

**JAMES RUSE AGRICULTURAL HIGH SCHOOL
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION
2003**

BIOLOGY

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

Total marks – 100

Section I – 75 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 part

Part B – 60 marks

- Attempt Questions 16-24
- Allow about 1 hour 45 minutes for this part

Section II – 25 marks (Question 25)

- Allow about 45 minutes for this section

Section I (75 marks)

Part A – 15 marks

Attempt Questions 1-15

Allow about 30 minutes for this part

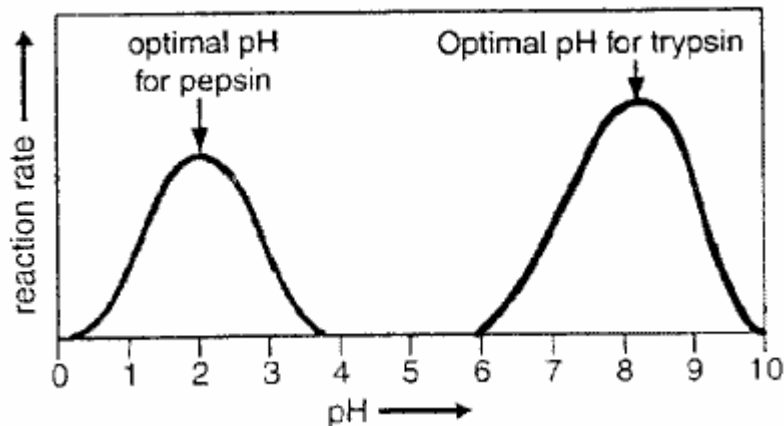
1. What tissue(s) can be seen in the diagram?



- (a) xylem in longitudinal section
(b) phloem in longitudinal section
(c) xylem and phloem in transverse section
(d) xylem and phloem in longitudinal section
2. What is the main form in which nitrogenous waste is carried in mammalian blood?
(a) amino acids
(b) ammonia
(c) uric acid
(d) urea
3. Some fish have an internal salt concentration which is lower than that of the surrounding water. What is the role of the kidney in these fish?
(a) To excrete concentrated urine
(b) To excrete dilute urine
(c) To actively absorb salt
(d) To actively excrete salt
4. Which of the following is the correct information concerning excretion of insects?

Excretory Product	Volume of water needed to remove excretory product	Excretory component
(a) Uric acid	High	Nephrons
(b) Ammonia	Low	Nephrons
(c) Uric acid	Low	Malpighian tubules
(d) Ammonia	High	Malpighian tubules

5. The graph below shows information about two enzymes and enzyme activity at various level of pH. Which statement below is correct?



- (a) Trypsin works better in more acidic conditions than pepsin
 (b) Pepsin works better in more acidic conditions than trypsin
 (c) Trypsin only works in alkaline conditions
 (d) Neither trypsin nor pepsin work in neutral conditions of pH
6. In rabbits, short hair (H) is dominant over long hair (h). the offspring produced from a cross between a short-haired female and a long-haired male were 1 long-haired and 7 short-haired individuals. Which of the following combinations represents the genotypes of the parents?
 (a) Hh and Hh
 (b) HH and hh
 (c) HH and Hh
 (d) Hh and hh
7. Some finches in the Galapagos islands use cactus spines to probe the bark of trees for insects. Woodpeckers in North America use their long, curved beak to remove insects from tree bark. Which of the following terms best describe the development of these similar food-gathering methods?
 (a) Gradual evolutions
 (b) Punctuated evolution
 (c) Convergent evolution
 (d) Divergent evolution
8. Red-green colour blindness is an X-linked recessive trait in humans. A carrier female marries a red-green colour blind man. What is the probability of their children showing the trait?
 (a) All of their sons will be colour blind and all of their daughters will have normal vision
 (b) Half of their sons and half of their daughters will be colour blind
 (c) Half of their sons will be colour blind and all the daughters will have normal colour vision
 (d) All of their daughters and half of their sons will be colour blind
9. In Andalusian fowls there are three phenotypes –black, blue-grey and white. A heterozygous bird is crossed with a white bird. What is the probability of getting offspring that are black?
 (a) 0%
 (b) 25%
 (c) 50%
 (d) 100%
10. Artificial pollination and insemination
 (a) increase a clone's chance of survival
 (b) quickly and efficiently spread desirable genes through a population
 (c) always increase the genetic diversity of the population
 (d) generally slow down the reproduction rate of the organism involved
11. Which of the following statements describes a correct role of one type of T cell?
 (a) Killer T-cells turn off the immune response
 (b) Suppressor T-cells engulf and destroy antigens
 (c) Helper T-cells help activate B-cells to produce antibodies
 (d) Memory T-cells produce antibodies

12. A micro-organism is described as a eukaryotic heterotrophic cell without cell wall. What is the most likely classification of this organism?
- (a) virus
 - (b) prion
 - (c) fungus
 - (d) protozoan
13. Which of the following best identifies the main components of the immune response?
- (a) T-cells, B-cells, antibodies
 - (b) B-cells, antibodies, phagocytes
 - (c) T-cells, antibodies, phagocytes
 - (d) antigens, antibodies, pathogens
14. What is the role of antigens?
- (a) A defence barrier to prevent infection
 - (b) Molecules that trigger the immune response
 - (c) To produce antibodies
 - (d) To engulf dead and damaged cells
15. Which scientist's work contributed to a better understanding of the immune response and the effectiveness of immunisation programs?
- (a) Pasteur
 - (b) Koch
 - (c) Ross
 - (d) McFarlane Burnett

Section I (continued)

Part B – 60 marks

Attempt Questions 16-27

Allow about 1 hour and 45 minutes for this part

16. Identify four defence barriers and how they prevent the entry of pathogens. **(4 marks)**

17. Some Biology students wanted to discover if there were micro-organisms in water. They took samples from bottled water, the laboratory, the canteen tap and school bubblers. **(8 marks)**

- Describe using a step by step procedure how this problem could be tested (3 marks)
- Describe a control for this experiment (1 mark)
- What observations could be made in a school laboratory to compare the water samples? (1 mark)
- Describe how the students could present their results (2 marks)
- Identify two safework practices needed during this investigation (1 mark)

18. **(8 marks)**

- Outline the way in which vaccinations prevent infection. (4 marks)
- Evaluate the effectiveness of vaccination programs in preventing the spread and occurrence of disease, including smallpox, diphtheria and polio. (4 marks)

19. The effect of temperature on the activity of an enzyme present in animal A and B is shown in the table below. **(7 marks)**

Temperature (°C)	0	5	10	15	20	25	30	35	40	45	50	55	60
Activity of Animal A enzyme	0	0	1	2	3	6	12	25	14	4	2	1	0
Activity of Animal B enzyme	0	1	4	8	15	22	25	22	14	9	3	1	0

- Draw a line graph of the data (2 marks)
- Describe the effect of temperature on enzyme activity for animal A and B (2 marks)
- Which animal A or B is an ectotherm and which animal is an endotherm? Explain your answer (2 marks)
- Name one Australian Ectotherm and describe an adaptation that enable it to assist temperature regulation (1 mark)

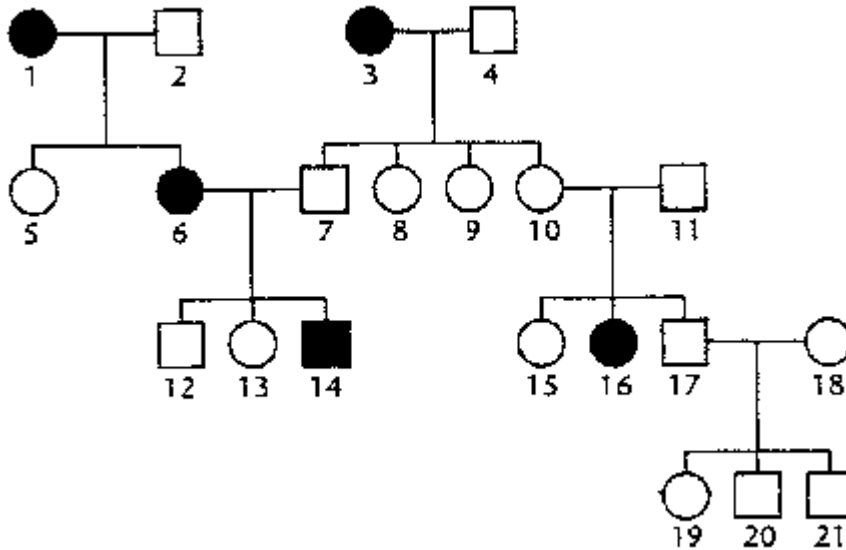
20. Homeostasis often involves a feedback mechanism. **(7 marks)**

- Describe the terms “homeostasis” and “feedback mechanism” (2 marks)
- Use a model to clearly and succinctly explain one example of a feedback mechanism in the human body (5 marks)

21. **(5 marks)**

- Outline the need for oxygen in living cells (1 mark)
- Explain why the removal of carbon dioxide from cells is essential (1 mark)
- Identify a current technology that allows the measurement of oxygen saturation in the blood (2 marks)
- Describe a condition under which this technology may be used (1 mark)

22. Alkaptonuria is a rare genetic disease that causes the formation of coloured cartilage, dark urine and arthritis. **(6 marks)**



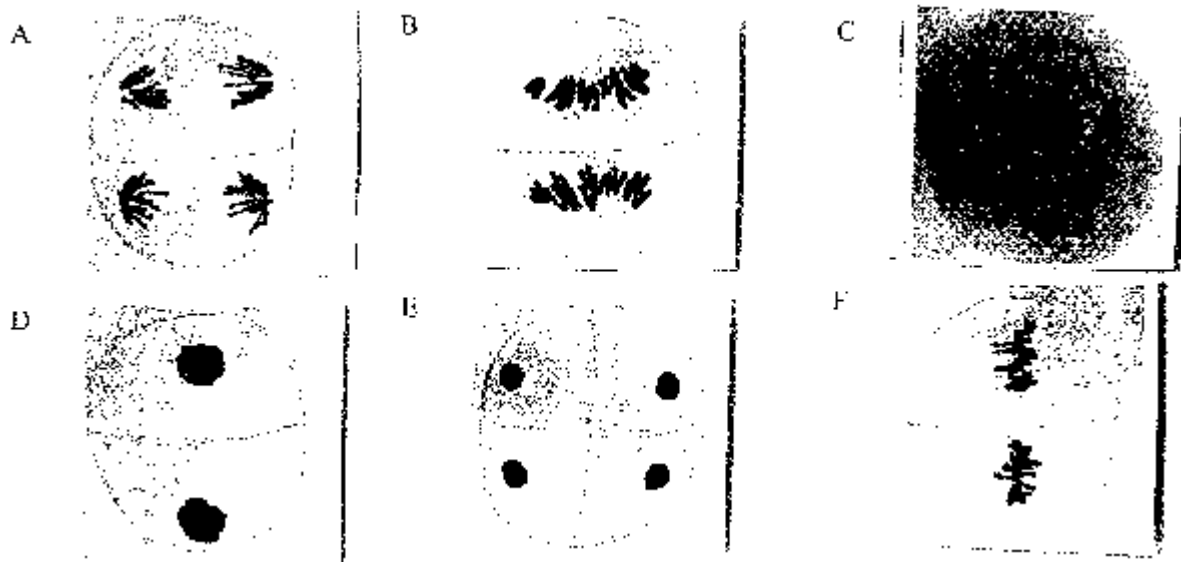
This is a pedigree which traces the inheritance of alkaptonuria in a family. The shaded symbols show those affected with alkaptonuria.

- (a) Is alkaptonuria dominant or recessive? Explain your answer (2 marks)
 (b) Complete the table: (2 marks)

Number	Phenotype	Genotype
3		
7		

- (c) Discuss the current use of pedigrees, such as the one above (2 marks)

23. The photographs below show various steps in meiosis. (8 marks)



- (a) Sequence the photographs (A to F) in the order in which these steps occurred in meiosis (1 mark)
 (b) Identify two ways in which variations in the gametes can occur in this process, and the photograph(s) in which this occurs (3 marks)
 (c) Variation can be increased in other ways. Explain how new alleles could be produced (2 marks)
 (d) Explain how an understanding of the source of variation in organisms has provided support for Darwin's theory of evolution by natural selection (2 marks)

24. (7 marks)

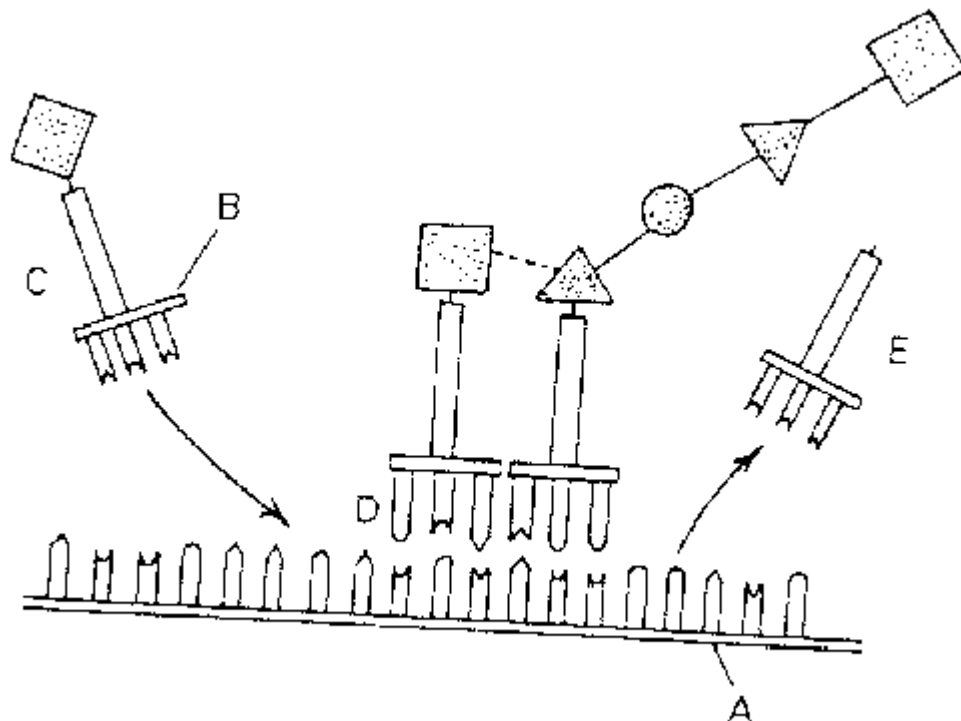
- (a) Outline the processes used to produce transgenic species (3 marks)
 (b) Identify examples of the use of transgenic species and reasons for their production (2 marks)
 (c) Discuss one ethical issue arising from this technology (2 marks)

Section II: Genetics: The Code Broken? (25 marks)

Allow about 45 minutes for this section

- (a) Construct a table to distinguish gene cloning from whole organism cloning in terms of: (5 marks)
- the processes
 - the products and
 - an example of a use for each
- (b) A woman with blood group type A gives birth to a child with blood group type O. The woman claims that a man whose blood group is type B is the father of the child. Is it possible for these two parents to produce a child with blood group type O?
- Explain your answer and show all relevant genotypes (2 marks)
 - Explain the term "multiple alleles", using the example in this question (1 mark)
 - Give one example of multiple alleles, other than in humans (1 mark)

(c)



peptide synthesis occurs at the surface of ribosomes. In the process, genetic information in a DNA molecule determines the sequence of amino acids that form particular polypeptide molecules. The diagram illustrates polypeptide synthesis.

- Name the molecules labelled A and B (1 mark)
 - Describe what is happening at the stages labelled C, D and E (3 marks)
- (d)
- Outline the procedure to produce recombinant DNA (3 marks)
 - Recombinant DNA has many uses in genetic research. One of the most important is to identify the position of a gene on a chromosome. Explain how the use of recombinant DNA technology can identify the position of a gene on a chromosome. (3 marks)
- (e) Describe the current use of gene therapy to manage a named disease (3 marks)
- (f) Identify one practicing Australian scientist, describe the area of research in which they are currently working and some information about their research (3 marks)

JAMES RUSE

2003 Trial HSC Biology
Marking Guidelines

Section 1

Part(A) Q1-15, mark each

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

Section 1

Part (B) Total Marks 60

Question 16 (4marks)

Outcome assessed H6

Criteria	Marks	Band
Correctly identifies 4 defence barriers and how they prevent entry of pathogens	4	5
Correctly identifies 3	3	4
Correctly identifies 2	2	3
Correctly identifies 1	1	2

Answer:

- *Skin- outer layer is dead and dry, poor environment for growth of pathogens
- *Mucous membranes- pathogens get caught in this viscous fluid and the mucous containing the pathogens can be removed
- *Cilia- cilia in the lungs beat to remove mucous out of the lungs, can be coughed out of the body.
- *Chemical Barriers-eg, stomach acid can kill the pathogens
- *Other body secretions could also be included in this answer such as tears, saliva, urine, bile

Question 17 (8marks)

Outcomes 11,13

(a) 3 marks

Criteria	Marks	Band
Correct aseptic techniques outlined in a controlled experiment using appropriate equipment, sterile nutrient agar, sterile petri dishes and method of inoculation	3	6
Correct procedure and any two of above	2	5
Correct procedure and any one of above	1	4

Answer:

- *Prepare sterile nutrient agar in an area that has been wiped with alcohol.
- *Pour this into sterile petri dishes by lifting the lid at a small angle to prevent spores in the air from entering. Allow the agar to set.

*Collect water samples using sterile equipment and add the same volume of water from the water samples to separate petri dishes, gently rocking the dish to allow the water to spread evenly over the agar. Seal and label the plates properly

*Incubate the plates at a warm temperature for a number of days.

(b) 1 mark

Criteria	Marks	Band
Control described	1	6

Answer:

Leave one plate unexposed to any water. This plate will not be opened after the pouring of the agar.

(c) 1 mark

Criteria	Marks	Band
2 correct observations required	1	6

Answer:

Any two of: shape, size, texture, number of colonies

(d) 2 marks

Criteria	Marks	Band
Identify a table or a graph and give a description of either	2	6
Identify a table or a graph, without description	1	5

Answer:

A table could be used to show record the differences in observations between the various water sources. Columns in table could include: source of water, numbers of colonies, shape, size, colour, bacterial or fungal.

(e) 1 mark

Criteria	Marks	Band
2 safe work practices identified for the method	1	6

Answer:

Lids must not be removed from petri dishes as they could contain pathogens. Wash hands before leaving the laboratory to prevent possible infection. Others could include wearing lab coats and closed in shoes to prevent spread of pathogens.

Question 18 (8 marks)

Outcome:4

(a) 4 marks

criteria	Marks	Band
Outlines the process of vaccination, the content of a vaccine, the effect of the vaccine and the long lasting protection given	4	5
Any 3 of the above	3	4
Any 2 of the above	2	3
Any 1 of the above	1	2

Answer:

Vaccination is the process of making people more resistant to infection by a pathogen. Vaccines may contain dead antigens, attenuated antigen (which is a closely related form) or a bacterial toxoid, all are able to induce the immune response. This can stimulate the cloning of B and T cells resulting in the body's own immune system releasing antibodies and memory cells which will give lasting protection at a later stage if the pathogen should enter the body. The memory cells will quickly respond so the person does not suffer the full symptoms of the disease.

(b) 4 marks

Criteria	Marks	Band
States that vaccination programmes have been highly effective in preventing the spread and occurrence of these 3 diseases mentioned, outlines the extent of the effectiveness for each of the 3 diseases	4	5
Any 3 of the above	3	4
Any 2 of the above	2	3
Any 1 of the above	1	2

Answer:

Vaccination programmes have been highly effective in preventing the spread and occurrence of smallpox, polio and diphtheria.

Smallpox-the WHO declared total eradication of this viral disease from all countries in 1980 as a result of a world wide vaccination programme

Polio- this viral disease has not been eliminated in all part of the world, but there have been no cases in Australia since 1986, due to the Sabin oral vaccine given to babies.

Vaccination programmes continue in the remaining countries with the hope that this disease will be eradicated in all countries in the next few years.

Diphtheria-this bacterial disease has been greatly reduced worldwide due to vaccination being given as part of the triple antigen vaccine to babies and is no longer a major cause of death in children. There has been a resurgence in the disease when vaccination rates decline.

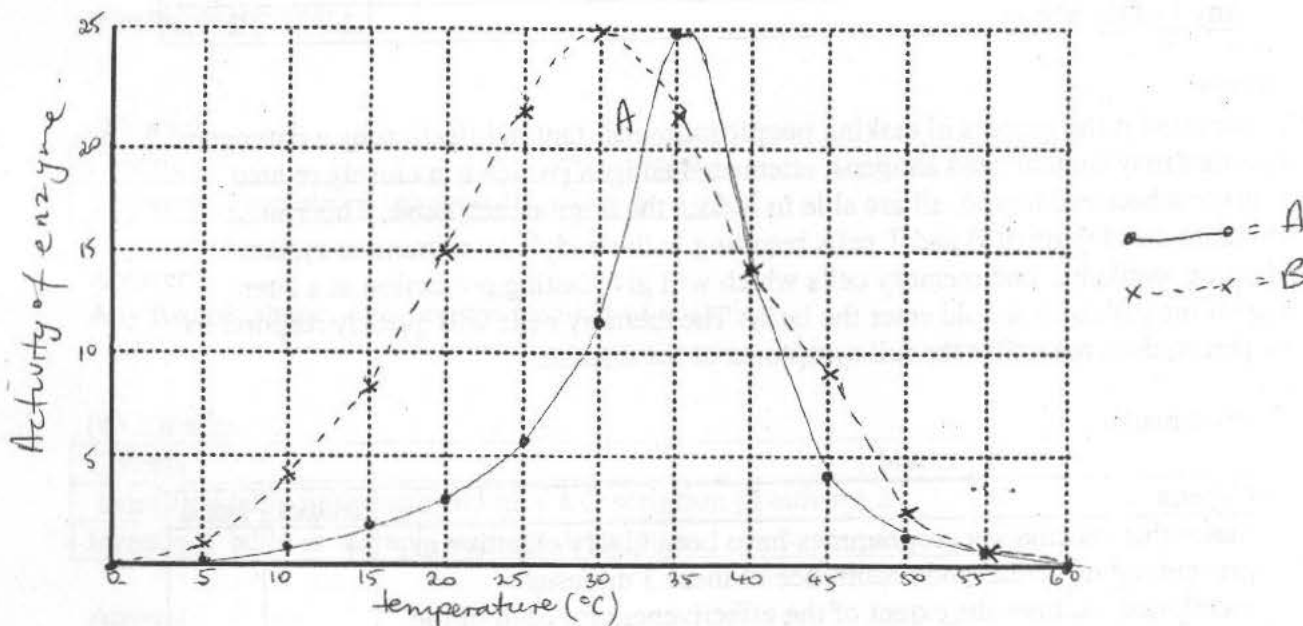
Question 19 (7 marks)

Outcomes:13,14

Part (a) 2 marks

Criteria	Marks	Band
A&B correctly plotted on appropriately labelled axes	2	5
Only A or B correctly plotted on appropriately labelled axes	1	4

Answer: Effect of Temperature on the Activity of Enzymes



Part(b) 2 marks

Criteria	Marks	Band
Correct description of effect of temperature on enzyme activity for A & B	2	5
Only A or B correctly described	1	4

Answer:

A: Enzyme activity in animal A reaches a peak at 35°-37°, falling sharply either side of this temperature.

B: Enzyme activity in B reaches a peak at about 30°C and gently falls away either side of this temperature.

Part (c) 2 marks

Criteria	Marks	Band
A=endotherm, B=ectotherm, appropriately explained	2	5
A=endotherm, B=ectotherm	1	4

Answer:

A=endotherm, their bodies are at a constant temperature and enzymes function in a narrow range around this temperature.

B=ectotherm, their enzymes must be able to function well at a wider range of temperatures.

Part (d) 1 mark

Criteria	Marks	Band
Correct name and description of adaptation	1	5

Answer:

e.g. desert lizard- basking body close to ground to increase temperature and raising it's body off ground at right angle to ground, to cool off (less surface area of body to gain heat)

e.g, earless dragon- panting, evaporating water from mouth and throat to cool down

Question 20 (7 marks)

Outcome: 6

Part (a) 2 marks

Criteria	Marks	Band
Homeostasis and feedback mechanism correctly described	2	6
One of the above	1	5

Answer:

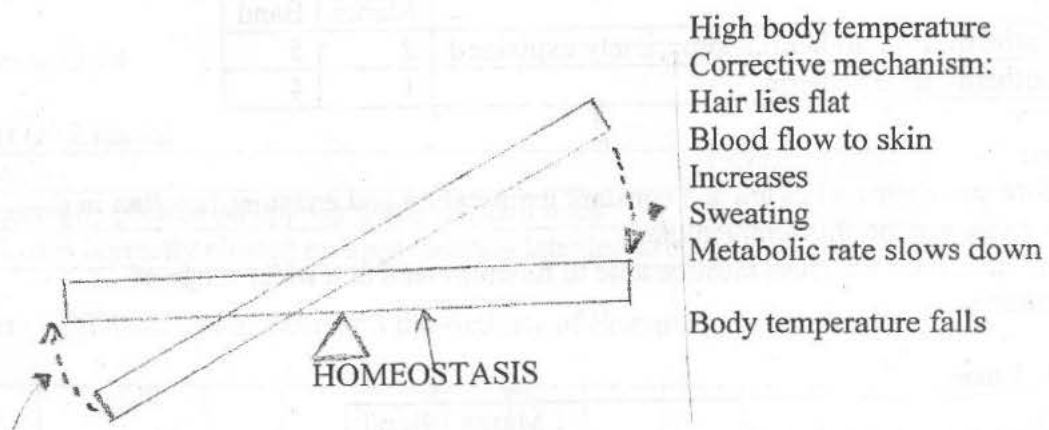
Homeostasis: the maintenance by an organism of a constant or almost constant internal state regardless of environmental change.

Feedback mechanism: the reaction of body counteracts the stress in order to restore homeostasis, the response influences the original stimulus that caused it.

Part(b) 5 marks

Criteria	Marks	Band
Use of a model, explains clearly an example of a feedback mechanism, shows how the body counteracts stresses, and restores homeostasis.	5	6
Completes the above without use of a model	4	5
Completes above without use of model or example	3	4
Does not use model, example and does not show how homeostasis is restored.	2	3
Provides only a general mechanism to show how the body counteracts stresses.	1	2

Answer: see-saw model for the control of body temperature



Body temperature rises

Low body temperature
 Corrective mechanism
 Hair raised
 Blood flow to skin decreases
 No sweating
 Metabolic rate increases
 Shivering

Question 21 (5 Marks)

Outcome 3,4

Part(a) 1 mark

Criteria	Marks	Band
Correctly outlines need for oxygen	1	3

Answer: Need for oxygen- respiration to produce energy

Part (b) 1 mark

Criteria	Marks	Band
Correctly explains why removal of CO ₂ from cells is essential	1	3

Answer: removal of CO₂- carbon dioxide is a waste which forms carbonic acid which produces H⁺ in plasma and increases the acidity, enzymes would not be at their optimum pH for maximum efficiency if CO₂ was not removed.

Part (c) 2 marks

Criteria	Marks	Band
Name and identify a devise that allows oxygen saturation in the blood to be measured	2	5
Names only the devise	1	4

Answer:

Pulse oximeter- senses the change in colour of blood to calculate the amount of oxygen in the blood, by the amount of light passing through the skin.
(or arterial blood gas analysis)

Part (d) 1 mark

Criteria	Marks	Band
Correctly describes a condition under which this technology can be used	1	5

Answer:

The instrument is used to monitor the amount of oxygen in patients undergoing surgery or who have abnormal breathing or circulation.

Question 22 (6 marks)

Outcomes: 9,14

Part (a) 2 marks

Criteria	Marks	Band
Recessive and correct reason	2	5
Recessive	1	4

Answer:

Recessive because parents 10 and 11 do not have the disease but have produced children who do have alkaptonuria, they must be heterozygous to produce child 16 who is has this recessive condition.

Part (b) 2 marks

Criteria	Marks	Band
Correct phenotype and genotype for number 3 and 7	2	5
Correct phenotype and genotype for number 3 or 7	1	4

Answer:

3: alkaptonuria (female) present aa
7: normal (male) Aa

Part (c) 2 marks

Criteria	Marks	Band
Discussion of one use	2	5
Use only	1	4

Answer: Pedigrees can be used by genetic counsellors to show the family history of a disorder, enabling them to discuss possible recurrence risk with their clients.

Question 23: (8 marks)

Outcomes: 10,14

Part(a) 1 mark

Criteria	Marks	Band
Correct sequence	1	5

Answer: CBDFAE

Part(b) 3 marks

Criteria	Marks	Band
Correctly identifies 2 ways in which variation occurs in gametes and the timing of this variation in the process according to the photographs	3	5
Correctly identifies 2 ways in which variation occurs in the process	2	4
Correctly identifies 1 way in which variation occurs in this process	1	3

Answer:

Variation occurs in gamete formation due to:

Crossing over and random segregation of homologous pairs of chromosomes.

This occurs in B (or C-B)

Part (c) 2 marks

Criteria	Marks	Band
Correctly identifies mutations as the means by which new alleles arise and explanation	2	5
Correctly identifies mutations	1	4

Answer:

Mutations are the means by which new alleles arise as changes to the DNA information on a chromosome e.g. base substitution.

Part (d) 2 marks

Criteria	Marks	Band
Correctly identifies that variation is the raw material for evolution and explains why	2	5
General statement that mutations provide the evidence for variation.	1	4

Answer: Mutations provide the evidence for variation. This theory relies on variation as the raw material for evolution. Organisms with favourable variations will tend to survive, reproduce and pass on this favourable variation increasing the frequency of the variation.

Question 24 (7marks)

Outcomes:3,7,8,16

Part(a) 3 marks

Criteria	Marks	Band
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Correctly outlines the procedure to produce transgenic species-e.g. recombinant DNA- plasmids, use of restriction enzyme, gene splicing,	3	6
Only two of the above	2	5
Only one of the above	1	4

Answer:

Transgenic species are produced by transferring DNA from one species to another. Bacterial plasmids can be used as vectors to transfer genes from one organism to another. Restriction enzymes split both types of DNA and the foreign gene is spliced into the plasmid using ligase enzymes. The plasmid is taken up by the bacterium and reproduces by mitosis (or if the gene is inserted into an egg cell, then fertilized, a whole new organism grows with the foreign gene contained in each cell)

Other processes: recombinant plasmid introduced into Agrobacterium which inserts plasmid into plant nucleus with the new DNA which is incorporated into plant DNA and reproduces and replicates foreign DNA along with their own.

(inserting genes into animal cells by microinjection or using a particle gun)

Part(b) 2 marks

Criteria	Marks	Band
2 examples of transgenic species and the reasons for their production	2	6
1 example of a transgenic organism and the reason for it's production	1	5

Answer: Bt cotton- produces a natural insecticide that comes from soil bacterium, less money spent on pesticides and the environment is protected.

Transgenic tomatoes- does not soften as quickly and has a longer shelf life

Transgenic strawberries- can grow better in cold conditions.

Part (c) 2 marks

Criteria	Marks	Band
Correctly discusses one ethical issue	2	6
States one ethical issue	1	6

Answer: Some people have reservations about eating transgenic organisms e.g. strict vegetarians may not want to eat transgenic strawberries that contain the gene of a fish.

Genetics the code broken

Part (a) Outcomes:3,5,13 (5 marks)

Criteria	Marks	Band
Clearly set out table with appropriate row and column headings, providing information about processes and products, an example of a use for both gene cloning and whole organism cloning.	5	6
Any 4 of the above	4	5
Any 3 of the above	3	4
Any 2 of the above	2	3
Any 1 of the above	1	2

Answer:

	Gene cloning	Whole organism cloning
Process	Use of technologies such as recombinant DNA and PCR	DNA from a "parent" cell is removed and inserted into an enucleated egg cell, which reproduces by mitosis and is implanted into the nucleus
Products	Produces multiple copies of a single gene or segment of DNA	Production of a genetically identical organism to the organism from which it was cloned. All the cells in the clone have the same genetic material as the original cell.
Example of use	Development of transgenic species, production of medicines such as insulin	Precise technology to breed animals with desirable characteristics e.g. high levels of milk, better quality of wool OR cloning of extinct or endangered animals

Part (b) Outcome 9,13

(i) 2marks

Criteria	Marks	Band
Genotypes of parents and offspring and explanation given	2	4
Genotypes of parents and offspring	1	3

Answer: Parents $I^A i$ and $I^B i$, child ii. Parents must be heterozygous in order for a i allele to be contributed by each parent to offspring. (punnet square could be given)

(ii) 1 mark

Criteria	Marks	Band
Explanation of multiple alleles and example	1	3

Answer:

Multiple alleles: More than two possible alleles for a particular gene e.g. I^A, I^B, i

(iii) 1 mark

Criteria	Marks	Band
Correct example	1	3

Answer:

Eye colour in Drosophila (12 alleles), white clover leaf patterns (7 alleles)

(c) Outcomes: 2 (4 marks)

(i) 1 mark

Criteria	Marks	Band
Name of both molecules	1	5

Answer: A= m-RNA, B= t-RNA

(ii) 3 marks

Criteria	Marks	Band
Stages C,D and E described	3	5
Only 2 of the above	2	
Only 1 of the above	1	

Answer:

C: t-RNA with an amino acid attached is approaching the m-RNA

D: the anticodon of t-RNA pairs with the complementary bases (codon) on the m-RNA

E: t-RNA detaches from the m-RNA and can pick up another amino acid molecule of the same type.

(d) Outcome 1, 3 (6 marks)

(i) 3 marks

Criteria	Marks	Band
Correct procedure outlined, including , use of restriction enzymes to cut segment of DNA from plasmid and from foreign DNA, insertion and splicing of foreign DNA into plasmid using DNA ligase, plasmid returned to cell and reproduces, including the foreign DNA.	3	6
Two of above	2	5
One if above	1	4

Answer: A plasmid (circular molecule of DNA in bacteria) is isolated. Restriction enzyme is used to cut segment from plasmid and also from another source of DNA e.g. human DNA. The foreign gene is spliced into the plasmid using DNA. The plasmid is returned into the cell which reproduces by mitosis(including the foreign DNA)

(ii) 3 marks

Criteria	Marks	Band
Correctly explains how recombinant DNA technology can identify the position of a gene on a chromosome. Three of the steps below	3	6
Two of the steps below	2	5
One of steps below	1	4

Answer: *A probe (specific sequence of DNA) complementary to a gene is produced, this can be cloned and tagged with fluorescent dye.

*The probe is added to a preparation of chromosomes which have their strands separated. They hybridise with the complementary DNA.

*Fluorescent light can be used to show it's position on the chromosome.

(e) Outcome: 4,5 (3 marks)

Criteria	Marks	Band
Explain the process of gene therapy in general, state a disease that can be managed with this procedure, describe how this procedure can be used for this disease	3	5
Two of the above	2	4
One of the above	1	3

Answer:

Gene therapy is the cutting of genes from the DNA of healthy cells and inserting them into the DNA of defective cells and tissues.

Cystic Fibrosis is a recessive disorder which creates thick mucous and results in lung damage and frequent long infections

Gene Therapy uses harmless viruses to carry and insert healthy DNA into the lung via a tube in the nose or spray producing some normal mucous.

Unfortunately the trials have not been able to deliver sufficient corrected genes to make a significant difference.

(f) Outcome: 12 (3 marks)

Criteria	Marks	Band
Name one Australian Scientist, describe area currently working in, and brief information about research	3	4
Two of above	2	3
One of above	1	2

Answer: Peter Doherty; area- immunology: Killer T cells can recognise altered self e.g if a virus infects a cell and the cell is displaying viral antigens in addition to it's own. A virally modified cell is destroyed in the same way a transplanted cell from another individual would be. This research has been used in understanding viral diseases, making vaccines and unravelling the mysteries of cancer.