



--	--	--	--	--

Centre Number

--	--	--	--	--	--	--	--	--	--

Student Number

SCEGGS Darlinghurst

**2004**

**Higher School Certificate  
Trial Examination**

# Biology

This is a TRIAL PAPER only and does not necessarily reflect the content or format of the Higher School Certificate Examination for this subject.

## General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Centre Number and Student number at the top of the pages indicated

**Total marks – 100**

### Section I

Pages 2 - 16

**72 marks**

This section has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1 – 15
- Allow about 30 minutes for this section

Part B – 57 marks

- Attempt Questions 16 – 27
- Allow about 1 hour and 40 minutes for this part

### Section II

Pages 18 - 19

**28 marks**

- Attempt Questions 28
- Allow about 50 minutes for this section

**BLANK PAGE**

## Section I

Total marks – 72

### Part A

15 marks

Attempt Questions 1-15

Allow about 30 minutes for this part

Use the Multiple Choice Answer Sheet provided

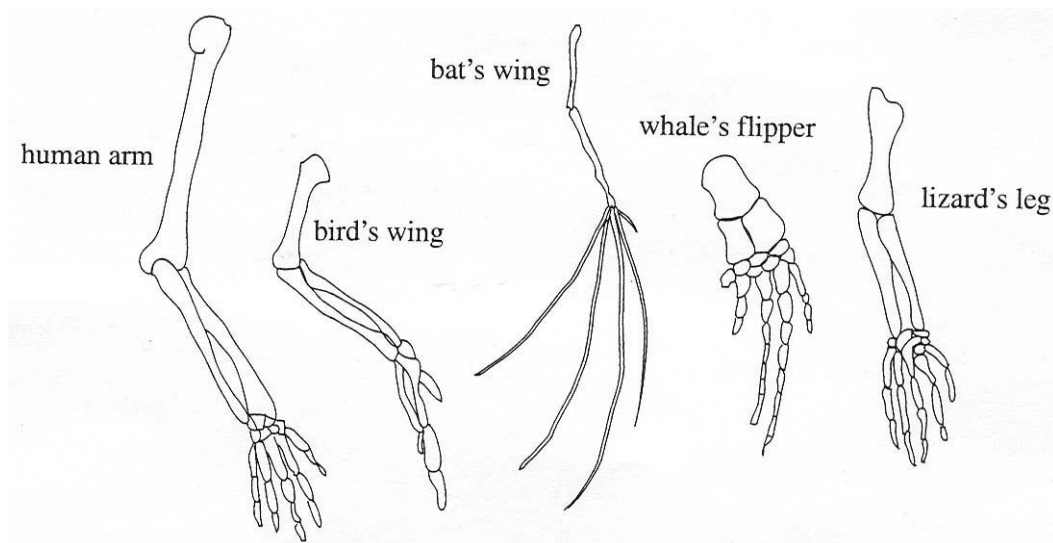
---

1. A student in a science laboratory bubbles carbon dioxide into a beaker containing water. Which of the following describes how this would affect pH?
  - (A) There would be no affect on pH.
  - (B) It would cause the pH to reach zero.
  - (C) It would raise pH.
  - (D) It would lower pH.
  
2. Mammals excrete mainly urea while insects and birds excrete mainly uric acid. What advantage do birds and insects gain by excreting uric acid?
  - (A) Less energy is lost producing uric acid.
  - (B) Less water is lost excreting uric acid.
  - (C) Uric acid is more soluble in water.
  - (D) Uric acid also rids the body of salts.
  
3. Which of the following examples describe a correct feedback process in an endotherm?
  - (A) Increase temperature → thermoreceptor → hypothalamus → vasodilation → heat loss
  - (B) Decrease of temperature → hypothalamus → vasodilation → heat gain → thermoreceptor
  - (C) Increase temperature → hypothalamus → thermoreceptor → vasodilation → hypothalamus → heat loss
  - (D) Increase temperature → thermoreceptor → vasodilation → hypothalamus → heat loss

4. What determines if an allele is dominant or recessive?
- (A) How common it is in a population.
  - (B) Which chromosome it is carried on.
  - (C) Whether it is inherited from the mother or father
  - (D) Whether it determines the phenotype, when both alleles are present.
5. Forensic science can be used these days to identify suspects using the unique genetic code held in their DNA. Which of the following suspects would be the one wanted by police if the only evidence they had was the following strand of mRNA?

**GGAACUUCAU**

- (A) Suspect 1 : DNA strand - CCTTGAAGTA
  - (B) Suspect 2 : DNA strand - GGAACUUCAU
  - (C) Suspect 3 : DNA strand - TTAAGTTGAT
  - (D) Suspect 4 : DNA strand - GGAACTTCAT
6. The diagram below shows the forelimbs of several different vertebrates.

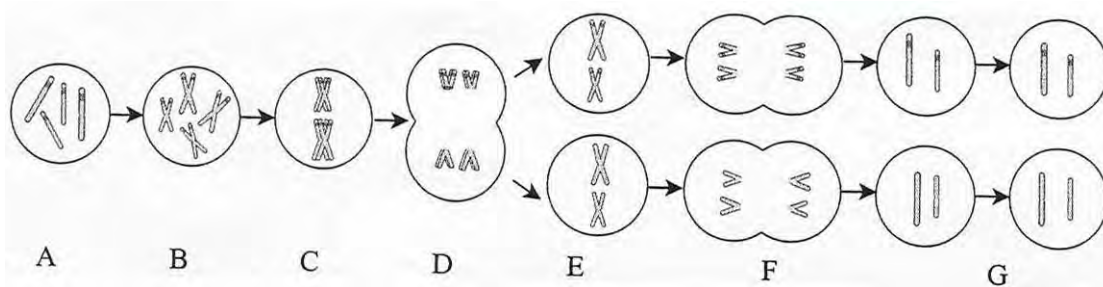


Identify the form of evidence for evolution shown in the above diagram.

- (A) Evidence from palaeontology.
- (B) Evidence from transitional forms in limbs of vertebrates.
- (C) Evidence from comparative embryology.
- (D) Evidence from homologous structures.

7. Which of the following statements most accurately describes Beadle and Tatum's "one gene – one enzyme" hypothesis.
- (A) There is only one type of gene in cells that codes for enzymes.
  - (B) There exists a one-to-one relationship between gene and the enzyme produced by that gene.
  - (C) Enzymes only act when stimulated by their corresponding gene.
  - (D) If a gene is changed by radiation, the enzyme produced by that gene can still be produced.

8. In the process below, what type of cell is G?

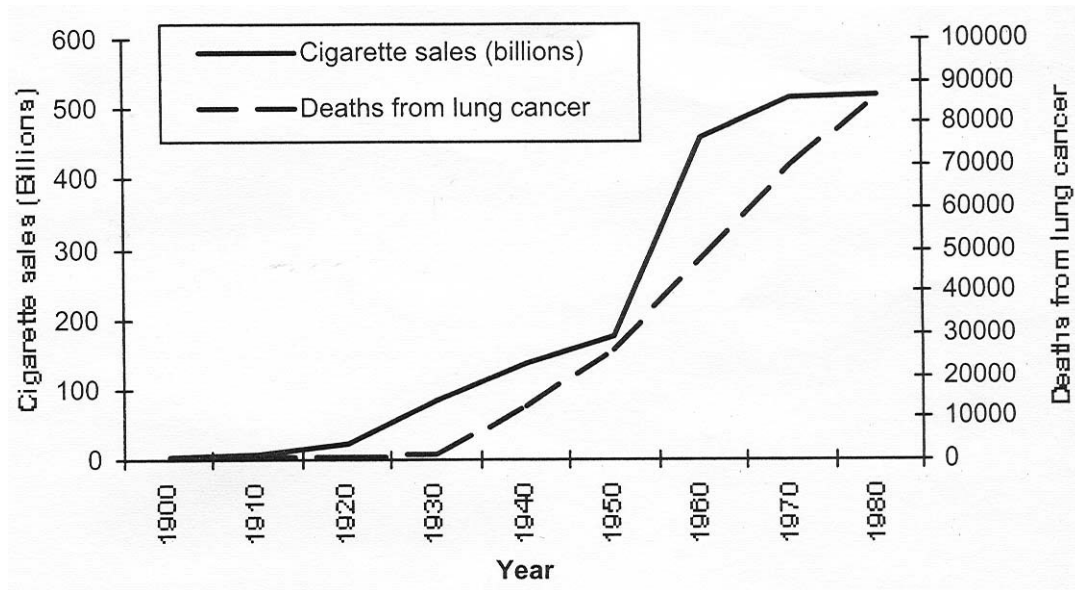


- (A) Gamete
- (B) Zygote
- (C) Diploid
- (D) Homologous

9. A researcher investigating ear length in native animals used the following symbols:  
**E** represents the allele for dominant short ear; **e** represents the allele for recessive long ear.  
 Which of the following represent animals with different genotypes but the same phenotype?

- (A) EE and ee
- (B) EE and Ee
- (C) Ee and ee
- (D) Ee and Ee

10. The graph shows changes in the incidence of deaths from lung cancer and changes in cigarette sales.



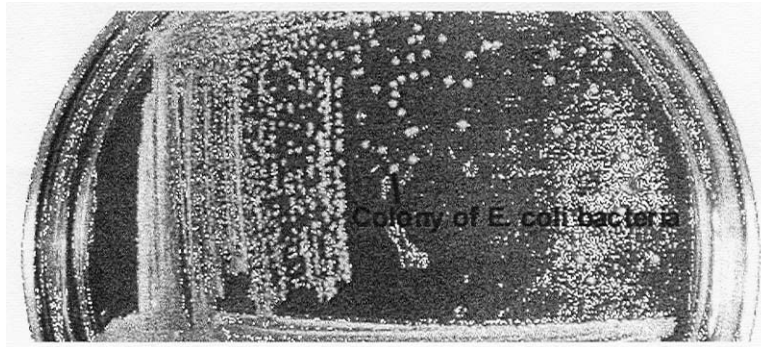
Which is the best conclusion to draw from this graph?

- (A) People with lung cancer are more likely to smoke.
- (B) Cigarette smoking causes lung cancer.
- (C) There is a relationship between cigarette smoking and lung cancer.
- (D) Lung cancer deaths did not start until 1930, so there is no connection between smoking and lung cancer.

11. An infective agent known as a prion can cause brain disease, including spongiform encephalopathy in humans. Which of the following is true of prions?

- (A) They are found in all cells in the body.
- (B) They are destroyed by some procedures that destroy proteins.
- (C) They are a group of viruses.
- (D) They cause disease very quickly.

12. The diagram shows a culture of *Escherichia coli* isolated from water in a creek. *E. coli* is a bacterium commonly found in the human gut.



What is the best way to ensure that the water in the creek remains clean enough to drink?

- (A) Filter the water through sand to remove pathogens.
- (B) Remove the source of sewage pollution.
- (C) Rapidly heat the water to 75°C and cool it quickly.
- (D) Allow the water to stand and add fluoride.

13. Identify Louis Pasteur's main contribution to our understanding of disease.

- (A) The discovery that micro-organisms are able to generate spontaneously.
- (B) The discovery of antibiotics to control bacterial growth.
- (C) The development of vaccinations for many diseases.
- (D) The realisation that microbes were responsible for infectious disease.

14. Identify the best description for a pathogen from the statements given below.

- (A) The visible effects of a disease.
- (B) The means by which a disease is contracted.
- (C) The area of the body that is most affected by disease.
- (D) An organism capable of causing disease.

**15.** What is the difference between a variable and a control in a Biology experiment?

- (A) A variable can change in an experiment and a control is used to ensure that it doesn't change too much.
- (B) A variable is a factor that could change the results of an investigation whereas a control is a standard against which experimental results can be compared.
- (C) A variable is always changing whereas a control always stays the same.
- (D) A variable must always be kept constant whereas a control will change depending on the experiment.



**Biology**

--	--	--	--	--

Centre Number

**Section I (continued)**

--	--	--	--	--	--	--	--

Student Number

**Part B – 57 marks**

**Attempt Question 16–27**

**Allow about 1 hour and 45 minutes for this part**

Answer the questions in the spaces provided.

**Marks**

**Question 16 (7 marks)**

- (a) Compare the structure of arteries, veins and capillaries in relation to their function. **5**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Describe a technology that could be used to measure oxygen saturation OR carbon dioxide concentration for a NAMED condition. **2**

.....

.....

.....

.....

.....

.....

**Question 17** (4 marks)

Describe how you carried out an experiment to test the effect of temperature on the activity of a NAMED enzyme. 4

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Question 18** (2 marks)

Describe an example that demonstrates the effect of environment on phenotype 2

.....

.....

.....

.....

.....

.....

**Question 19** (3 marks)

Explain how radiation may lead to the creation of new alleles.

**3**

.....

.....

.....

.....

.....

.....

.....

.....

**Question 20** (7 marks)

(a) Outline the processes used to produce a NAMED transgenic species.

**3**

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Question 20 continues on page 11**

Question 20 (continued)

- (b) Assume you have been asked to participate in a debate on the ethical issues arising from the development and use of transgenic species. 4  
Outline TWO arguments that you would expect to be raised by EACH side in this debate.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Question 21 (6 marks)**

**Marks**

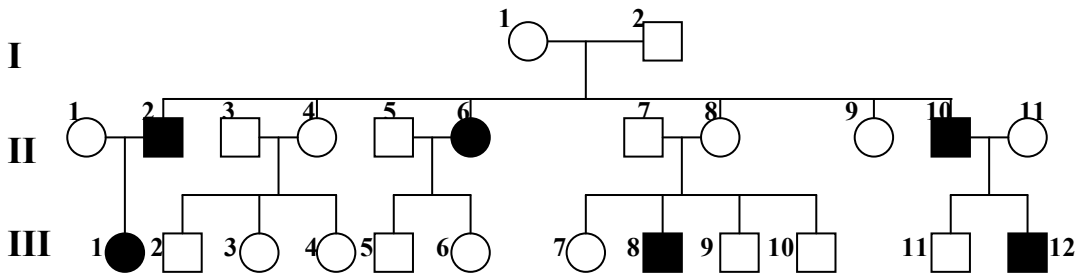
Sutton, Boveri and Morgan investigated the roles of chromosome structure in inheritance. **6**  
By referring to the research carried out by each of the above scientists, justify their importance in providing evidence of the role of chromosomes in inheritance.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

**Question 22** (5 marks)

**Marks**

The diagram below is a pedigree for albinism in humans. Albinism can be any one of a number of genetic conditions that cause lack of pigment in the eyes, skin and hair of sufferers.



(a) Is the allele responsible for albinism dominant or recessive? Justify your answer **2**

.....

.....

.....

.....

(b) If individuals 10 and 11 in Generation II had a daughter, what chance would there be of her being an albino? Show working. **3**

Answer to (b).....

**Question 23** (3 marks)

**Marks**

Outline how the failure of genes to function correctly may result in disease.

**3**

.....

.....

.....

.....

.....

.....

.....

**Question 24** (5 marks)

Discuss the role of quarantine in Australia. Include relevant examples in your answer.

**5**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Question 25** (3 marks)

**Marks**

For a named non-infectious disease, identify its cause, symptoms and treatment/management. **3**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**Question 26** (4 marks)

Discuss the relationship between our understanding of the cause of malaria and its prevention. **4**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



**Question 27** (8 marks)

**Marks**

Medical doctors need to be kept up to date with current knowledge and understanding about infectious diseases. Knowledge has enabled doctors to deal with disease using different methods.

**8**

Using information that you have gathered, processed and analysed, present a detailed description of ONE named infectious disease including how methods of dealing with this disease may have changed.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**BLANK PAGE**

**Biology**

--	--	--	--	--

Centre Number

**Section II**

--	--	--	--	--	--	--	--

Student Number

**28 marks****Attempt Question 28 Communication****Allow about 50 minutes for this section**

Answer the question on the pad paper provided.

Use the graph paper provided separately to answer Question (f) (i) in this option.

**Question 28 – Communication (28 marks)****Marks**

- (a) (i) Name TWO parts of the eye and briefly describe the function of each part you name. **2**
- (ii) Identify the conditions under which refraction of light occurs. **2**
- (iii) Identify the refractive media in the eye. **2**
- (b) The table below shows different wavelengths of the electromagnetic spectrum and their respective colour that can be identified by the human eye.

<b>COLOUR</b>	<b>WAVELENGTH (nm)</b>
Violet	420
Blue	470
Green	530
Yellow	580
Orange	620
Red	700

- Compare the colour vision of a named insect with that of a human. **3**
- (c) Explain how depth perception can be achieved. **2**
- (d) (i) Compare the nature and functioning of photoreceptor cells in mammals and insects. **4**
- (ii) Outline the role of rhodopsin in rod cells. **2**
- (e) The Fred Hollows Foundation works with blindness prevention agencies in more than 29 countries to establish the mechanisms to treat and prevent avoidable blindness.

Describe a technology that could be used to prevent blindness resulting from cataracts and discuss the implication of this technology for society. Compare this technology to technologies that would be used to correct myopia and hyperopia. **7**

- (f) The data in the table gives the relative amount of light absorbed by an individual human cone at different wavelengths of light.

<b>Wavelength of light (nm)</b>	<b>Absorbance of light (arbitrary units)</b>
460	20
480	50
500	90
520	100
540	95
560	55
600	10

- (i) Graph the data on the graph paper provided. **3**
- (ii) What wavelength of light is this cone most sensitive to? **1**

**End of paper**

--	--	--	--	--

Centre Number

--	--	--	--	--	--	--	--	--	--

Student Number

### BIOLOGY – MULTIPLE CHOICE ANSWER SHEET

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

**Sample:**  $2 + 4 =$       (A) 2      (B) 6      (C) 8      (D) 9  
A       B       C       D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A       B       C       D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A       B       C       D   
**correct**

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

**BLANK PAGE**

--	--	--	--	--

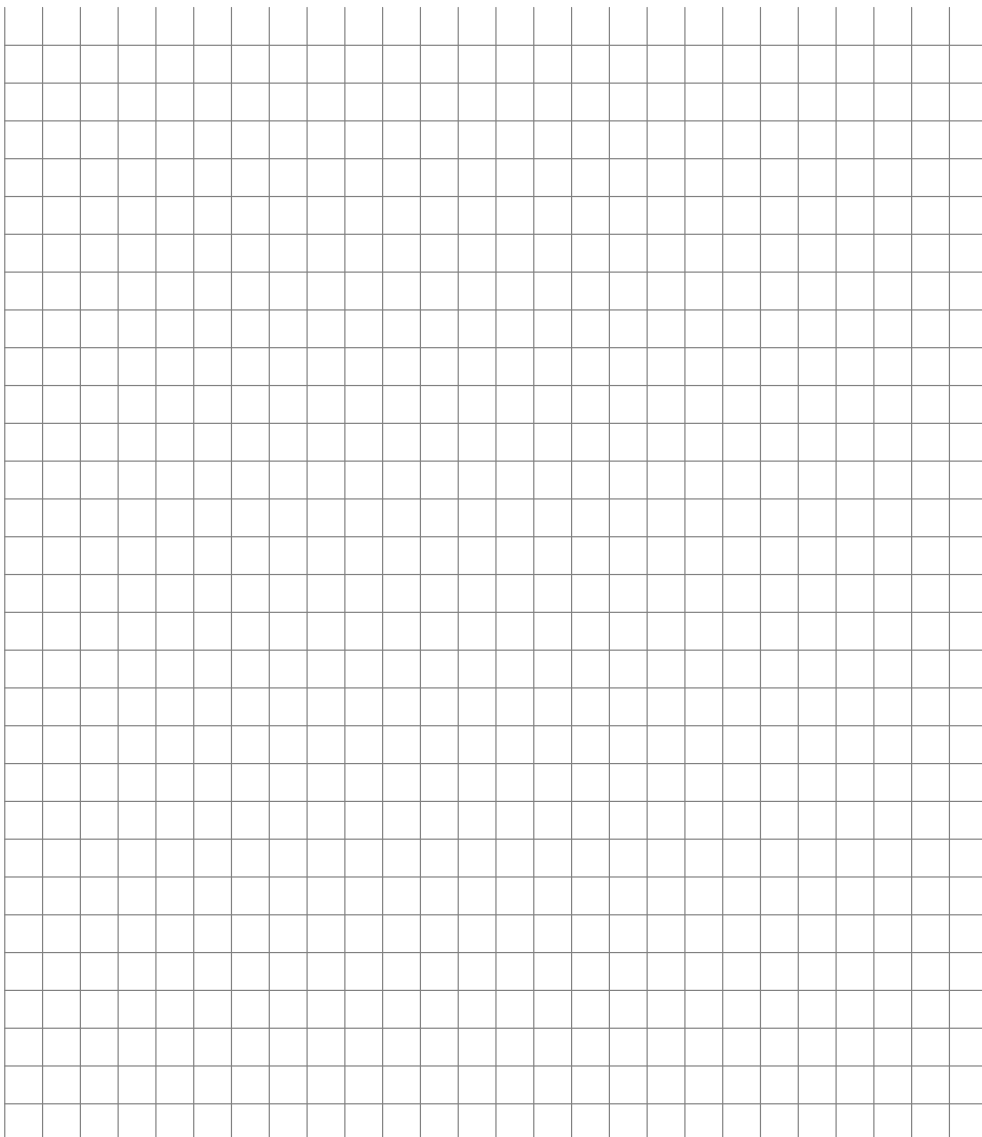
Centre Number

--	--	--	--	--	--	--	--	--

Student Number

## Biology – Section II

This sheet of 5mm graph paper is required for students to answer question (d) (i) in each Option.  
HAND UP WITH YOUR ANSWER BOOKLET FOR YOUR OPTION.



**YEAR 12 Trial 2004**  
**MAPPING GRID & MARKING CRITERIA**

Question	Marks	Content	Syllabus outcomes	Targeted performance bands
1	1	9.2.2	H6	2-3
2	1	9.2.3	H4, H6	3-4
3	1	9.2.1	H6	4-5
4	1	9.3.2	H9	3-4
5	1	9.3.4	H9	4-5
6	1	9.3.1	H10	3-4
7	1	9.3.4	H6,H9	3-4
8	1	9.3.3	H9, H14	3-4
9	1	9.3.2	H10, H13	3-4
10	1	9.4.3	H4, H13	3-4
11	1	9.4.3	H4	4-5
12	1	9.4.2	H4	3-4
13	1	9.4.3	H1, H8	2-3
14	1	9.4.2	H6,H8	2-3
15	1	9.4.2	H12	4-5
16a	5	9.2.2	H6,H13	2-6
16b	2	9.2.2	H4	3-5
17	4	9.3.1	H6, H11, H12, H13, H14	2-5
18	2	9.3.3	H9	2-4
19	3	9.3.	H8, H9	3-5
20a	3	9.3.5	H6, H8, H9	2-4
20b	4	9.3.5	H7, H8, H9, H13	3-6
21	6	9.3.3	H2,H9	3-6
22a	2	9.3.2	H7, H10	3-5
22b	3	9.3.3	H7, H10	3-5
23	3	9.4.1	H9	3-6
24	5	9.4.7	H1, H4, H10	2-5
25	3	9.4.6	H6, H13	3-5
26	4	9.4.3	H5, H8, H10	3-6
27	8	9.4.3 & 9.4.7	H1,H4, H6	2-6

<b>Q1. D</b>	<b>Q2. B</b>	<b>Q3. A</b>	<b>Q4. D</b>	<b>Q5. A</b>	<b>Q6. D</b>
<b>Q7. B</b>	<b>Q8. A</b>	<b>Q9. B</b>	<b>Q10. C</b>	<b>Q11. B</b>	<b>Q12. B</b>
<b>Q13. D</b>	<b>Q14. D</b>	<b>Q15. B</b>			

**Q16a            Band 2-6        5 mks            9.2.2**

<ul style="list-style-type: none"> <li>describes similarities and/or differences in the structure of arteries, capillaries and veins (at least <b>two clear differences</b> e.g. thickness, valves and elasticity</li> <li>links structure to function for all three types of vessel</li> <li>makes clear comparisons between them</li> </ul>	<b>5</b>
<ul style="list-style-type: none"> <li>as above with one error e.g. one vessel's structure may not be linked to its function <b>OR</b> only ONE difference discussed and linked</li> </ul>	<b>4</b>
<ul style="list-style-type: none"> <li>describes the similarities and differences in the structure &amp; function of three types of blood vessel <b>OR</b> if 3 blood vessels discussed and one linked to structure (but errors in function)</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>some comparison of structure and attempt at function but not linked</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>states that blood vessels have different structures to suit different functions <b>OR</b> gives structure of at least two types of blood vessel <b>OR</b> if states difference in thickness of all 3</li> </ul>	<b>1</b>



**Sample answer:**

	Arteries	Capillaries	Veins
Similarities	<ul style="list-style-type: none"> <li>all transport blood in one direction</li> <li>all vessels have smooth inner wall to reduce turbulent flow</li> </ul>		
Differences	<ul style="list-style-type: none"> <li>blood carried under pressure</li> <li>greater amt. of muscle tissue in walls (as blood pressure high)</li> <li>not sites of exchange</li> <li>elastic walls to maintain steady blood flow</li> <li>no valves</li> </ul>	<ul style="list-style-type: none"> <li>blood not under pressure</li> <li>very thin walls to aid exchange of materials</li> <li>no valves</li> </ul>	<ul style="list-style-type: none"> <li>blood at low pressure</li> <li>thinner walls (as blood pressure low)</li> <li>not sites of exchange</li> <li>valves to assist blood movement</li> </ul>

**Q16b Band 3-5 2 mks 9.2.2**

<ul style="list-style-type: none"> <li>Describes ONE appropriate technology for a NAMED condition requiring blood gas measurements</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>Identifies ONE appropriate technology for a NAMED condition requiring blood gas measurements <b>OR</b> describes fully technology (no named condition)</li> </ul>	<b>1</b>

**Sample answer:**

A saturation oxygen probe connected to a datalogger is attached to a premature baby in order to continuously monitor the degree of oxygen saturation of foetal haemoglobin. This will prevent oxygen toxicity and hence reduce the incidence of blindness.

Other technologies which could be described/identified: **oxygen**: pulse oximeter, ABG analysis;

**carbon dioxide**: ABG analysis, capnometer

p242 Heinemann

**Q17 Band 2-5 4mks 9.3.1**

<ul style="list-style-type: none"> <li>appropriate <b>equipment</b> included/listed (e.g. measuring cylinders, test tubes, H<sub>2</sub>O<sub>2</sub>, potato/liver etc) =<b>EQ</b></li> <li>enzyme (e.g. catalase in potato) = <b>E</b> and substrate (e.g. hydrogen peroxide) = <b>S</b> clearly identified</li> <li>features of correct <b>procedure</b> with details of <b>independent</b> variable (different temperatures) – should have min. 4 different temps = <b>T</b> e.g. 5<sup>o</sup>C, 10<sup>o</sup>C, 20<sup>o</sup>C, 37<sup>o</sup>C, 70<sup>o</sup>C &amp; details of variables to be controlled e.g same amt. of enzyme, same amt. and concentration of substrate, etc.,</li> <li>replication=<b>R</b>.</li> <li>described how <b>dependent</b> variable recorded e.g. timing of reaction rates =<b>D</b>.</li> <li>logical sequence of steps</li> </ul>	<b>4</b>
<ul style="list-style-type: none"> <li>all of the above with one major error</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>a correct procedure outlined OR if incorrect expt. but equipment correct &amp; other details</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>a procedure identified</li> </ul>	<b>1</b>

**Q18 Band 2-4 2 mks 9.2.3**

<ul style="list-style-type: none"> <li>Using an appropriate example, provides features of the change in phenotype that results from a specified environmental factor</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>Gives a feature of a phenotype and links it to an environmental factor</li> </ul>	<b>1</b>

**Sample answer:**

The expression of the gene for flower colour in Hydrangeas depends on the substances present in the soil. The gene produces a pink pigment or a blue pigment depending on the concentration of certain substances in the soil. OR a geranium plant grown in sunlight will produce chlorophyll and have green leaves whereas the same plant grown in the dark will not produce chlorophyll and will have yellow leaves.

e.g. skin colour in humans, Siamese cat

NB. Not peppered moth or smoking, radiation etc.

**Q19 Band 3-5 3 mks 9.3.**

• Uses cause and effect statement, showing link between radiation and changes in the base sequence of DNA of a gene, resulting in a new allele	<b>3</b>
• States a link between radiation and changes in the base sequence of a gene	<b>2</b>
• States that radiation affects DNA	<b>1</b>

**Sample answer:**

When high energy radiation such as X-rays are absorbed by the nucleus of a cell, the sequence of bases in the DNA can be changed. A base (or series of bases) may be deleted or changed for a different base, or sections of DNA can be inverted. This change in base sequence means a gene may no longer produce the same product. The gene now has a new allele.

**Q20a Band 2-4 3 mks 9.3.5**

• Outlines steps involved in development of a transgenic species, including choosing the desired gene, excising from the donor species' DNA, and inserting it into the recipient species' DNA • Steps above linked to correctly named transgenic species	<b>3</b>
• Outlines steps involved in development of a transgenic species, including choosing the desired gene, excising from the donor species' DNA, and inserting it into the recipient species' DNA without linking to named species OR some major detail of above missing	<b>2</b>
• Outlines some of the steps involved in the development of a transgenic species OR correctly names a transgenic species and the desired characteristic produced	<b>1</b>

**Q20b Band 3-6 4 mks 9.3.5**

• Indicates the main features of TWO issues from each side of the debate	<b>4</b>
• Indicates the main features of THREE relevant issues or incompletely outlines FOUR	<b>3</b>
• Indicates the main features of TWO relevant issues or incompletely outlines THREE	<b>2</b>
• Indicates the main features of ONE relevant issue or incompletely outlines TWO	<b>1</b>

**Sample answer:**

FOR: Crops like “Bt cotton” with “built-in” pesticides can reduce the need for chemical pesticides. The reduction in chemical pesticides is better for the environment/more cost effective for the farmer.

Foods engineered to deliver medication could reduce suffering and improve health.

AGAINST: Cross-pollination could transfer herbicide resistant genes from crops to weeds.

Big agricultural companies who patent genetically modified crops could control the world’s food supply.

Technology tampers with nature.

Native/natural plants and animals may be disadvantaged.

See pg. 235 Jacaranda.

**Q21 Band 3-6 6 mks 9.3.3**

• experiments of all three scientists i.e. Sutton, Boveri and Morgan described • conclusions of three scientists outlined • importance justified	<b>6</b>
• as above but something missing - must still detail independent work of Sutton, Boveri & Morgan, outline at least one correct conclusion & make a statement about their importance	<b>5</b>
• some details of experiments of all three scientists & a general statement about their importance	<b>4</b>
• correct conclusions of three scientists but lacks detail of exptl work (must see independent scientific contribution)	<b>3</b>
• some details of exptl work of all three scientists OR detailed work and conclusion of at least one scientist	<b>2</b>
• correct <b>conclusion</b> of one scientist OR correct organisms used/investigated by three scientists OR exptl work of one scientist OR understanding of the necessary sequence in which the investigations occurred	<b>1</b>

**Sample answer:**

**Boveri's Original Research:**

- 1) crossed 2 species of sea urchin producing hybrid larvae; the larvae showed characteristics of BOTH parents.
- 2) fertilised the enucleated eggs of 1 species with sperm of another species; the offspring were dwarf males with no characteristics of female parent.

**Boveri's conclusion 1896: the nucleus of a cell not the cytoplasm is concerned with inheritance**

**Sutton 1902:** observed meiosis occurring in grasshopper testes and drew on and synthesised the work of other scientists; recognised that chromosomes could account for the operation of Mendel's Laws and could account for the behaviour of Mendel's factors (noted parallel behaviour of chromosomes and genes); identified that several genes were located on one chromosome

**Sutton's conclusion 1902: Mendel's factors are located on chromosomes**

**Boveri 1904:** agrees with Sutton - **Mendel's factors are located on chromosomes in the nucleus of a cell**

*NB At this time scientists think chromosomes are equivalent.*

**Boveri 1907:** more sea urchin experiments – sea urchin eggs fertilised by 2 sperm allowed to divide to the 4 cell stage then separated into 4 single cells, each cell containing a different chromosome combination  
- showed that a complete set of chromosomes was necessary for normal development of an embryo; cells with chromosomes missing had abnormalities depending on which chromosome was missing

**Boveri's conclusion: each chromosome is the location of distinct and different genes**

**Morgan 1910:** used Drosophila (fruit flies)

- 1) crossed a lone white-eyed male with red-eyed female – all F1 offspring red-eyed (dominant gene)
- 2) crossed F1 offspring with each other – all females red-eyed, ½ males white-eyed
- 3) crossed a white-eyed female with a red-eyed male – all F1 males white-eyed; all females red-eyed
- 4) crossed these F1 offspring with each other – ½ males white-eyed; ½ females white-eyed

Explained in terms of inheritance of white eyes on the X chromosome; no matching allele on the Y chromosome to mask the effect of the recessive allele for white eye; females need two copies of the allele, males only one to have white eyes

**Morgan's conclusion: a particular gene is located on a particular chromosome (eye colour in fruit fly is inherited on the X chromosome)**

**Each person's work was necessary in producing a sequence of events which led to a greater understanding of the importance of chromosomes and genes in inheritance and the relationship between the two.**

**Q22a Band 3-4 2 mks 9.4.2**

• Allele identified as recessive and correctly justified i.e. albinism is recessive as the parents in Gen. I are both normal/not albinos and have children who are albinos which indicates they must be heterozygous and both have recessive allele to pass on to their offspring <b>OR</b> Gen II 7 & 8	<b>2</b>
• Allele identified as recessive without correct justification	<b>1</b>

**Q22b Band 3-4 3mks 9.4.3**

• Correct answer, correct genotypes for II 10 & 11 with correct working in a Punnett square	<b>3</b>
• All of above with one error	<b>2</b>
• Some correct working	<b>1</b>

**Sample answer:**

Let N=normal allele  
n= albino allele

N	n	n
N	Nn	Nn
n	nn	nn

50% chance of couple having an albino

**Q23**                      **Band 3-6**                      **3 mks**                      **9.4.1**

<ul style="list-style-type: none"> <li>Identifies and describes the links between genes and the production of products for maintaining healthy cellular activity. Makes links between loss of cellular activity and disease in the body/gives appropriate example of where change in gene can cause disease</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>Attempts to link non-functional genes with abnormal phenotype</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>States normal genes are necessary for health OR Links failure of cells to function properly and abnormal mitosis/cancer</li> </ul>	<b>1</b>

**Sample answer:**

The phenotype of a normal, healthy individual depends on the normal functioning of cells, which in turn depends on functioning products of genes. If genes do not produce a functional product such as enzymes, then cells cannot survive or function properly. Disease is the result. e.g. cystic fibrosis is the result of abnormal gene etc.

**Q24**                      **Band 2-5**                      **5 mks**                      **9.4.7**

<ul style="list-style-type: none"> <li>At least three major roles of quarantine discussed (protection from other countries, border control, interstate control, education etc)</li> <li>At least TWO relevant examples included</li> </ul> <p><b>OR TWO MAJOR</b> roles discussed with excellent examples (including disease/pathogen etc)</p>	<b>5</b>
<ul style="list-style-type: none"> <li>At least three major roles of quarantine discussed (protection from other countries, border control, education etc)</li> <li>At least ONE relevant example included</li> </ul> <p><b>OR TWO MAJOR</b> roles discussed with reasonable examples (may lack some detail)</p>	<b>4</b>
<ul style="list-style-type: none"> <li>At least three major roles discussed with no examples <b>OR ONE</b> major role discussed and good examples <b>OR</b> two roles and vague examples</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>At least two major roles discussed with no examples <b>OR</b> one role and vague example/s</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>One major role discussed</li> </ul>	<b>1</b>

**Sample answer:**

The presence of quarantine services at entry points into Australia act as a barrier. The fact that Australia is an island allows this to be reasonably successful. Careful supervision occurs at all ports and airports around the country. Any smuggled goods cannot be checked therefore risking the introduction of disease.

The AQIS also checks goods leaving as exports. This acts as a means of protecting the good name of exporters. A certification process is used for all exporters. Again the illegal movement of goods without certification can cause problems for disease. The AQIS has a large educational process for the population including advertisements etc. It is important to ensure that as many people as possible are aware of the role of quarantine and its importance in preserving our low level of disease in Australia. The AQIS also has regulations for visiting vessels in terms of ballast water management at Australian ports.

e.g. Australia does not have rabies as all pets must be vaccinated before entering Australia;  
SA wine industry does not have aphid found in NSW etc as no grape vine cuttings etc allowed to cross into SA.

**Q25**                      **Band 2-5**                      **3 mks**                      **9.4.6**

<ul style="list-style-type: none"> <li>non-infectious disease <b>named</b> correctly (e.g. Addison's disease)</li> <li><b>cause</b> of disease identified (e.g. adrenal glands not making aldosterone)</li> <li><b>symptoms</b> described (e.g. decreased reabsorption of sodium from the kidney tubule into the blood/low sodium levels in blood which means less water follows by osmosis/blood volume decreases &amp; low blood pressure /filtration out of the glomerulus slows down and wastes accumulate &amp; increased reabsorption of potassium)</li> </ul> <p>NB. Addison's crisis= low blood pressure, low blood sugar, high potassium (life threatening)</p> <ul style="list-style-type: none"> <li><b>treatment/management</b> described (e.g. take Florinef (Fludrocortisone acetate) once a day which replaces the hormones that the adrenal glands are not making &amp; increase salt intake)</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>non-infectious disease named and <b>two</b> of correct cause, symptom and treatment</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>non-infectious disease named and correct cause <b>or</b> symptom <b>or</b> treatment</li> </ul>	<b>1</b>

**Q26 Band 3-6 4 mks 9.4.3**

<ul style="list-style-type: none"> <li>• Good discussion of how malaria is prevented with reference to understanding of cause, including at least three past ideas about cause and consequent means of prevention AND current idea about cause and related prevention OR at least four current methods of prevention related to the stated currently known cause.</li> </ul>	<b>4</b>
<ul style="list-style-type: none"> <li>• Three past ideas about the cause of malaria and related means of prevention OR at least three current methods of prevention related to the stated currently known cause OR a really good more general answer linking methods of prevention to the currently known cause.</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>• Two past ideas about the cause of malaria and related means of prevention OR at least two current methods of prevention related to the stated currently known cause.</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>• One idea about the cause of malaria and related means of prevention OR at least one current method of prevention related to the stated currently known cause.</li> </ul>	<b>1</b>

**NB If correct cause not given, maximum mark 1.**

**Sample Answer:**

The current idea about the cause of malaria is that it is due to the presence in the bloodstream of the protozoan *Plasmodium*, a parasite with a complicated life cycle in humans and *Anopheles* mosquitoes. As it is too difficult to get rid of the parasite, current methods of prevention include targetting the removal of the mosquito which acts as a vector of the disease to humans or prevention of mosquito bites. Spraying areas where mosquitoes breed, removal of swampy areas and puddles, covering and/or spraying of the body at night, quarantine procedures to prevent entry of *Anopheles* mosquito into uninfested areas are all methods of prevention related to the known cause. There are currently attempts being made to develop a vaccine to destroy the *Plasmodium* parasite in humans.

Relevant extracts from this info may be used

SIGNIFICANT PEOPLE/DATES	IDEAS ABOUT CAUSE	PREVENTION
Chinese Mythology	3 demons- hammer(headache), cold water(chills), stove( fever)	
Ancient Greeks and Romans	Fevers due to drinking stagnant water or breathing marsh vapours	Drains built
Early 1800s	As above + mosquito bites;	Bark of the cinchona tree boiled into a broth (quinine extracted)
Pasteur & Koch's work	Stimulated the search for microbes as the cause	Quinine continues to be used for prevention and treatment
Italian scientists	Find rod-shaped bodies in the blood of malaria patients and granules and black pigment in blood and other tissues	
1880 Alphonse Laveran	Found bodies in the blood of malaria patients but not in the blood of healthy people; in 1886, wriggling flagellated structures identified as the cause of malaria; these were classified as Protozoa; the peak of fever coincided with them bursting out of blood cells; mosquitoes were	
1892-1897 Ronald Ross	Dissected mosquitos to look for parasites including Plasmodium; his 2 groups of mosquitos included those which had fed on malarial patients blood and those which hadn't; tracked the development of the parasites from day to day; used bird malaria as a model and found that the parasite was transmitted in mosquito saliva produced as the mosquito sucks blood.	
1898 Grassi	Described the life cycle of malaria and the two hosts (the Anopheles mosquito was identified as one of the hosts and the vector to humans)	
1918 German scientists	Develop several alternative drugs	Atabrine Resochin and Sonto chin (chloroquinine)
1940s		DDT sprayed to kill mosquitos in areas of open water
Early 50s	DDT resistance develops in Anopheles mosquitos	
1960s	Chloroquinine resistance develops in Anopheles mosquitos	Alternative drugs developed
1969	Goal becomes prevention rather than treatment	Attempts to develop a vaccine. More emphasis on measures to prevent initial infection or interruption of the life cycle of the parasite eg use of insecticides and covering up body at night, removal of water puddles where mosquitos breed etc

**Q27 Band 2-6 8 mks 9.4.3 & 9.4.7**

<ul style="list-style-type: none"> <li>• Demonstrates extensive and detailed knowledge by correctly <b>naming</b> an infectious disease and its <b>cause</b>. Features of description include the <b>host response</b>, <b>TWO</b> or more <b>major symptoms</b> and an outline of an appropriate <b>treatment</b> for the disease. <b>Links</b> made between changes in control and prevention for the disease.</li> </ul>	<b>8</b>
<ul style="list-style-type: none"> <li>• All of above but some detail missing (e.g. name of bacterium and host response)</li> </ul>	<b>7</b>
<ul style="list-style-type: none"> <li>• Demonstrates extensive knowledge by correctly naming an infectious disease and its cause. Features of description include the host response, TWO or more major symptoms and an outline of an appropriate treatment for the disease. Identifies methods of prevention and control.</li> </ul>	<b>5-6</b>
<ul style="list-style-type: none"> <li>• Demonstrates knowledge by correctly naming an infectious disease and its cause. Features of description include the major symptom and an identification of an appropriate treatment for the disease. Identifies methods of prevention or control.</li> </ul>	<b>4</b>
<ul style="list-style-type: none"> <li>• Names disease, gives a major symptom and treatment and methods of control or prevention outlined but no details of cause <b>OR</b> Name, cause and links made between changes in control and prevention BUT no symptoms or treatment etc</li> </ul>	<b>3</b>
<ul style="list-style-type: none"> <li>• Demonstrates knowledge by correctly naming an infectious disease. Features of description include an appropriate symptom and an identification of an appropriate treatment for the disease <b>OR</b> instead of symptoms or treatment-some control or prevention etc</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>• . Demonstrates knowledge by correctly naming an infectious disease and some details of disease</li> </ul>	<b>1</b>

**Sample answer:**

Cholera is an infectious disease caused by the bacterium *Vibrio cholerae*, generally ingested in contaminated food or waste. The bacteria produces a toxin which causes excessive secretion by the host of fluids and electrolytes. The lining of the intestine is broken down by bacterial enzymes. Muscle cramps, inflammation of the bowel, “rice-water” stools and consequent dehydration results. Cold, shrivelled skin and sunken eyes, fall in blood pressure and faint pulse are other symptoms..

The toxin causes the host to produce antibodies in response.

Treatment involves replacement of fluid and salts. Antibiotics are effective in the early stages only but may reduce the need for fluid replacement. Oral Rehydration Solution containing water, salt and sugar is generally used to prevent dehydration.

To prevent people from becoming infected, vaccines which are effective for 6 months are available for travellers. Drinking water or eating food likely to be contaminated should be avoided.

In third world countries in particular, the emphasis is now on prevention of the disease rather than treatment. This involves creating an environment where the pathogen cannot survive or be transmitted. Contaminated faeces must be prevented from entering the water supply by provision of effective sewerage systems and chlorination of water. Education of communities about ways in which the disease spreads is also being undertaken. Warnings to travellers and notification of new cases is also important.

**Q28 Communication Option 9.5**

NB Leave a line between each part of the question (otherwise you annoy the marker!)

**(a)(i) Band 2-3 2 mks 9.5.2**

<ul style="list-style-type: none"> <li>• Two parts of the eye correctly named with a correct function for each part</li> </ul>	<b>2</b>
<ul style="list-style-type: none"> <li>• One part of the eye correctly named with its correct function OR two partly correct functions (P)</li> </ul>	<b>1</b>

**Sample answer:** Any two of: conjunctiva, cornea, sclera, choroid, retina, iris, lens, aqueous/vitreous humour, optic nerve with description of function specifically given for part. Inclusion of something very incorrect with a correct function scores no mark.

NB Pupil not an eye part so only accepted with iris.

Learn to spell: ciliary, aqueous humour, vitreous humour

**(ii) Band 3-4 2 mks 9.5.2**

• Conditions under which refraction of light occurs correctly identified with example or expansion (see sample answer)	<b>2</b>
• A correct statement about refraction without a relevant example or expansion	<b>1</b>

**Sample Answer:** Refraction of light occurs when it moves from one medium to another and the density of the new medium is different e.g. air to water, air to cornea, cornea to aqueous humour etc OR causing the light to change speed/direction

**(iii) Band 2-3 2 mks 9.5.2**

• Four refractive media in the eye identified	<b>2</b>
• Two or more refractive media in the eye identified	<b>1</b>

**Sample Answer:** cornea, aqueous humour, lens, vitreous humour (cornea was rarely mentioned)

**(b) Band 3-5 3 mks 9.5.2**

NB The word compare was rarely considered (what happened to similarities/differences tables??)

• Correct comparison (including THREE similarities or differences) between the colour vision of humans and a <b>named</b> insect including correct range of wavelengths, range of colours OR TWO similarities/differences AND one possible reason for the difference	<b>3</b>
• As above with one aspect omitted	<b>2</b>
• As above with two aspect omitted	<b>1</b>

**Sample answer:**

	<b>HUMANS</b>	<b>BEEES</b>
<b>SIMILARITIES</b>	both detect light from violet to yellow	
<b>DIFFERENCES</b>	detect light in range 420-700 nm	detect light in range 300-600nm
	see from violet to red in the visible spectrum	see UV wavelengths to yellow
<b>POSSIBLE REASONS FOR DIFFERENCES</b>	active during the day and sight is important for communication	UV allows them to see certain patterns on flowers more easily

NB Bees see a **different** range of colours not necessarily a wider range; thought that they see red wavelengths as black. (In this question, the table given in question was a guide as to what to include in answer)

**(c) Band 2-4 2 mks 9.5.4 H2, H13**

• Complete answer with explanation	<b>2</b>
• Poor answer or explanation only	<b>1</b>

**Sample answer:**

Humans have two eyes that capture slightly different images from an overlapping field of view and send that image to the brain. The brain combines these images together creating a 3-D picture and enabling distances to be judged accurately.

**(d) (i) Band 3-5 3 mks 9.5.2**

• correct comparison of the nature AND functioning of photoreceptor cells in mammals and insects including at least THREE similarities or differences	<b>3</b>
• correct comparison of the nature and/ or functioning of photoreceptor cells in mammals and insects including at least TWO similarities or differences	<b>2</b>
• correct comparison of the nature OR functioning of photoreceptor cells in mammals and insects including at least ONE similarity or difference OR some correct information about the nature and functioning of either type of photoreceptor.	<b>1</b>

NB nature or functioning NOT location

**Sample answer:**

**mammals** – photoreceptors are rods and cones on the retina; rods are for black and white vision (especially at low light intensities), detection of movement and peripheral vision; cones are for colour vision and visual acuity

**insects** – photoreceptors are in ommatidia containing retinal cells in their compound eyes; each ommatidium forms an image & then the images come together as mosaic pattern (blurred compared to images formed in mammalian eye; less visual acuity); insect photoreceptors detect slight movements; good short range view.

**similarities:** all photoreceptors contain refractive media and light sensitive pigments.

**(ii) Band 3-5 2 mks 9.5.4**

• full outline of the <b>role</b> of rhodopsin	<b>2</b>
• brief outline of the <b>role</b> of rhodopsin eg chemicals in rod cells which absorb light, enabling a message to be sent to the brain	<b>1</b>

**Sample Answer:** The main function of rhodopsin is to absorb light. When light energy is absorbed, the rhodopsin breaks down into opsin and a free retinal part. The activated pigment causes a change in the membrane of the rod starting an electrical impulse transmitted to the brain via a succession of cells in the retina. The rhodopsin is then regenerated for reuse.

**(e) Band 2-6 7 mks 9.5.3**

• Describes a technology used to prevent blindness from cataracts. (T1 partly; T2 fully)	<b>6-7</b>
• Discusses at least one implication for society.(S1 partly; S2 fully)	
• Discusses technologies used to correct myopia (M) and hyperopia (H) well and states how they would be different/similar to the technology for treating cataracts (C). (M/H means more detail needed or something incorrect).	
• Describes a technology used to prevent blindness from cataracts	<b>4-5</b>
• Discusses at least one implication for society.(	
• Discusses a technology used to correct myopia and hyperopia correctly.	
• Describes a technology used to prevent blindness from cataracts	<b>2-3</b>
• Discusses technology used to correct myopia and hyperopia but limited or some aspects incorrect	
• Limited discussion of one aspect of the question.	<b>1</b>

**NB Laser eye surgery is not used for cararacts.**

**Sample Answer:**

**Cataracts** (clouding of lens) can be removed using phacoemulsification and IOL surgery (breaking up of lens with ultrasound). Artificial lens replaces damaged one. This technique is relatively inexpensive, uncomplicated and can occur in day surgery.

Successful surgery allows people who could be blind to see which gives them independence and less reliance on society. This benefits society economically as people can remain in the workforce for longer and have a better quality of life. Huge impact on developing countries in Africa who have performed surgery cheaply and restored vision to many.

**Myopia** (short sightedness) is the result of the image being focused in front of the retina/elongated eyeball etc. & **hyperopia** (long sightedness) occurs when the image falls behind the retina/shorter eyeball. Technological advances are mainly in the alteration of the refraction of light entering the eye e.g. 1.lenses (glasses and contact lenses) bend light before it enters the eye. Myopia-corrected by diverging lenses/concave lenses & hyperopia-corrected by converging lenses/convex lenses.2. Laser surgery reshapes cornea.

Main Difference: cataract surgery involves replacement of part of the eye whereas the other technologies do not.

PS Learn to spell **incision**



**(f) (i) Band 2-4      3 mks      9.5.4**

Draws graph correctly including: <ul style="list-style-type: none"><li>• heading, adequate size, correct labels incl. units on correct axes</li><li>• scales correct</li><li>• correct plots, curve of best fit or ruled line (not extended beyond data) – not a bar graph</li></ul>	<b>3</b>
<ul style="list-style-type: none"><li>• Two of the above</li></ul>	<b>2</b>
<ul style="list-style-type: none"><li>• One of the above</li></ul>	<b>1</b>

**Sample Answer:** See graph overhead

Common errors: extending line to 0

not drawing a curve (not penalised here but learn to do the right thing)

Less common errors: axes reversed

leaving out answer to f(ii) – a “give-away”!

**(f) (ii) Band 2-3      1mk      9.5.4**

Correctly identifies wavelength with units i.e. 520nm	<b>1</b>
---	----------