Smith's Hill High School

Promoting excellence in a spirit of trust and co-operation

STUDENT NAME:_____

TEACHER:_____

2017

Trial HSC Examination

Assessment Task 4

Biology

General Instructions

- Reading time – 5 Minutes
- Working time – 3 hours
- Write using black or blue pen
- Write your name and / or student number at the top of every page
- Draw diagrams using pencil
- Board-approved calculators may be used

Total Marks – 100

Section I
75 marks
This section has two parts, Part A and Part B

Part A – 20 marks
- Attempt Questions 1 – 20
- Allow about 35 minutes for this part

Part B – 55 marks
- Attempt Questions 21 – 33
- Allow about 1 hour and 40 minutes for this part

Section II
25 marks
- Attempt ALL of question 34
- Allow about 45 minutes for this part

This paper MUST NOT be removed from the exam room

Part A – 20 marks
Attempt Questions 1-20
Allow about 35 minutes for this part

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
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1 Public health activities focus on prevention, promotion and protection rather than on treatment, on populations rather than on individuals, and on the factors and behaviours that cause illness and injury rather than the illness and injury itself. Australia has many public health initiatives.

Why are these public health programs important?

(A) They reduce the risk of spread of infectious diseases

(B) They reduce the incidence of certain environmental diseases

(C) They educate people about infectious diseases to prevent outbreaks

(D) They provide information to identify cause and effect relationships for infectious diseases

2 What is usually introduced into the body by administering a vaccine?

(A) Antigens

(B) Killer T-cells

(C) Macrophages

(D) Plasma cells

3 What is an example of a disease caused by an imbalance of microflora in our bodies?

(A) AIDS

(B) Obesity

(C) Tinea

(D) Thrush

4 When can the malarial protozoan *Plasmodium* be transferred from mosquitoes to humans?

(A) When female mosquitoes feed

(B) When humans eat contaminated food containing mosquitoes

(C) When mosquito larvae inhabit drinking water

(D) When mosquitoes lay eggs in water where humans swim

5 Doctors specify that a course of antibiotics should be taken to completion. It is also specified that antibiotics be taken at regular intervals in that time.

Why is it necessary for a person with a bacterial infection to take antibiotics at evenly spaced time intervals?

(A) To increase the concentration slowly to a level which is lethal to the bacteria

(B) To maintain a concentration in the body which is lethal to the bacteria

(C) To prevent mutation which may lead to resistant strains of the bacteria

(D) To select and kill all bacteria that are present in the body

6 The transplantation of body organs from one person to another is now a regular event. One of the problems associated with transplants is attack by the immune system on the transplanted organ and the possibility of the body rejecting the new organ. Special drugs are used in attempts to overcome these problems. You would expect that these drugs would:

(A) promote the production of B and T cells.

(B) stimulate the spread of antibodies.

(C) slow down the growth of the transplanted organ.

(D) slow down the multiplication of lymphocytes.

7 Some antibiotics are used in livestock feed to reduce disease. These animals are used as food for humans. Why should these antibiotics not be used in the treatment of human diseases?

(A) The antibiotics may cause an allergic response in humans

(B) Human cells may stop responding to all antibiotics

(C) Pathogenic bacteria may develop resistance to these antibiotics

(D) Natural microflora may be destroyed by these antibiotics

8 Which option best represents the structure of an artery when compared to a a vein when viewed in cross section under a microscope?

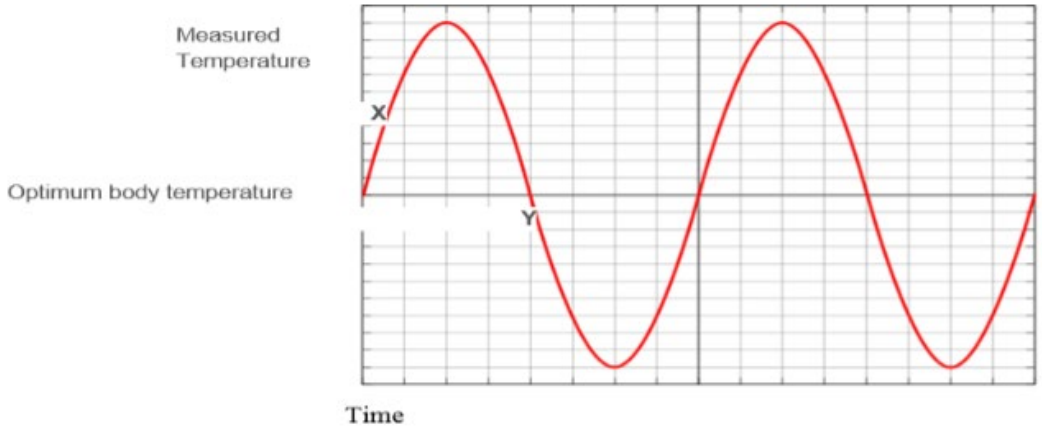
	Muscle and elastin layers	***Outer wall of artery***	***Diameter of lumen***
(A)	thinner	thinner	wider
(B)	thinner	thicker	narrower
(C)	thicker	thicker	narrower
(D)	thicker	thinner	wider

9 Which structures assist in the conservation of water in plants?

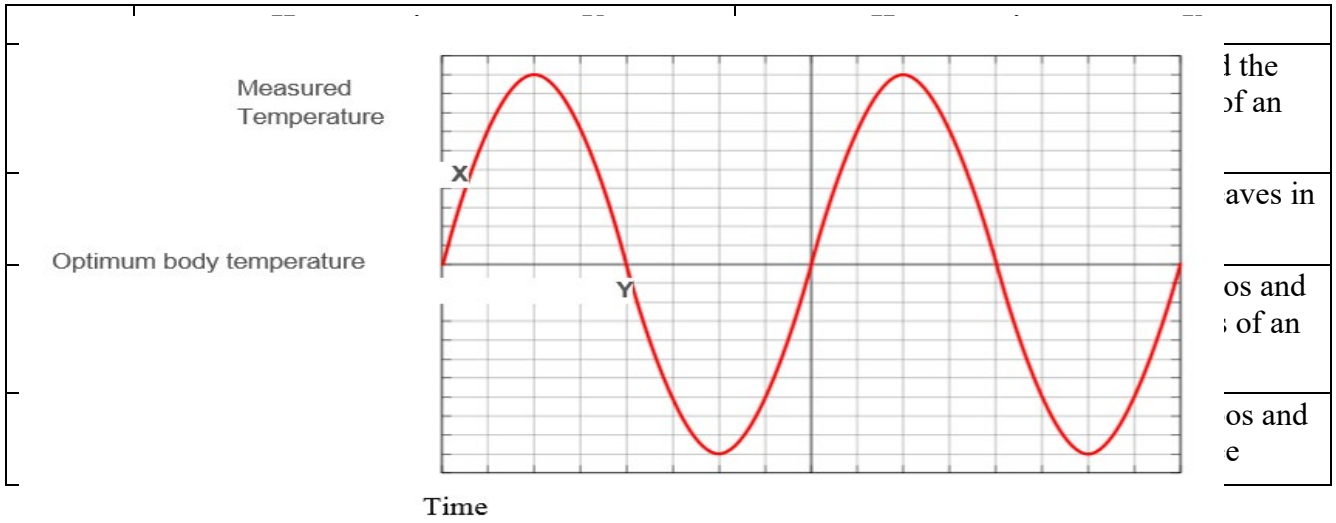
	Sunken Stomates	***Rolled Leaves***	***Swollen Leaves***	***Thick Waxy Cuticle***
(A)	√	√	**X**	√
(B)	√	√	√	**X**
(C)	√	**X**	√	√
(D)	**X**	√	√	√

10 Homeostasis is a characteristic of an organism that regulates its internal environment and tends to maintain it at a relatively stable condition. Temperature is one aspect of the environment which needs to be kept relatively constant. Humans and other organisms have different means of doing this.

The graph represents the negative feedback of temperature in an organism.



Which of the following represent homeostatic processes at X and Y?



11 A student performed a first-hand investigation about the effect of changes to substrate concentration on the activity of an enzyme.

Which correctly identifies the independent variable?

(A) Concentration of substrate

(B) Enzyme activity

(C) Amount of enzyme

(D) Temperature of substrate

12 Plants produce carbohydrates (sugars) in the palisade mesophyll cells of their leaves by photosynthesis. Translocation is the movement of materials from leaves to other tissues throughout the plant.
What is the mechanism for this movement?

(A) Active transport

(B) Diffusion

(C) The Pressure-flow model

(D) The sap transport model

13 Which Correctly identifies the functions of aldosterone and antidiuretic hormone (ADH)?

	Aldosterone	*Antidiuretic hormone (ADH)*
(A)	Controls the amount of water released in urine	Controls the amount of sodium and potassium ions reabsorbed into the blood
(B)	Produced by adrenal glands	Produced by the hypothalamus and released by the pituitary gland
(C)	Regulates the levels of sodium and potassium ions in the blood	Increases water reabsorption in the kidney's collecting ducts
(D)	Increases the permeability of the collecting duct to salt	Increases the permeability of the distal convoluted tubule and collecting duct to water

Which of the following is true at time **X**?

(A) Most bromelain molecules will have free active sites

(B) The number of available gelatin molecules is high

(C) The number of bromelain-gelatin complexes is low

(D) The rate remains the same if more bromelain is added

14 A botanist counted 26 chromosomes in the cells of the shoots and root tips of a plant. What is the haploid and diploid number of this species?

	Diploid number	***Haploid number***
(A)	13	26
(B)	26	13
(C)	26	52
(D)	52	26

15 Darwin's Theory of Evolution by Natural Selection can be summarised in 4 steps.

1. Some individuals are better suited to a particular environment.
2. Over time there is an increase in particular traits in the population.
3. Genotypic variation exists among individuals in a population.
4. Individuals with favourable traits reproduce.

The statements are not in the correct order. What is the order which best represents Darwin's Theory?

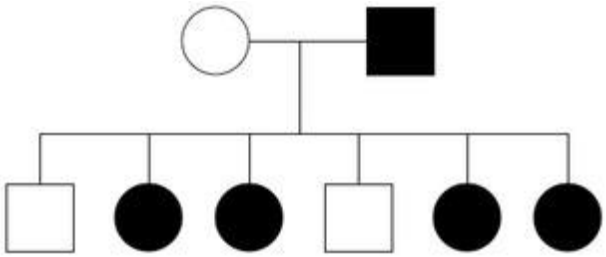
(A) 1, 2, 4, 3

(B) 1, 3, 2, 4

(C) 3, 2, 1, 4

(D) 3, 1, 4, 2

16 The following pedigree shows the inheritance of Goltz Syndrome. This is a dominant sex linked disorder which presents in a person as yellow – pink bumps on the skin and pigmentation changes.



What are the genotypes of the parents in this pedigree?

	Mother	***Father***
(A)	X^HX^h	X^hY
(B)	X^HX^H	X^hY
(C)	X^hX^h	X^HY
(D)	X^HX^h	X^HY

17 The larvae of the pitcher plant mosquito, Wyeomyia smithii, live in the water contained in the purple pitcher plant, Sarracenia purpurea. The larvae feed on the bodies of drowned insects that have been captured by the pitcher plant. As winter approaches and day length decreases, the larvae enter diapause, a state of developmental arrest. Global warming has resulted in shorter winters and researchers have found that the larvae now require shorter days than they did 30 years ago before they will enter diapause.



The mechanism that caused this change is best described as:

(A) natural selection.

(B) punctuated equilibrium.

(C) convergent evolution.

(D) the environment affecting the expression of a gene.

18 Which statements are correct about DNA transcription and translation?

	Transcription	***Translation***
(A)	Occurs in the nucleus	Produces mRNA
(B)	Produces mRNA	Occurs in the nucleus
(C)	Occurs at the surface of ribosomes	Produces mRNA
(D)	Produces mRNA	Occurs at the surface of ribosomes

19 During mitosis DNA must be replicated to ensure all cells have the correct number of chromosomes. This process is semi-conservative and is best described as:

(A) DNA being broken down into bases and reassembled with new bases

(B) DNA being split into two strands, each of which is replicated

(C) DNA being split into triplets and new triplets are added

(D) DNA remaining intact and a new DNA copy is built from new nucleotides

20 The tRNA anticodons coding for 3 amino acids is shown below.

tRNA Anticodon	***Amino acid***
Glutamic Acid	CUU
Asparagine	UUA
Threonine	UGG

A cell makes a polypeptide with the amino acid sequence:

Threonine – Asparagine – Glutamic Acid

What was the sequence of bases on the strand of the DNA which was complementary to the mRNA from which this polypeptide was formed?

(A) ACCAAUGAA

(B) TCCAATGAA

(C) TGGTTACTT

(D) UGGUUACUU

Section I (continued)
Part B – 55 marks

Attempt Questions 21-31
Allow about 1 hour and 40 minutes for this part

Answer the questions in the spaces provided.

Marks
Question 21 (5 marks)

Selective breeding has been used to improve livestock and poultry in Australia. Different selective breeding paths have produced better chickens for commercial meat and egg laying purposes. One grows to a large body size with more meat and the other produces more eggs.

(a) Identify a difference between selective breeding and random mating in a flock of chickens. **1**

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(b) Outline how selective breeding affects genetic variability in a flock of chickens. **2**

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Question 21 continues over the page

(c)

Dairy cow milk yield has increased from an average of 3,750 litres per cow per year (12 litres/per day) in the 1970s to 7,445 litres (24.5 litres/per day).
The quality and yield of milk in cattle has been improved by artificial insemination in which semen from a selected bull is used.

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Describe the process of artificial insemination.

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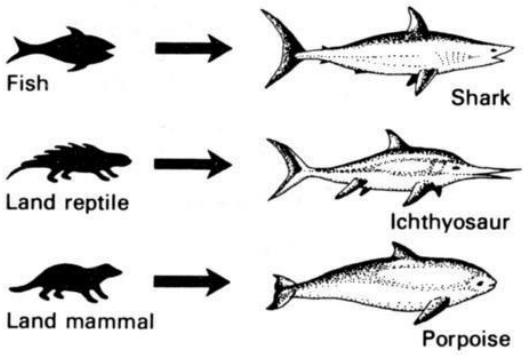
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End of Question 21

Question 22 (6 marks)



(a) The organisms shown are evidence for *convergent evolution*. Justify this statement. **4**

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(b) Outline how the environment may affect the expression of a gene in a named example. **2**

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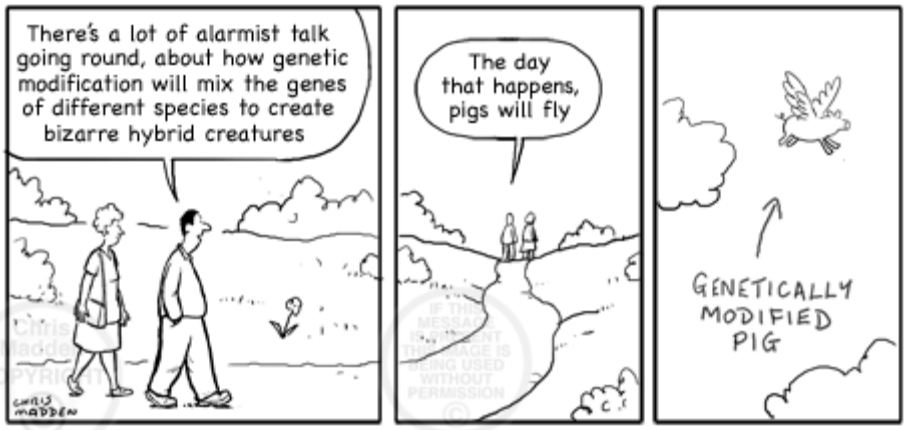
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Question 23 (5 marks)



Give an example of a transgenic organism and discuss issues relating to the development and use of such organisms. **5**

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Question 24 (4 marks)

(a) Identify a product extracted from donated blood and outline its function. **2**

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(b) Give two potential benefits of artificial blood **2**

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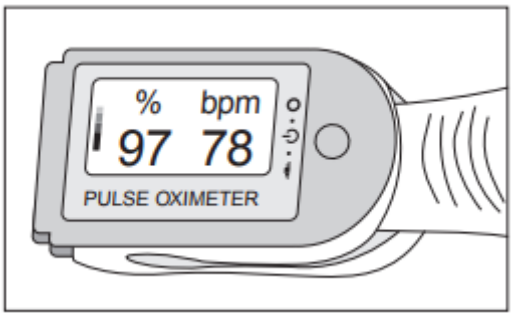
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Question 25 (4 marks)

Data can be provided by a pulse oximeter pegged to a person's finger, as shown in the diagram.



Explain TWO advantages in using a pulse oximeter to measure oxygen saturation compared to using another named technology in a specific setting. **4**

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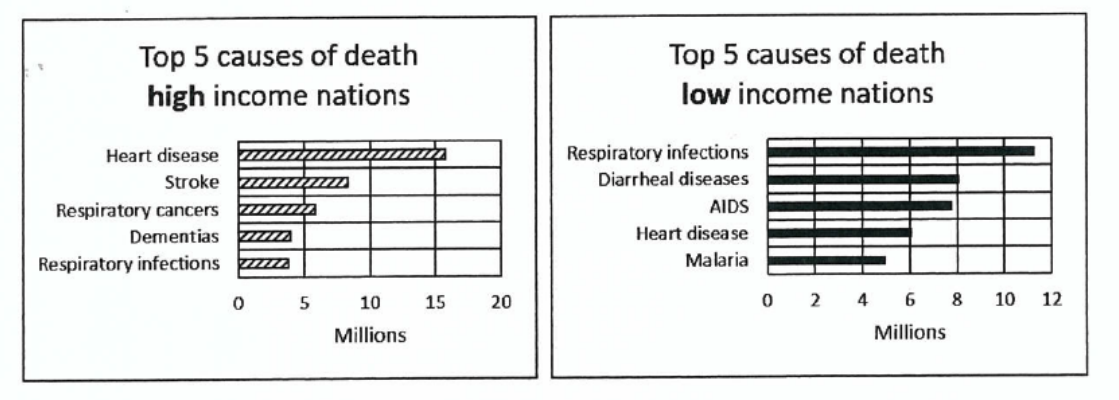
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Question 26 (5 marks)

The graphs compare the top 5 causes of death among nations of high AND low average incomes



(a) What name is given to the study of *patterns of disease* occurrence? **1**

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(b) Use these graphs to justify the generalisation that 'lifestyle' is the major factor determining disease and mortality **4**

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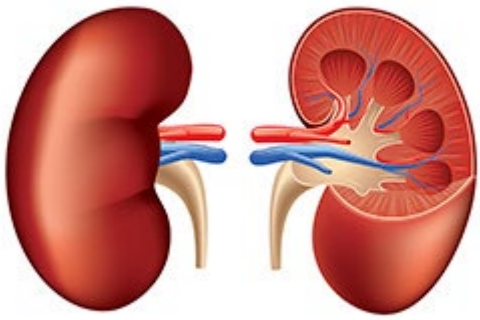
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Question 27 (6 marks)

The kidneys are the main organ of osmoregulation in humans. Each person has approximately one million nephrons - the functional units of the kidneys.



(a) Draw a labelled nephron in the space below. (Your diagram should include: Bowmans capsule, glomerulus, proximal tubules, distal tubules, loop of Henle, collecting duct, capillaries) **1**

The human kidneys process 1200 mL of blood every minute. 125 mL forms the glomerular filtrate and is produced by a process is called filtration.

(b) Identify how the concentration of TWO substances will change as fluid moves through the proximal convoluted tubule **2**

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(c) Explain why both active AND passive transport are required in the nephron to regulate body fluid composition **2**

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Question 28 (4 marks)

Complete the table of pathogens below. **4**

Pathogen	***Disease caused***	***Distinguishing features of pathogen***
i)	Creutzfeldt-Jakob Disease	A form of proteins that have undergone alteration from their normal shape to an abnormal shape. No nucleic acids and acellular
Virus	AIDS	**ii)**
Bacteria	Tetanus	Cellular Procaryotic: no membrane bound organelles, cell wall and Single or circular strand of DNA
iii)	Malaria	Eucaryotic: membrane-bound nucleus. No cell wall
Fungi	**iv)**	Eucaryotic: membrane-bound nucleus, Cell wall and no chloroplasts

i)……..

ii)…….

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iv)……

Question 29 (6 marks)

"It is better to receive a donated kidney than to remain on dialysis"

Assess this statement. **6**

Question 30 (5 marks)

Compare the body's first and second lines of defence in protecting the body from pathogens which cause infectious diseases. **5**

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Question 31 (4 marks)

Rennin is an enzyme found in the stomach of young mammals. Rennin curdles the milk drunk by the mammal and allows the milk solids to stay longer in the stomach to be further digested. Students conducted an investigation into rennin activity. They bubbled different volumes of carbon dioxide gas into milk samples. Each sample was 50 mL and was kept at a constant temperature. The students then added rennin to each milk sample and recorded the time taken for the milk to curdle

Volume of CO_2 (number of bubbles)	*Time taken for rennin to curdle milk samples* (seconds)				
	Trial 1	*Trial 2*	*Trial 3*	*Trial 4*	*Average*
100	253	257	250	260	255
150	238	232	241	229	235
200	216	214	219	211	215
250	208	202	212	198	205
300	210	200	199	311	203

Explain the results of this experiment. **4**

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Section II

25 marks
Attempt ONE question from Questions 32-36
Allow about 45 minutes for this section

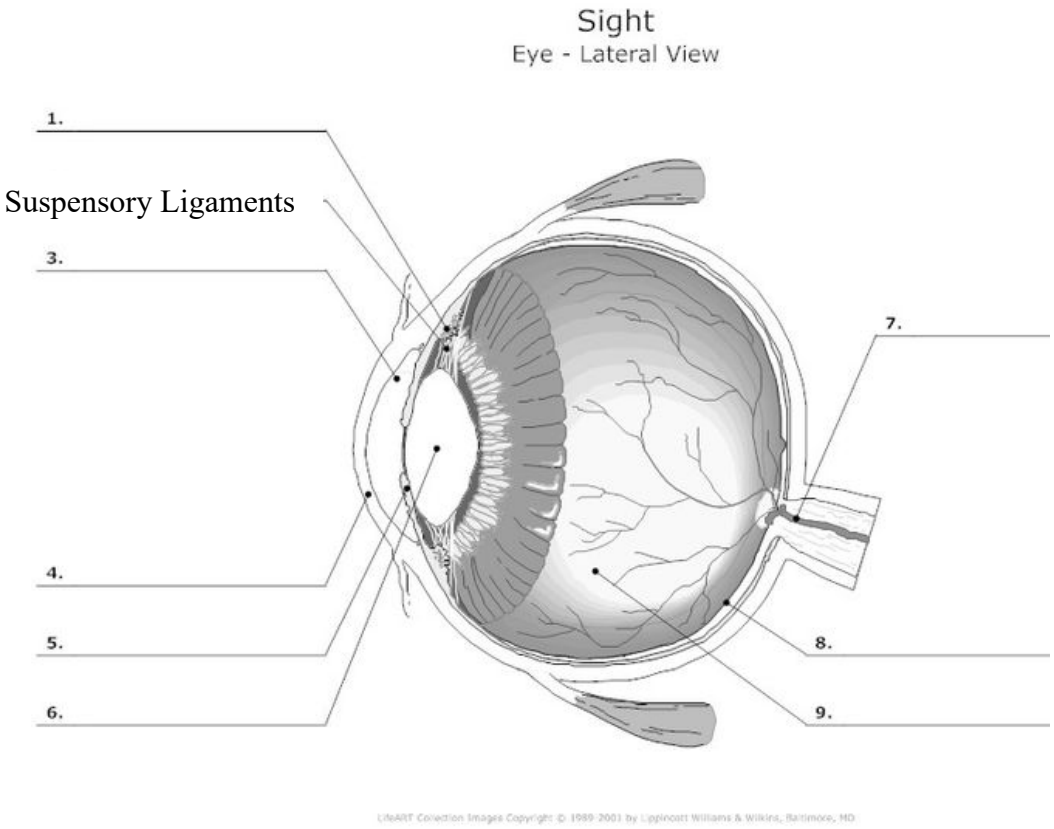
Answer parts (a)–(e) in the space provided

			Pages
Question 32	**Communication**	…….....	24-28

Question 32 – Communication (25 marks)

(a) Site is a sense that is involved in communication, enabling an organism to receive information in the form of visual stimuli. These visual stimuli, in the form of light, are detected by sensory cells called photoreceptors in the eye.

(i) Label the ALL the identified parts of the eye in the diagram below **4**



(ii) Outline the function of three of the labelled parts above **3**

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(b) During the study of Communication, you undertook an investigation to model the process of accommodation.

(i) Outline the method used in this first-hand investigation **2**

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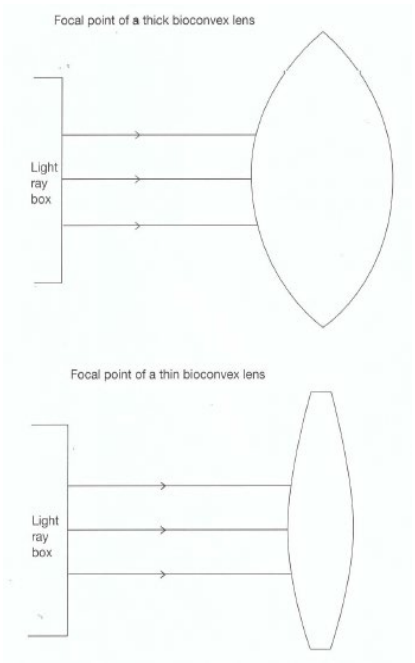
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(ii) Complete the following diagrams to show the focal point of each lens in each situation. **2**



(iii) Explain how the thickness of the convex lens changes the focal length **2**

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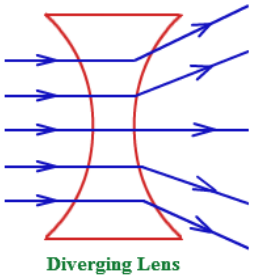
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(iv) Biconcave lenses refract light outwards as shown in the diagram.



This type of lens is used to correct vision problems. Outline how glasses using this type of lens affects the focal length in the eyes. Include a labelled diagram in your response.

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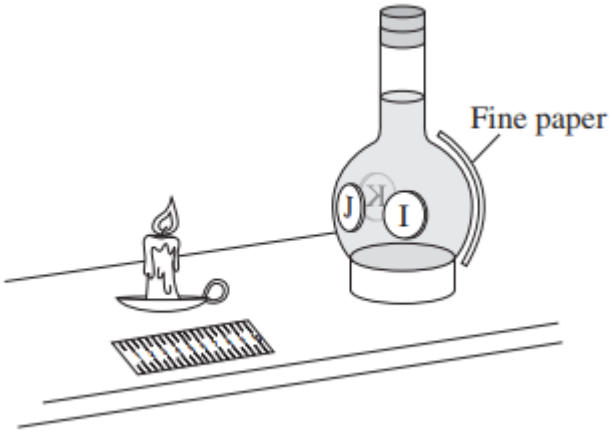
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Diagram: **3**

(c) An experiment was performed to model accommodation in the eye:

- a round bottom flask was filled with a solution
- the flask was placed on a stand on which it was able to rotate
- three lenses (I, J and K) of different thicknesses were attached to the surface of the flask
- a layer of fine paper was stuck around the opposite side of the flask
- a candle was placed near the flask
- different lenses could be brought into the light path by rotating the flask
- an image of the candle was observed on the layer of fine paper.



(i) Match THREE pieces of apparatus used in this experiment with THREE identified parts of the eye. **3**

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(ii) Describe the quantitative data that could be collected in the experiment. **2**

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(iii) Compare this model to mechanisms of accommodation in the eye. **2**

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