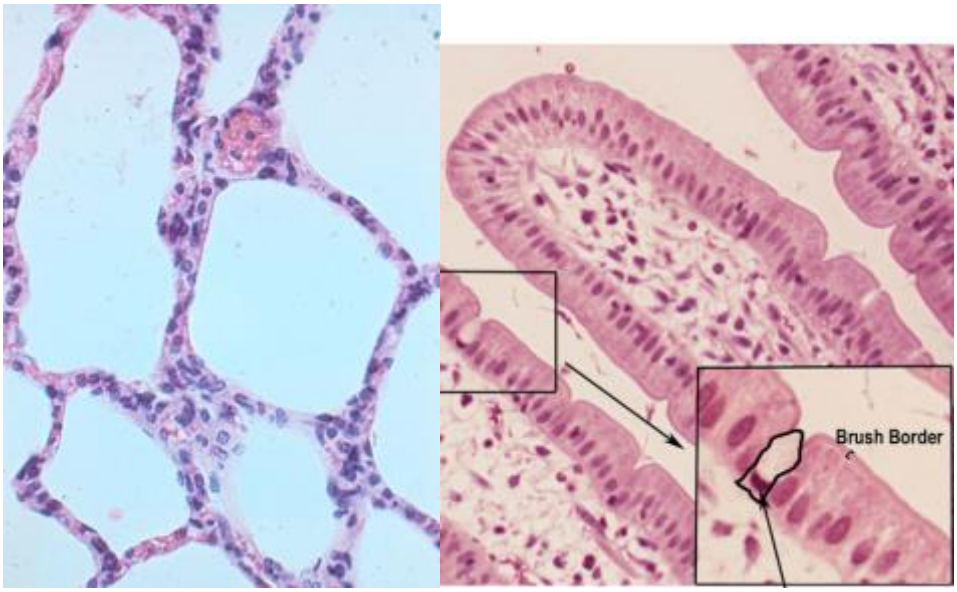
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare 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(s) that you are continuing to answer at the top of the page.

Suggested working time for this section is 70 minutes.

Question 26 **10 marks**

The diagram below shows two slides, A and B as seen under the electron microscope.



A B

a) Which particular type of tissue is shown in slides A and B?

_____

1 mark

b) Describe the general function of this tissue type.

_____

_____

1 mark

c) Explain one characteristic of this tissue type that makes it well suited to its general function.

_____

_____

1 mark

d) For each of the slides shown above, describe where you might find this tissue.

A_____

B_____

2 marks

e) Glucose is a very necessary energy source for the body, as brain cells in particular use glucose in aerobic respiration to provide energy.

i. What is the full name of the principal chemical carrier of energy produced in aerobic respiration?

_____

1 mark

ii. What are two advantages of using the molecule named above, as the energy carrier in the cell.

_____

_____

_____

2 marks

iii. Glucose will cross the cell membrane when a cell has little glucose in the cytoplasm relative to the extracellular fluid, for example after fasting, and when there is an excess of glucose in the cytoplasm relative to the extracellular fluid, for example after a very sugary meal when the cells have already taken up a lot of glucose.
Describe the process by which glucose is transported across the cell membrane in each of these cases.

A. After fasting: _____

B. After a very sugary meal: _____

2 marks

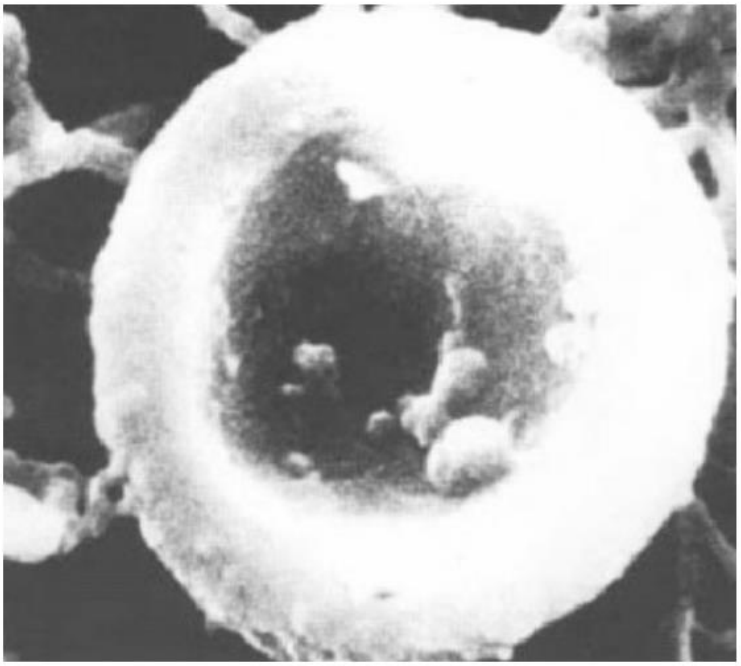
Question 27 10 marks

a) In the table below, place the appropriate name of the microscopic part that best matches the function given.

Microscope part	Function
stage	Provides a stable platform for holding slides of the sample object
…….	Magnifies the image of the object typically by × 4, × 5, × 20
…….	Magnifies the image again to be detected by the user's eye

2 marks

b) Consider the image below of a red blood cell.



The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.
Use the formula to calculate the magnification of the photograph.

diameter on photograph = real diameter × magnification

Magnification = ...

2 marks

b. i. A light microscope with a measured field of view diameter of 2.4 mm is being used.
Calculate the total magnification of the microscope when a x4 ocular and a x5 objective lens are used.

1 mark

ii. Would the above magnification be considered high or low powered on the school light microscopes?

_____

1 mark

iii. A student now changes the objective lens to x20 magnification.
What is the diameter of the new Field of View in micrometres
[Show all of your workings]

2 marks

iv. If the student can see 10 cells sitting side by side across the diameter of the final Field of view, how wide is each cell?

2 marks

Question 28 **10 marks**

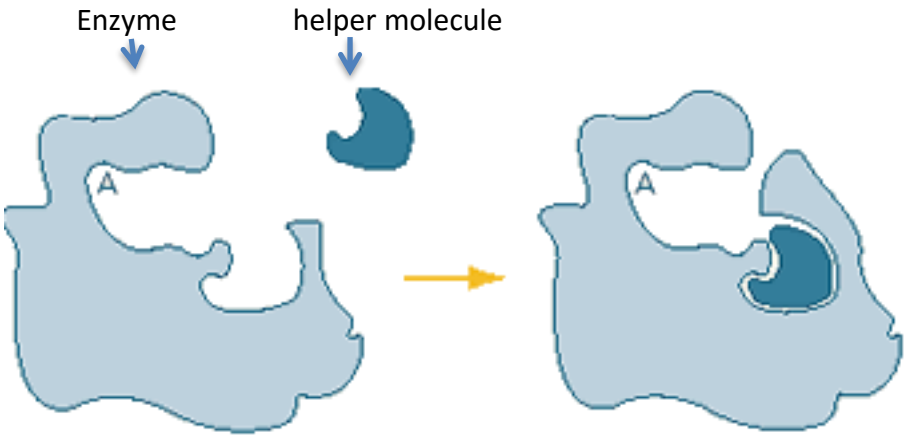
In addition to proteins, other helper molecules are necessary for many enzyme reactions.

a) These helper molecules are called?

_____

1 mark

Folic acid, a B vitamin, is one of these helper molecules. It has been determined that these molecules assists by improving the fit between numerous enzymes and their substrates.



b) Mark on the diagram above where the active site for the enzyme is **likely** to be.

1 mark

c) Explain fully how an enzyme, will work to assist a chemical reaction.
[Hint: the space below may be used for a modelled reaction]

_____

_____

_____

_____

_____

4 marks

d) i) Describe what is meant when an enzyme is denatured.

_____

_____

1 mark

ii) Describe the effect that denaturing has on the activity of an enzyme.

_____

_____

1 mark

e) ATP synthase is an enzyme that catalyses the synthesis of ATP within the mitochondria. Identify the substrates for the reaction catalysed by ATP synthase.

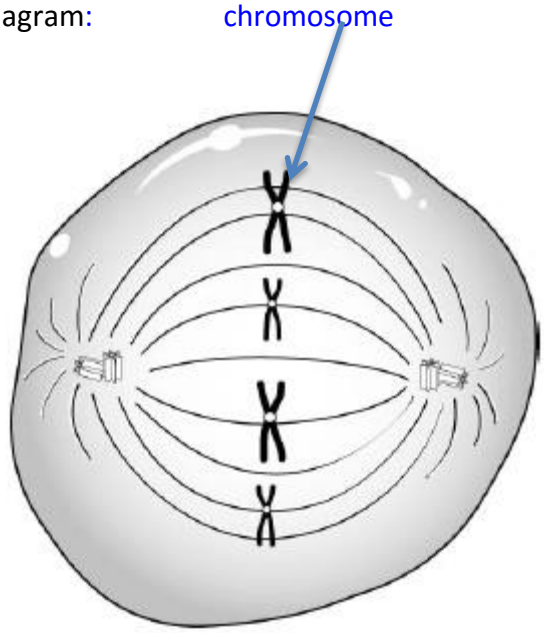
_____

_____

2 marks

Question 29 **10 marks**

a) Complete the table below comparing and contrasting mitosis and meiosis processes for a cell with 2 pairs of homologous chromosomes by adding diagrams where indicated.

Mitosis	**Meiosis**
Prophase : Chromosomes appear	Prophase I : Chromosomes appear
Chromatids **do not** cross over	Chromatids **may** cross over .
Metaphase : Label: chromosome Diagram: chromosome 	Metaphase I : Label: Homologous chromosomes **Diagram**:
Anaphase: Label: centromere, chromatids **Diagram**:	Anaphase I : Label: centromere, homologous chromosomes **Diagram**:
Telophase : two groups of chromatids come together, uncoil and form new nuclei	Telophase I : two groups of chromosomes come together but do not uncoil

5 marks

b) For the table in Question 29a), in meiosis only the first division is shown. Explain what would happen to the chromosomes in the second nuclear division of meiosis.

_____

1 mark

c) Name 2 ways variation can be increased in sexual reproduction.

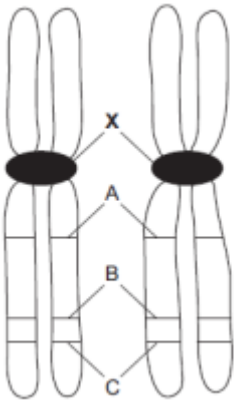
_____

_____

_____

2 marks

The diagram below shows two chromosomes in a cell undergoing cell division.



A – Gene for feature A
B – Gene for feature B
C – Gene for feature C

d) These are homologous chromosomes. Identify two pieces of evidence from the diagram that supports this.

_____

_____

_____

2 marks

Question 30 **15 marks**

A research scientist finished her research and published her findings about an exciting new drug, Sconol. She had trialled the drug on 80 adult patients suffering from exercise triggered asthma over a three month period.

It is thought that the use of the mouth when breathing increases the stress on the bronchioles resulting in constriction of the airways.

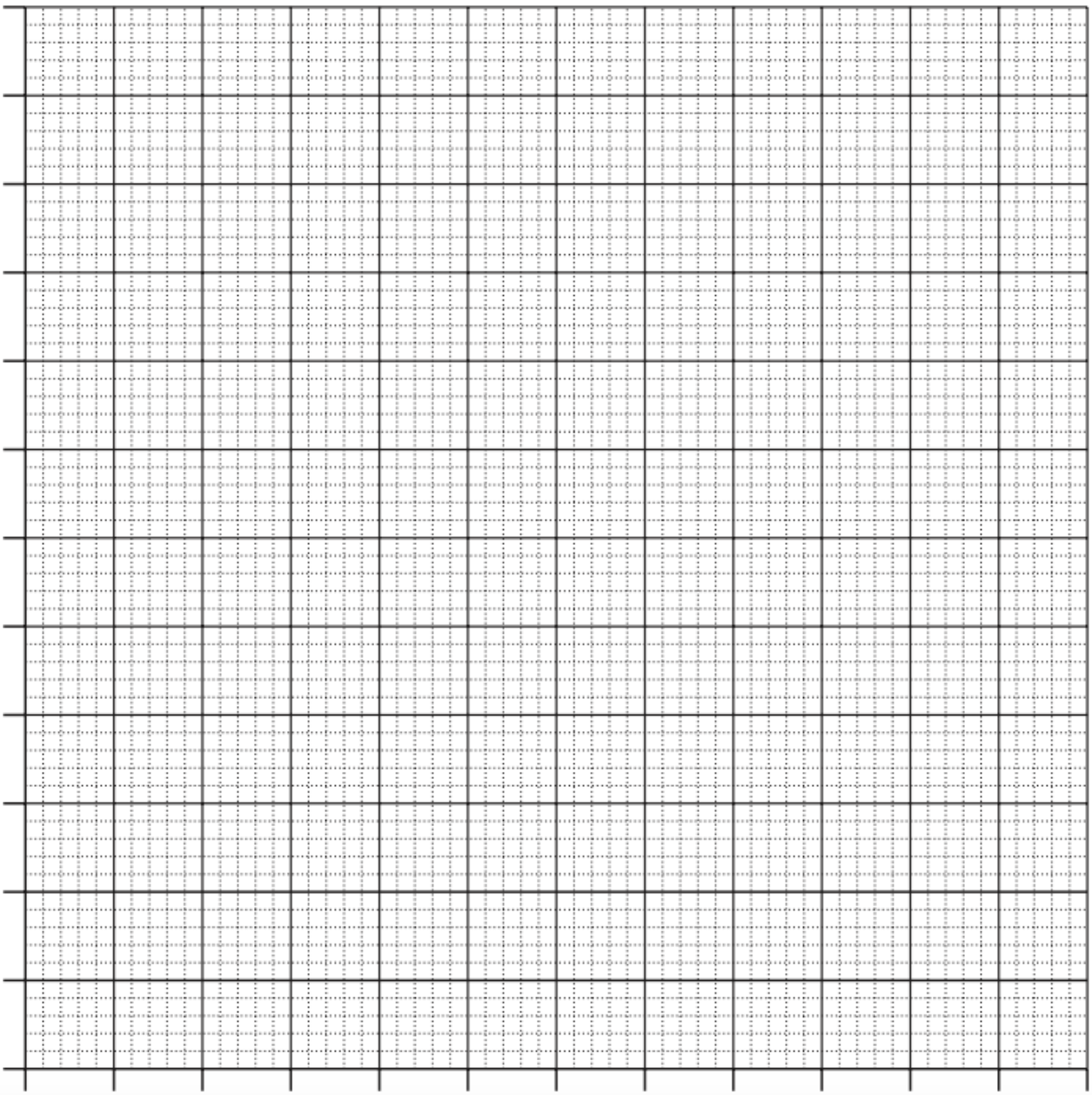
Group 1 took one Sconol tablet daily. Group 2 took a daily dose of a sugar-coated tablet containing no Sconol. Neither the participants nor the investigator knew which tablet was being taken at the time.

Breathing rates were taken immediately after the end of 10 minutes sustained exercise that everyone in the research group participated in each morning at 10.00am in a particular university room. The breathing rate measured at the beginning and the end of the trial period each day is recorded. The results are shown below.

	Average Volume of air inhaled per minute (m^3/minute)	
Time	**Group 1**	**Group 2**
Before treatment at rest	.01	.01
Before treatment after exercise	.04	.04
After 1 month of treatment after exercise	.042	.04
After 2 months of treatment after exercise	.046	.041
After 3 months of treatment after exercise	.05	.04

a) Graph the data on the grid on the next page.
(spare grid paper is provided at the back of this booklet if required)

5 marks



b) What hypothesis was the investigator trying to test?

_____

_____

_____

2 marks

c) In this investigation, identify the dependent variable

_____

1 mark

d) Why is it important that the sample be exclusively adult in this investigation?

_____

1 mark

e) Identify two variables that were controlled in this investigation.

_____

_____

_____

_____

2 marks

f) Suggest two factors that could increase ‘stress’ on the bronchioles when breathing through the mouth?

_____

_____

_____

2 marks

g) Suggest two improvements that would increase the reliability of the results.

_____

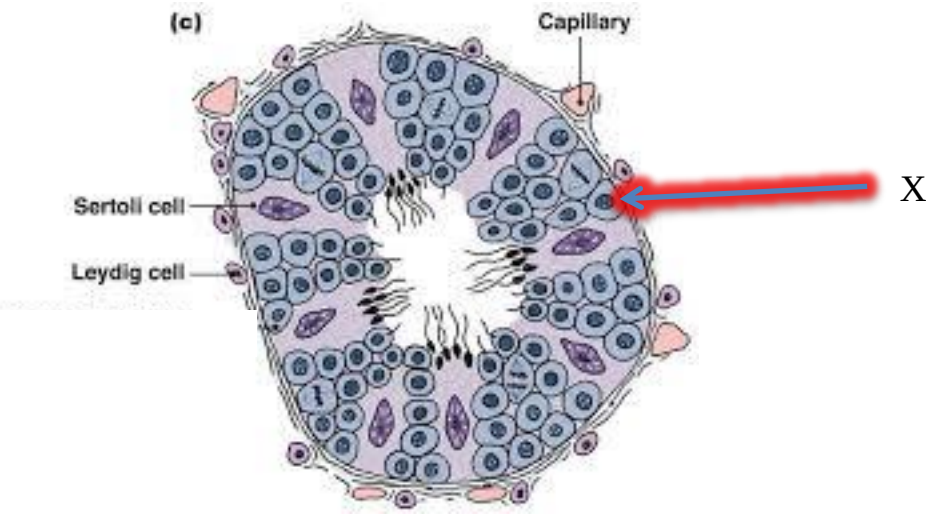
_____

_____

2 marks

Question 31 5 marks

This question refers to the diagram of the male reproductive system below.



a) Identify the cell indicated by the label.

_____

1 mark

b) What is the name of the tube shown in the cross section diagram above?

_____

1 mark

c) Once the sperm have formed they will swim along the tube to 'rest' in the epididymis. Continuing from the epididymis is the Vas deferens. What is the name of the process in which the Vas deferens is cut as a form of sterilisation?

_____

1 mark

A laboratory technician was examining a semen sample mixed with an egg and observed the following:

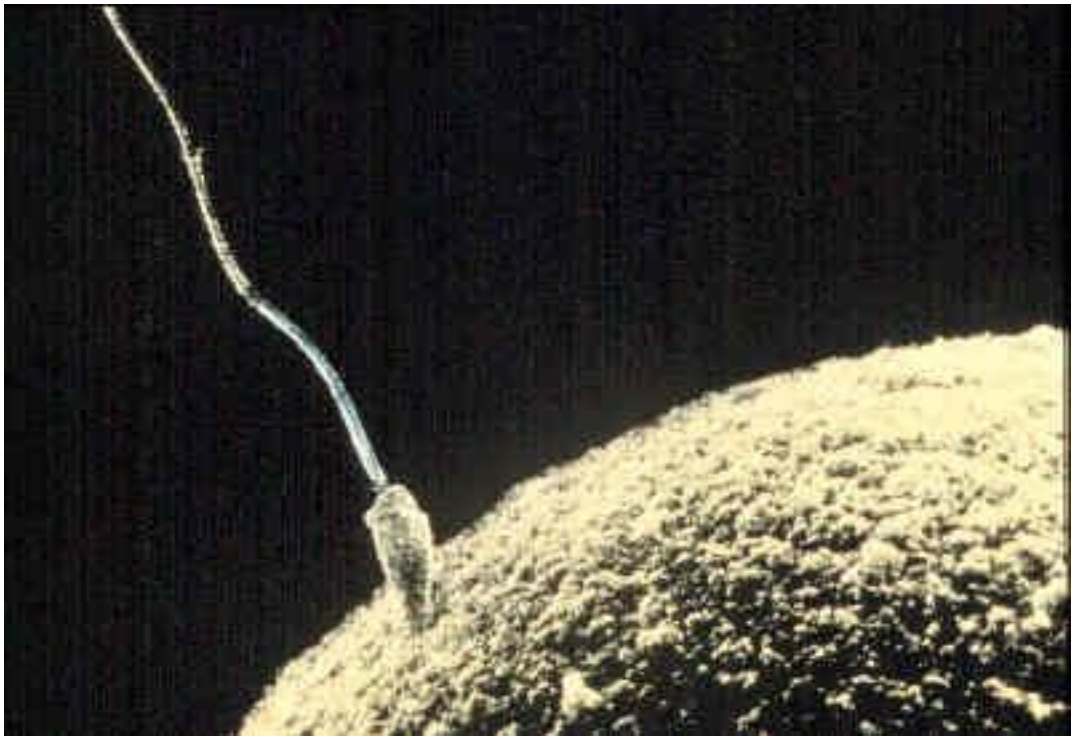


photo "Visual by www.PDImages.com"

d) Could this sperm, as shown, fertilise the egg? Fully explain your answer.

_____

_____

_____

_____

2 marks

Question 32 **10 marks**

Once an egg is fertilised by a sperm it becomes a zygote. It then will travel down the oviduct, multiplying into a ball of cells called a blastocyst. By day 5 what we see is a blastocyst.

a) The part of the blastocyst called the inner cell mass is made up of cells that are largely undifferentiated. What does this mean?

_____

_____

2 marks

b) The inner cell mass that makes up the embryo will form three layers. Complete the table below naming one tissue type which will develop from the specified layer of embryonic tissue.

Embryonic Layer	**Tissues that can develop from this layer**
Ectoderm	Skin, hair, and ……
Mesoderm	Heart, skeletal tissue, renal tissue, blood and ……
Endoderm	Lung, pancreas and intestine

2 marks

c) State three functions of the placenta.

_____

_____

_____

_____

_____

_____

3 marks

d) Name two hormones that need to be produced throughout pregnancy to maintain the placenta and uterus.

_____

_____

_____

2 marks

e) Describe what happens in the final stage of labour.

_____

_____

_____

_____

1 mark

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

This section contains **three (3)** questions. You must answer **two (2)** questions. Write your answers in the space provided. Each question carries twenty (20) marks.

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(s) that you are continuing to answer at the top of the page.

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.

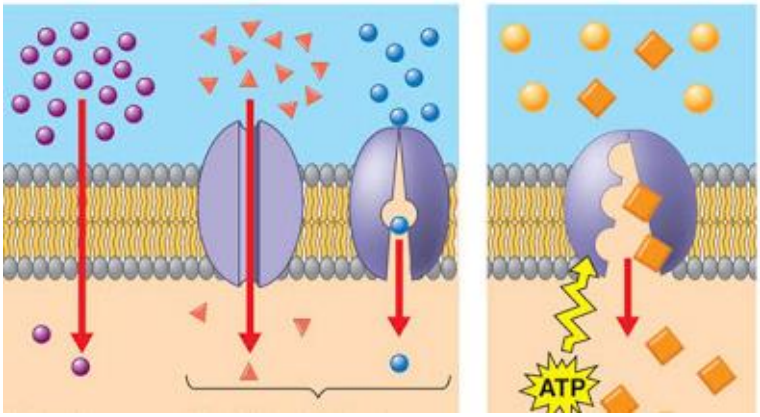
Suggested working time for this section is 50 minutes.

Answer any two (2) questions from 33 to 35.

Indicate the first question you will answer by ticking the box next to the question. Write your answer on pages 29 – 34. When you have answered your first question, turn to page 35 and indicate the second question you will answer on that page

☐ **Question 33** **(20 marks)**

a) i. Name, describe and give an example of the three (3) different processes illustrated in the diagrams below that allow substances to move across the cell membrane using a protein to assist in some manner.



12 marks

ii. Explain why the size of the cell is limited.

3 marks

b) What are the religious, ethical and economic considerations that need to be taken into account when assisted reproduction is being considered OR when research into this area is being undertaken.

5 marks

OR

☐ **Question 34** **(20 marks)**

a) Describe the processes of anaerobic and aerobic respiration.

10 marks

b) List five organelles and describe their appearance. Then for each named organelle explain its function.

10 marks

OR

☐ **Question 35** **(20 marks)**

a) Explain how a section of DNA, called a gene, is used as a template that results in the synthesis of a particular protein.

14 marks

b) Blood samples were taken from a female patient to determine her hormone levels on the following dates:

5^{th} and 7^{th} May
18^{th} and 21^{st} May

The daily temperature record indicated that she ovulated on 14^{th} May.

Describe the hormonal differences you would predict, when the composition of the blood plasma in these two periods of sampling is analysed, and explain how the differences came about (Assume she is not pregnant).

6 marks

c) Identify and explain two factors that could result in a physical difference between genetically identical zygotes by the time they are born.

2 marks

See next page

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

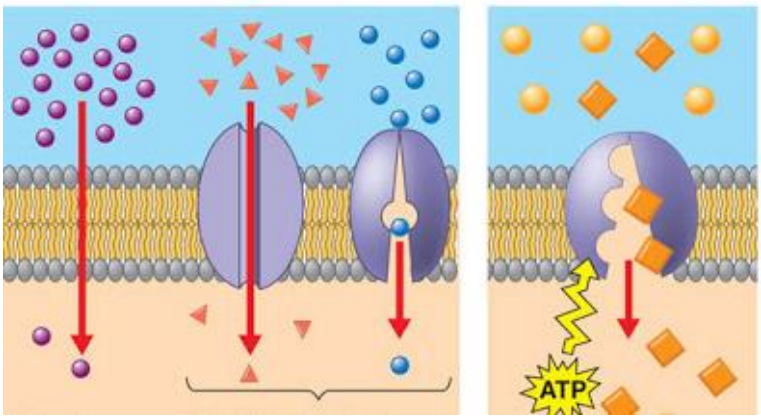
Question number: _____

Answer any two (2) questions from 33 to 35.

Indicate the first question you will answer by ticking the box next to the question. Write your answer on pages 29 – 34. When you have answered your first question, turn to page 35 and indicate the second question you will answer on that page

☐ **Question 33** **(20 marks)**

a) i. Name, describe and give an example of the three (3) different processes illustrated in the diagrams below that allow substances to move across the cell membrane using a protein to assist in some manner.



12 marks

ii. Explain why the size of the cell is limited.

3 marks

b) What are the religious, ethical and economic considerations that need to be taken into account when assisted reproduction is being considered OR when research into this area is being undertaken.

5 marks

OR

☐ **Question 34** **(20 marks)**

a) Describe the processes of anaerobic and aerobic respiration.

10 marks

b) List five organelles and describe their appearance. Then for each named organelle explain its function.

10 marks

OR

☐ **Question 35** **(20 marks)**

a) Explain how a section of DNA, called a gene, is used as a template that results in the synthesis of a particular protein.

12 marks

b) Blood samples were taken from a female patient to determine her hormone levels on the following dates:

5^{th} and 7^{th} May
18^{th} and 21^{st} May

The daily temperature record indicated that she ovulated on 14^{th} May.

Describe the hormonal differences you would predict, when the composition of the blood plasma in these two periods of sampling is analysed, and explain how the differences came about (Assume she is not pregnant).

6 marks

c) Identify and explain two factors that could result in a physical difference between genetically identical zygotes by the time they are born.

2 marks

See next page

Question number: _____

Question number: _____

Question number: _____

Question number: _____

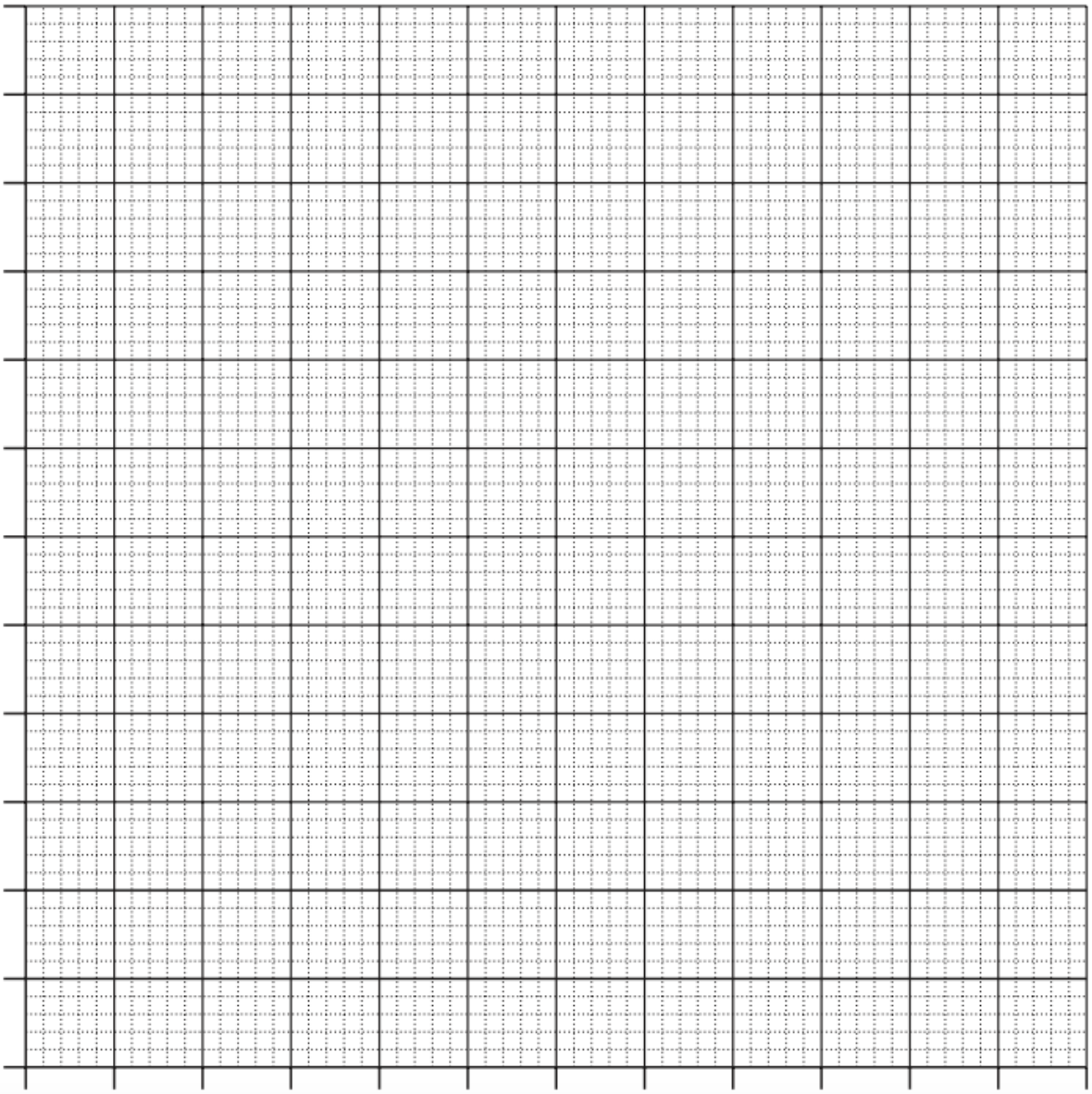
Question number: _____

Question number: _____

Additional working space

Additional working space

Spare grid for Question 30.



Methodist Ladies' College

MULTIPLE CHOICE ANSWER SHEET

Subject Human Biology ATAR Year 11

Name: _____

Teacher _____

Directions

1. Use a ballpoint pen or ink pen.
2. Mark the boxes in the following way [A] [B] [C] [D]■
3. Please enter your name, and teacher's name as directed by your supervisor.
4. Give only one answer for each question. If you change your mind, place a cross over your mark and then mark your new answer. [■] [B] [C] [D]
5. More than one answer will invalidate the answer
6. If you change your mind back to the original answer that has a cross through it, place a cross through your last answer and then circle the new answer. [■] [B] [C] [D]
7. At the end of the examination, place this Multiple Choice Answer Sheet inside the front cover of your Examination Answer Booklet.

1	[A] [B] [C] [D]	6	[A] [B] [C] [D]	11	[A] [B] [C] [D]
2	[A] [B] [C] [D]	7	[A] [B] [C] [D]	12	[A] [B] [C] [D]
3	[A] [B] [C] [D]	8	[A] [B] [C] [D]	13	[A] [B] [C] [D]
4	[A] [B] [C] [D]	9	[A] [B] [C] [D]	14	[A] [B] [C] [D]
5	[A] [B] [C] [D]	10	[A] [B] [C] [D]	15	[A] [B] [C] [D]

16	[A] [B] [C] [D]	21	[A] [B] [C] [D]
17	[A] [B] [C] [D]	22	[A] [B] [C] [D]
18	[A] [B] [C] [D]	23	[A] [B] [C] [D]
19	[A] [B] [C] [D]	24	[A] [B] [C] [D]
20	[A] [B] [C] [D]	25	[A] [B] [C] [D]

Score _____

	QUESTION	MARKS AVAILABLE	MARK	PERCENTAGE OF EXAM	TOTAL
SECTION I	1 – 25	25		20%	
SECTION II	26	10			
	27	10			
	28	10			
	29	10			
	30	15			
	31	5			
	32	10			
SECTION II TOTAL	26-31	70		60%	
SECTION III	32 or 33 or 34	20			
	32 or 33 or 34	20			
SECTION III TOTAL	32-34	40		20%	