

**HURLSTONE AGRICULTURAL HIGH SCHOOL****Trial Higher School Certificate Examination  
2010****BIOLOGY****General Instructions -**

- \* Reading time - 5 minutes
- \* Working time - 3 hours
- \* Write using black or blue pen
- \* Draw diagrams in pencil
- \* Board-approved calculators may be used
- \* Write your Student Number at the top of each answer page

**Total marks - 100****SECTION I (85 marks)****Part A - Multiple Choice - 20 marks**

- \* Attempt questions 1 - 20
- \* Your choices should be placed on the multiple choice answer sheet
- \* Allow about 35 minutes for this part

**Part B - Extended response - 65 marks**

- \* Attempt questions 20 - 29
- \* Allow about 1 hour 55 mins for this part

**SECTION II (15 marks)**

- \* Questions on option Genetics: The Code Broken?
- \* Allow about 30 minutes for this section

**SECTION I****PART A - 20 marks****Attempt questions 1 - 20****Allow about 35 minutes for this part**

Use the Multiple Choice answer sheet for questions 1 – 20

### 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 this by writing the word correct and drawing an arrow as follows:

(A)  (B)  (C)  (D)   
correct  
↓  
(A)  (B)  (C)  (D)

## Section I – Part A

- Which observations can be used to demonstrate Koch's contribution to understanding the cause of disease?
  - Polio vaccinations trigger an immune response.
  - Some mosquitoes carry a pathogen that is often fatal to people.
  - The bacteria, *Helicobacter pylori*, is present in the stomach of all people diagnosed with stomach ulcers.
  - A lack of vitamin C is found in all people suffering the nutritional disease scurvy.
- Which two processes are important for the maintenance of health?
  - Mutation and mitosis
  - Mitosis and meiosis
  - Mitosis and cell differentiation
  - Meiosis and cell differentiation

3. Students performed an investigation to compare the effectiveness of two water treatments for purifying pond water. Three samples of pond water, *A*, *B* and *C*, were collected and each used to inoculate an agar plate. The plates were incubated at 25°C and examined three days later. The number of visible bacterial colonies on each plate was counted and the results tabulated.

<b>Sample</b>	<b>A</b>	<b>B</b>	<b>C</b>
<b>Treatment</b>	5 grams of pool chlorine per litre of water	Boiling for one minute	No treatment
<b>Number of visible bacterial colonies</b>	0	6	22

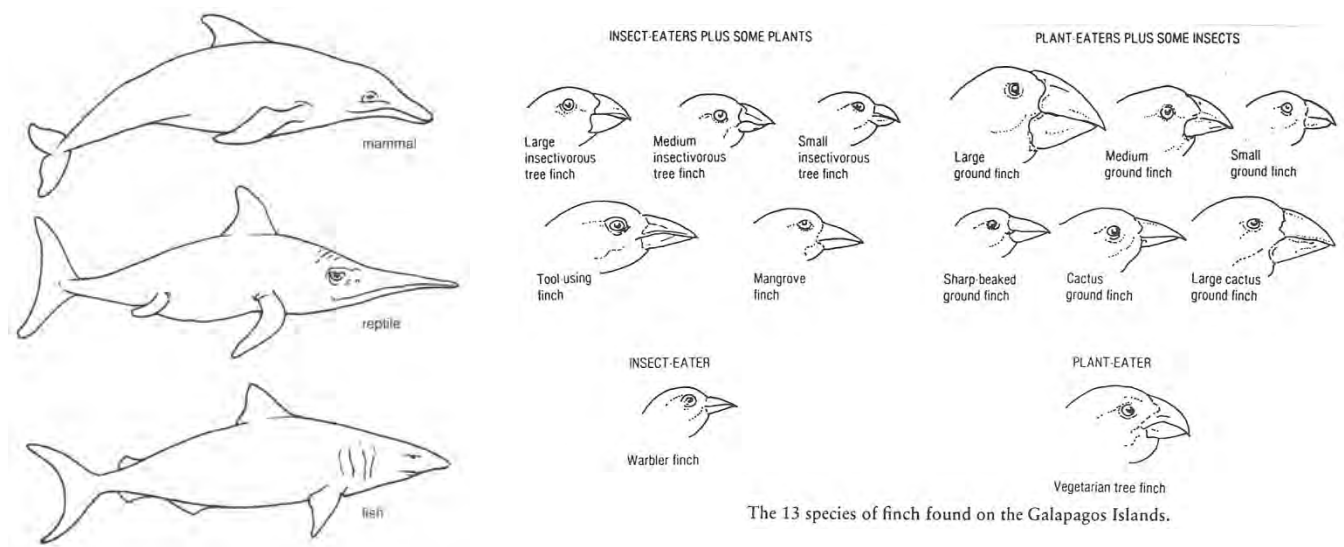
What is the dependent variable in this investigation?

- (A) The use of a control sample
  - (B) The number of visible bacterial colonies
  - (C) The use of sterile agar plates for each sample
  - (D) Treating the water by boiling or adding pool chlorine
4. Which of the following statements is true?
- (A) Boveri observed meiosis in grasshopper cells and concluded that chromosomes occur in distinct pairs and during meiosis each gamete receives one chromosome from each pair.
  - (B) Morgan experimented with fruit flies and showed that the gene for eye colour is located on the X – chromosome and that hereditary factors can be exchanged between the X – chromosomes of an individual
  - (C) Sutton experimented with sea urchins and observed that a complete set of chromosomes – one half from the sperm cell and one half from the egg cell – is needed for normal development.
  - (D) Beadle and Tatum irradiated bread moulds producing mutations which in turn could no longer produce specific enzymes and they proposed the “one gene – one polypeptide” theory.

5. The two diagrams each represent a type of evolution -

**Type one:** Past and present vertebrates of the seas

**Type two:** Galapagos Island finches



Which statement correctly identifies the types of evolution being shown –

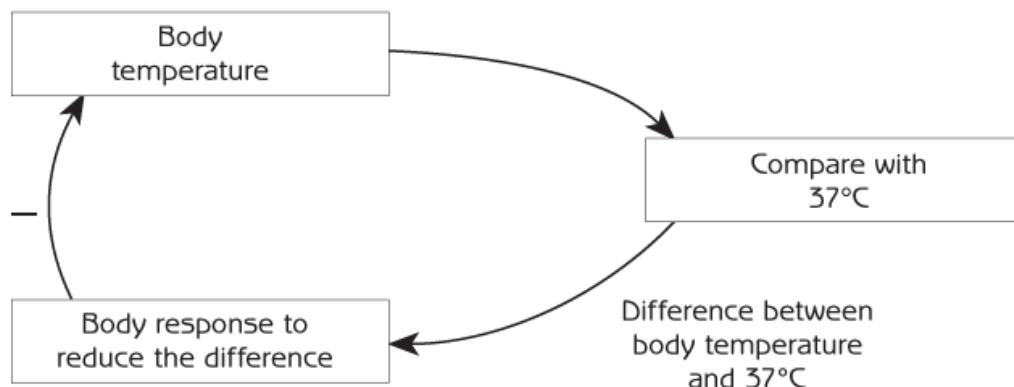
- (A) Type one represents convergent evolution and type two represents divergent evolution
- (B) Type one represents punctuated evolution and type two represents convergent evolution
- (C) Type one represents gradual evolution and type two represents convergent evolution
- (D) Type one represents convergent evolution and type two represents punctuated evolution
6. The production of a transgenic organism does not involve
- (A) removing a gene from the DNA of one organism by using a restriction enzyme.
- (B) the insertion of a donor gene into the egg (embryo) of another organism.
- (C) inducing mutations with radiation.
- (D) use of circular sections of DNA (plasmids) from bacteria.
7. Palaeontology contributes to our understanding of evolution by
- (A) comparing the embryological development of many organisms
- (B) comparing homologous structures
- (C) studying continental drift and biogeographical regions
- (D) studying developmental sequences in the fossil record
8. Which water treatment best reduces the risk of infection by killing pathogens in drinking water?
- (A) Chlorination
- (B) Filtration
- (C) Fluoridation

(D) Precipitation

9. In Labrador dogs, black fur “B” is dominant to white fur “b”. What would be the phenotypic ratio of the offspring from a cross between a heterozygous black dog and a white dog?
- (A) Black : white 1 : 3  
(B) Black : white 4 : 0  
(C) Black : white 2 : 2  
(D) Black : white 3 : 1
10. In the normal kidney of a human, which of the following substances would **not** be found in the Bowman's capsule?
- (A) glucose  
(B) haemoglobin  
(C) water  
(D) urea
11. What is the purpose of the mechanisms of homeostasis?
- (A) The maintenance of equal nutrient supply to all tissues.  
(B) The excretion of toxic waste products.  
(C) The maintenance of a stable cellular environment.  
(D) The maintenance of a constant concentration of all blood constituents.
12. Plants cannot move away from extremes of temperature. Which of the following mechanisms may be employed by plants in response to a large increase in temperature?
- (A) Increase the rate of photosynthesis.  
(B) Open stomates to allow for heat loss.  
(C) Close stomates to allow for water conservation.  
(D) Open stomates to allow for water conservation.
13. Which of the following adaptations would decrease the chance of survival for a mammal living in an extremely cold habitat?
- (A) low surface area : volume ratio  
(B) Being partly aquatic.  
(C) Dilation of skin blood vessels.  
(D) Migration.

Refer to the diagram below for the next **two** questions.

14. Which alternative in the table best describes the organ or process at X, Y and Z?



	X	Y	Z
A	Shivering	Skin	Hypothalamus
B	Skin	Sweating	Hypothalamus
C	Skin	Hypothalamus	Sweating
D	Sweating	Hypothalamus	Skin

15. What is the name used to describe this particular type of control system?

- (A) Enantiostasis
- (B) Homeostasis
- (C) Negative feedback control
- (D) Positive feedback control

16. The action of co-enzymes can affect the activity of an enzyme by:

- (A) making the active site of the enzyme more receptive to the substrate.
- (B) changing the optimal pH range of the enzyme.
- (C) denaturing the enzyme.
- (D) changing the shape of the substrate.

17. Like animals, plants use a number of processes for the movement of substances. Which of the following requires a plant to use cellular energy?

- (A) The drawing up of water through root hairs
- (B) Transpiration of water from its leaves
- (C) Opening and closing stomata in the leaves
- (D) Moving the products of photosynthesis around the plant

18. The order of bases of a strand of DNA is AATGGCCA. What would be the order of bases on the complementary strand of DNA?
- (A) AATGGCCA  
 (B) TTACCGGT  
 (C) UUACCGGU  
 (D) TTUGGCCT
19. In fruit flies that are homozygous for the gene for vestigial wings have wings that are only tiny stumps if they are reared at room temperature (about 22°C). But if they are reared at temperatures as high as 32°C their wings will grow almost as long as normal wings. This is an example of:
- (A) Crossing over  
 (B) Mutations in a weak gene influencing phenotype  
 (C) The environment influencing phenotype  
 (D) Lamarkian evolution
20. An experiment was conducted to examine the effect of ultraviolet radiation on the development of antibiotic resistance in a strain of bacteria. The table summarises the outcomes of this experiment.

Treatment	Antibiotic resistance				
	<i>Antibiotic P</i>	<i>Antibiotic Q</i>	<i>Antibiotic R</i>	<i>Antibiotic S</i>	<i>Antibiotic T</i>
No exposure to ultraviolet radiation	✓	✓	✗	✗	✗
Exposure to ultraviolet radiation	✓	✓	✗	✓	✗

Which of the following statements best summarises the stages in the development of the new strain of bacteria that was resistant to antibiotic *S*?

- (A) Hybridisation → Mutation → Natural Selection  
 (B) Replication → Mutation → Natural Selection  
 (C) Mutation → Natural Selection → Replication  
 (D) Mutation → Hybridisation → Natural Selection

**Section I - Part B**

**65 marks**

**Extended response questions**

**Attempt questions 21 - 30.**

**Allow 1 hour 55 minutes for this part**

Answer the questions in the spaces provided

**Question 21**

The table below shows the relative concentrations of a number of substances in normal blood, blood plasma from someone suffering renal failure and in dialysing fluid used in a kidney dialysis machine.

Substance	Relative concentration in		
	normal blood plasma	blood plasma in renal failure	dialysing fluid
glucose	100	100	125
urea	26	200	0
sodium ions	142	142	133
chloride ions	107	107	105
plasma proteins	80	80	0

(a) Which of the substances will be able to diffuse through the dialysis membrane? **1**

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(b) In which direction will each of these substances identified in (a) diffuse? **1**

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(c) Explain why the dialysing fluid has no urea. **2**

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**Question 22**

- (a) Normal venous pressure in the feet is about 25 mmHg. When a person stands completely still, the blood pressure in the feet rises very quickly to about 90 mmHg. Apply your understanding of the structure and function of blood vessels to explain this situation. **2**

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- (b) Compare the way mammals transport oxygen and carbon dioxide in the blood. **4**

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- (c) The chemical composition of the blood changes significantly as it travels around the body. Describe the main changes in concentration of carbon dioxide in the blood and identify the tissues in which these changes occur. **2**

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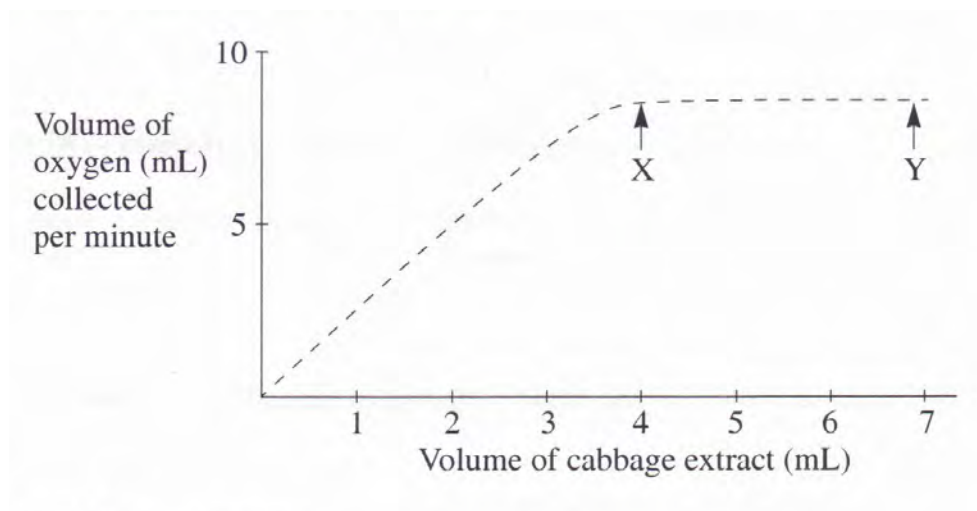
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**Question 23**

Many living cells contain the enzyme catalase which catalyses the breakdown of hydrogen peroxide to water and oxygen.



The graph below shows the result of an experiment carried out at \_\_\_\_\_ with a fixed amount of hydrogen peroxide and a constant pH, using green cabbage extract as a source of catalase.



a) Define the term *enzyme*. **1**

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(b) Identify the independent variable in the experiment. **1**

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(c) Explain the shape of the graph between points X and Y. **2**

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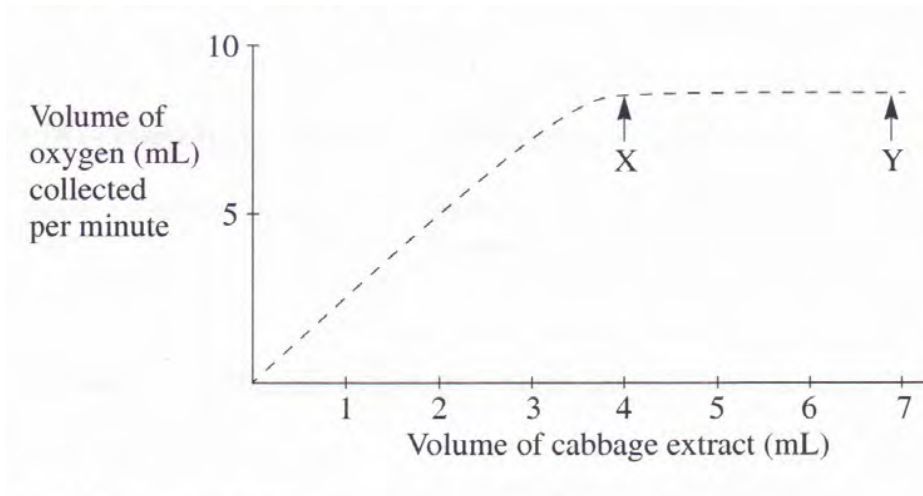
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- (d) Assume the catalase in this experiment has an optimum temperature of .  
On the pair of axes provided below, draw a curve to predict the volume of collected per minute, if the experiment had been carried out at .

1



- (e) Catalase is an intracellular enzyme, most active in the pH range of 6.5 – 7.5  
Describe what would happen to the activity of the catalase if the pH range of its environment was outside this range.

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- (f) Imagine you are a scientist researching a new poison. Knowing that hydrogen peroxide is toxic to cells, use your knowledge of enzymes to explain how such a poison could work.

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**Question 24**

Mammalian kidneys are very efficient at producing urine of varying concentrations depending on requirements. The table below gives the relative lengths of nephron tubules and maximum urine concentrations in the kidneys of a number of different mammals.

<b>Mammal</b>	<b>Relative tubule length</b>	<b>Maximum urine concentration (arbitrary units)</b>
Rat	5.2	300
Pig	1.3	110
Human	2.6	140
Kangaroo rat	7.8	550
Animal X	9.8	940

- (a) Describe and explain the relationship between urine concentration and the relative length of the nephron tubule.

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- (b) Propose the natural habitat of Animal X. Justify your choice.



**1**

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**Question 25**

Complete the following table to compare the mechanism of movement of substance(s) through the vessel, with reference to the structure of the vessel identified. **4**

	Diagram of vascular tissue	Comparison of mechanism of movement
Xylem		
Phloem		

**Question 26**

Black spot is an infectious apple disease that occurs in New Zealand and makes apples unsuitable for sale.

Describe a method to prevent the spread of the disease into Australia **3**

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**Question 27**

Our understanding of what causes a particular disease and how it can be prevented often involves research

and discoveries by scientists over many years. An example of such a disease is malaria.

Drugs have often been used to treat malaria, but with mixed success.

The following table outlines the history of treatment by some antimalarial drugs.

Drug	History
Quinine	Used for more than three centuries. Until the 1930's was the only effective agent for the treatment of malaria. Presently used for severe cases due to undesirable side effects.
Atebrin	Used in the Second World War. No longer used due to side effects.
Chloroquine	Used in the 1940's but no longer effective due to resistance in most strains of malaria.
Proguanil	First synthesised in 1946. Drug destroys malarial parasite and is still used.
Malarone	Released in Australia in 1998 as a combination drug. Still effective but expensive to produce.
Maloprim	No longer used due to resistance.
Fansidar	Combination drug no longer recommended due to resistance and serious side effects.
Mefloquine	First introduced in 1971. Decline in its use due to resistance and undesirable side effects including acute brain syndrome.
Halofantrin	Introduced in the 1980's. Resistance to the drug is increasing, plus undesirable side effects including neuropsychiatric disturbances.

Discuss how the historical developments associated with the treatment of malaria improve our understanding of the cause and prevention of malaria. *(hint; you do not have to restrict yourself to information in the table, you do not have to use the information in the table at all, use your knowledge of the history of the development of understanding of malaria to answer the question)*

**3**

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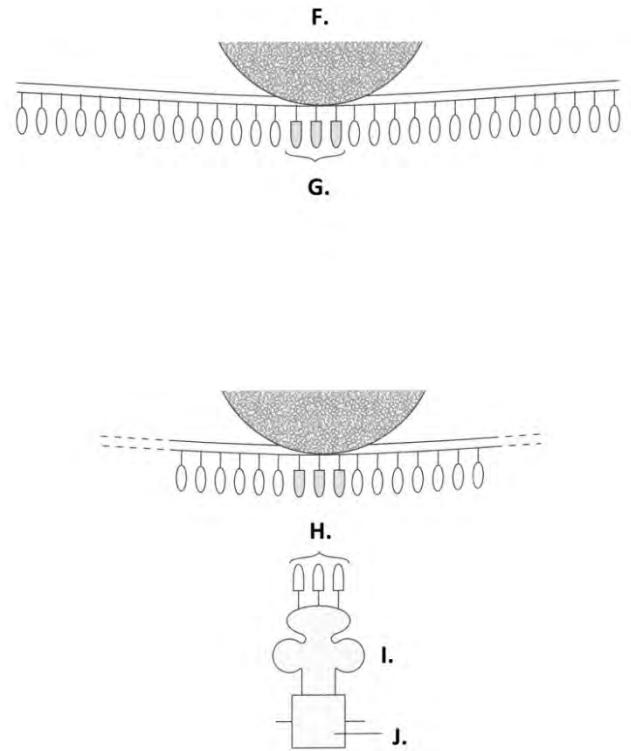
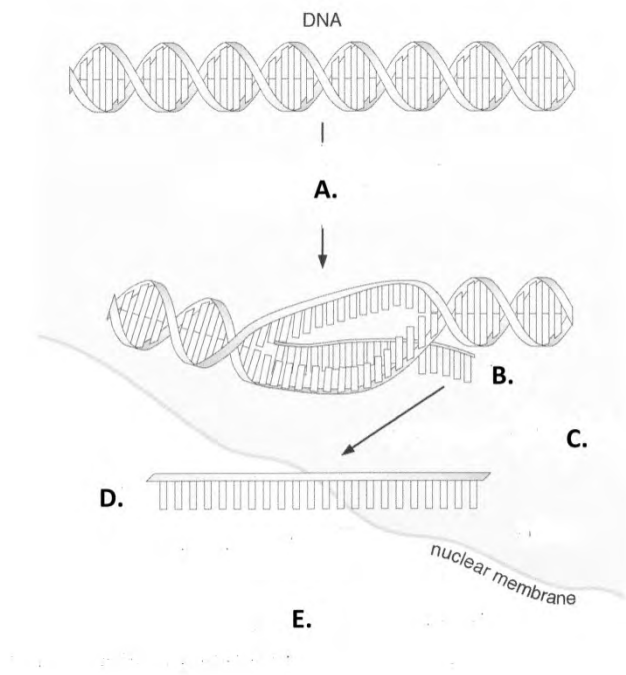
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**Question 28**

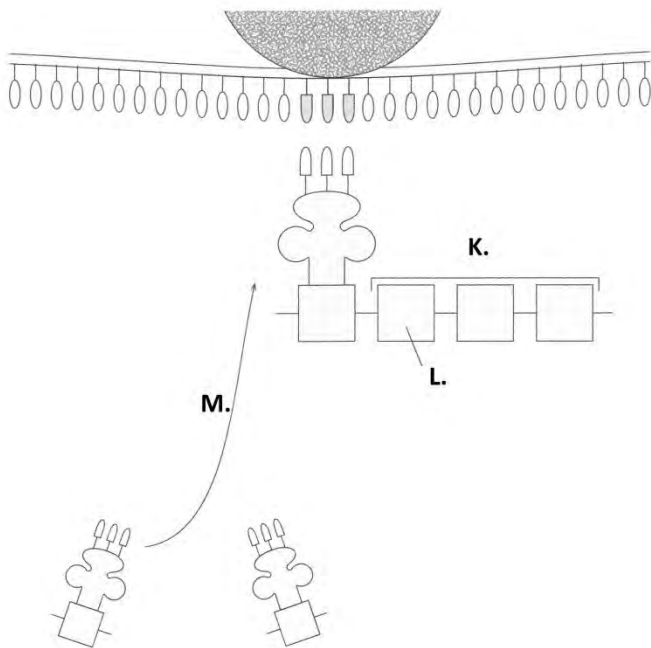
The following diagrams show the formation of an enzyme within a cell.

**Diagram 1.**

**Diagram 2.**



**Diagram 3.**



**(a)** Identify the structures represented by each of the following letters –

**3**



(3 marks)

D: ..... F: .....

G: ..... H: .....

I: ..... J: .....

**(b)** Identify and describe the processes occurring at – **4**

B: .....

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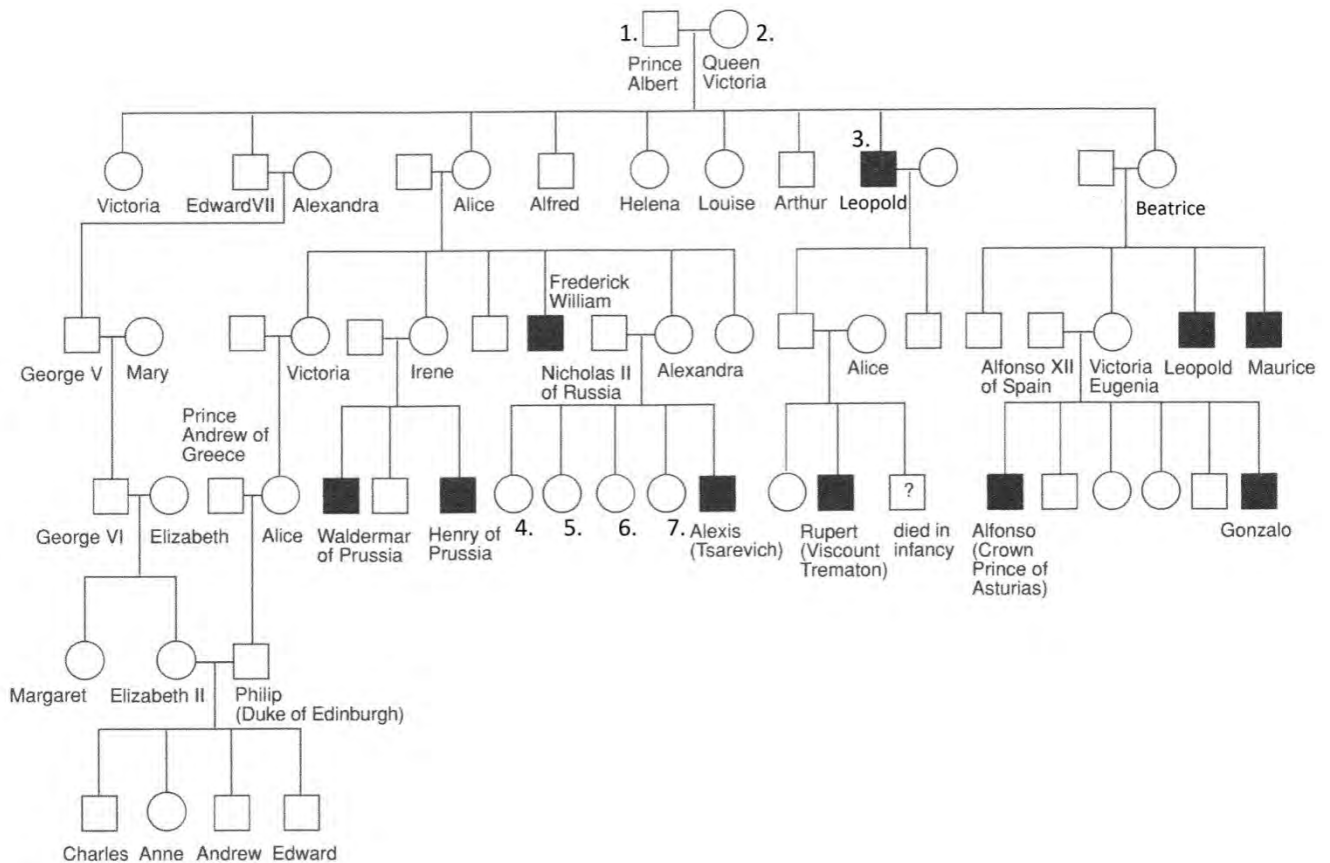
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K/M: .....

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**Question 29**



The family tree or pedigree shows the incidence of haemophilia in the royal families of Europe.

**(a)** Identify the type of inheritance and justify your choice. **2**

(2 marks)

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**(b)** Allocate appropriate genotypes to individuals 1, 2 and 3 **2**

**2**(2 marks)

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**(c)** Prince Albert and Queen Victoria had nine children – 5 girls and 4 boys.  
Explain, genetically, why their son Leopold was unlucky to inherit haemophilia. **2**

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**(d)** Nicholas II of Russia and Alexandra had a haemophilic son and four daughters.  
What was the probability of each of the daughters ( 4, 5, 6 and 7) carrying the allele for haemophilia? Show all working. **2**

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**Question 30**

Outline three mechanisms in sexually reproducing organisms that produce variability in offspring.

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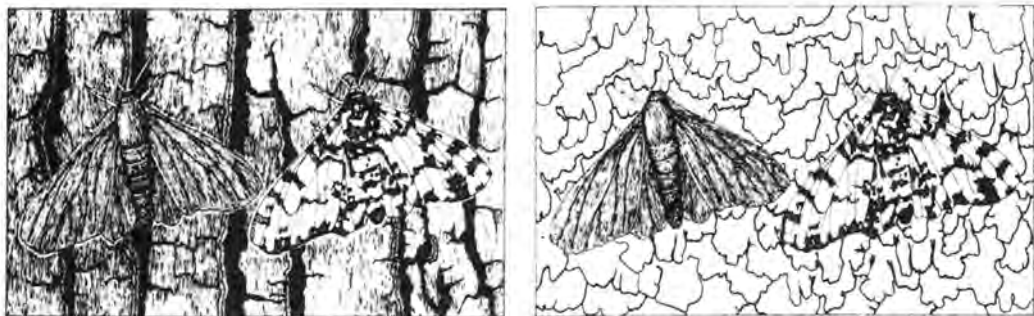
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**Question 31**

The diagram shows two variants of the peppered moth that were present in the English countryside during the 19<sup>th</sup> century. Many birds prey on the moth. As the industrial revolution progressed, the trees in the countryside became covered in black soot and the proportions of each peppered moth variant changed.



Explain the change in the peppered moth populations in terms of natural selection and evolution.

**3**

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**Question 32**

Distinguish between the following terms –

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(4 marks)

**(i)** gene and allele

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**(ii)** diploid and haploid cells

**2**

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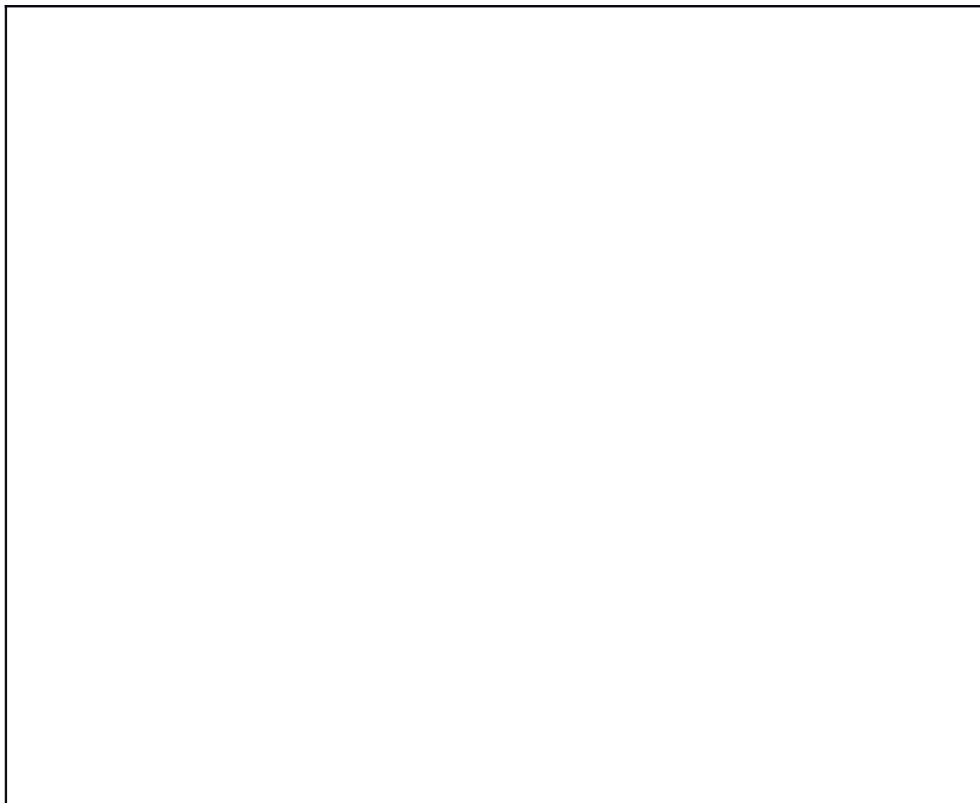
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**Question 33**

(a) Use a flow diagram to show the processes used in cloning an organism.

**3**



(b) Discuss some of the potential problems of cloning.

**2**

(3 marks)

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**End of Section B  
Section II**

**Option- Genetics: The Code Broken- 15 marks**

**Allow about 30 minutes for this section**

**Answer the question in a writing booklet**

Place your candidate number on each writing booklet that you use.  
Extra writing booklets are available.

**Question 34**

(a.a) The data in the table shows the results of measuring the heights of 1000 adult humans.

Height group (m)	Number of individuals in group
1.60 -1.64	58
1.65 – 1.69	92
1.70 -1.74	175

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1.74 -1.79	311
1.80 -1.84	185
1.85 -1.89	107
1.90 -1.94	50
1.95 -1.99	0

- (i) Graph the data with a column graph on the graph paper provided in writing booklet. 4
- (ii) Define what is meant by *polygenic inheritance*. 1
- (iii) How does the pattern of polygenic inheritance of height in humans compare with the pattern of inheritance discovered by Gregor Mendel in his research on pea plants? 2
- (a.b) (i) Explain why gene expression needs to be controlled 1
- (ii) Outline two possible mechanisms that could play a role in determining if a gene is expressed in a particular cell. 2
- (a.c) A man who has blood type O, Rh+ is married to a woman who has blood type A, Rh+. They have a daughter who is blood type O, Rh-. He claims his wife must have been unfaithful. From your understanding of inheritance of blood types, what would you advise him? Show all working. 3
- (a.d) Outline how and why DNA fingerprinting is useful in forensic science. 2

**End of examination**

# Marking Criteria: Trial HSC Biology 2010

1	2	3	4	5	6	7	8	9	10
C	C	B	B	A	C	D	A	C	B

11	12	13	14	15	16	17	18	19	20
C	C	C	C	C	A	D	B	C	C

Question	Criteria	Mark
21(a)	Glucose, urea, sodium & chloride ions or "all except plasma proteins" minus (-0.5) for each error of omission or inclusion	1 mark -(0.5) each
21(b)	Glucose – into blood; all the rest out of blood to dialysing fluid* *Plasma proteins do not pass through membrane. No double whammy with part (a). For this it was assumed all substances were able to pass through membrane so candidates were not penalised twice. minus (-0.5) for each error of omission or inclusion	1 mark  -(0.5) each
21(c)	The main purpose of dialysis is to remove urea which is toxic The level is zero to maximise diffusion along concentration gradient	1 mark 1 mark

Question	Criteria	Mark
22(a)	Veins rely on leg muscle movements to squeeze veins to move blood. Standing still allows blood to pool. Veins also have valves to prevent backflow of blood so that it doesn't pool	1 mark 1 mark
22(b)	Points of comparison made (ie need to mention same thing in relation to both oxygen and CO <sub>2</sub> ). For example: Oxygen is <i>mainly</i> carried as oxyhaemoglobin complex. CO <sub>2</sub> <i>mainly</i> carried as HCO <sub>3</sub> ions. CO <sub>2</sub> is mainly carried in plasma (70%) as well as carbamino- haemoglobin complex (20%). O <sub>2</sub> is carried in cells (98.5%) and a very small proportion dissolved in plasma (1.5%).	2 marks 2 marks
22(c)	Lungs: CO <sub>2</sub> diffuses out of blood so level decreases Muscle tissue: CO <sub>2</sub> diffuses into blood so level increases	1 mark 1 mark

Question	Criteria	Mark
23(a)	A biological catalyst	1 mark
23(b)	Volume of cabbage extract	1 mark
23(c)	Describes the reaction in terms of the active sites are used up because the amount of substrate is limited (ie fixed) and the reaction reaches its maximum Describes active sites being used up Describes some relevant feature of reaction	2 mark 1 mark 0.5 mark
23(d)	Draws curve with a lower maximum rate than original Draws curve with lower gradient but levels out at same Volume of Oxygen	1 mark 0.5 mark
23(e)	Enzyme becomes less effective (and may eventually stop or denature) Enzyme stops working	1 mark 0.5 mark
23(f)	The new poison would work by inhibiting the production of catalase enzyme in cells. This would allow the build up of peroxide in cells to eventually kill target organism. Some general discussion of how poisons may inhibit enzyme action by filling active sites. Some relevant point made.	2 marks 1 mark 0.5 mark

Question	Criteria	Mark
24(a)	The longer the tubule, the more concentrated the urine The longer the tubule, the greater the opportunity there is for the reabsorption of water from the tubule back into the bloodstream, producing a more concentrated urine.	2 marks 2 marks

24(b)	Desert mammal- needs to conserve water by producing concentrated urine.	1 mark
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Question	Criteria	Mark
25	<p>The comparison must have references to the structure of the vessels identified, as per instructed by the question.</p> <p>Points of comparison that could be used include;</p> <ul style="list-style-type: none"> <li>• Active and passive transport</li> <li>• The direction of flow</li> <li>• Reference to cohesion/adhesion/transpiration (CAT) as mechanisms in xylem</li> <li>• Reference to the Source/Flow/Sink theory or similar in phloem</li> </ul>	<p>½ each</p> <p>1 each (max 3)</p>

Question	Criteria	Mark
26	<p>Identification and description of a method, such as quarantine, with some relevant processes that could be employed in applying the method/quarantine, such as :-</p> <ul style="list-style-type: none"> <li>• Inspection at points of entry</li> <li>• Legislation</li> <li>• Fines</li> <li>• Public education</li> <li>• Disposal bins</li> </ul>	3

Question	Criteria	Mark
27	<p>Clearly relates an historical development to an improvement in understanding of the cause or prevention.</p> <p>Information not provided in the stimulus is required for a satisfactory answer.</p>	<p>2</p> <p>1</p>

Question	Criteria	Mark
28 (a)	<p>D = mRNA                      F = ribosome                      G = codon</p> <p>H = anti-codon                      I = tRNA                      J = amino acid</p>	6 X ½ mark
(b)	<p><b>B: Transcription</b></p> <ul style="list-style-type: none"> <li>* DNA unzips (RNA polymerase) exposing a base sequence representing a gene.</li> <li>* an mRNA strands forms on the exposed gene base sequence.</li> <li>* the mRNA leaves the nucleus and moves into the cytoplasm of the cell.</li> </ul> <p><b>K/M: Translation</b></p> <ul style="list-style-type: none"> <li>* mRNA molecule attaches to ribosome which “reads” the base sequence.</li> <li>* tRNA anticodons bind onto their complementary codons on the mRNA strand and so the amino acids carried by each tRNA molecule are brought in line.</li> <li>* the amino acids join to form a polypeptide.</li> </ul>	<p>Four parts to answer – 4 X ½ mark</p> <p>Four parts to answer – 4 X ½ mark</p>

Question	Criteria	Mark
29 (a)	<p>X – linked recessive</p> <p>More common in males than females → X – linked</p> <p>Affected sons may be produced by normal parents → recessive</p>	<p>½ mark + ½ mark</p> <p>1 mark</p>



(b)	$X^N$ = normal $X^n$ = haemophiliac 1. = $X^N Y$ 2. = $X^N X^n$ 3. = $X^n Y$	½ mark deducted for each incorrect genotype									
(c)	Albert $X^N Y$ X Queen $X^N X^n$ <table border="1" style="margin-left: 40px;"> <tr> <td></td> <td><math>X^N</math></td> <td>Y</td> </tr> <tr> <td><math>X^N</math></td> <td><math>X^N X^N</math></td> <td><math>X^N Y</math></td> </tr> <tr> <td><math>X^n</math></td> <td><math>X^N X^n</math></td> <td><math>X^n Y</math></td> </tr> </table> Probability that 50% of males will be sufferers. By chance only 1 of 4 sons became a sufferer and Leopold was the one. <i>Needed to discuss probabilities and the fact that by chance 50% of males would inherit the disease needed to be included in comments</i>		$X^N$	Y	$X^N$	$X^N X^N$	$X^N Y$	$X^n$	$X^N X^n$	$X^n Y$	2 marks
	$X^N$	Y									
$X^N$	$X^N X^N$	$X^N Y$									
$X^n$	$X^N X^n$	$X^n Y$									
(d)	Nicholas $X^N Y$ X Alexandra $X^N X^n$ <table border="1" style="margin-left: 40px;"> <tr> <td></td> <td><math>X^N</math></td> <td>Y</td> </tr> <tr> <td><math>X^N</math></td> <td><math>X^N X^N</math></td> <td><math>X^N Y</math></td> </tr> <tr> <td><math>X^n</math></td> <td><math>X^N X^n</math></td> <td><math>X^n Y</math></td> </tr> </table> 50% of daughters would be carriers and so of the 4 daughters, the probability is that 2 of them were carriers.		$X^N$	Y	$X^N$	$X^N X^N$	$X^N Y$	$X^n$	$X^N X^n$	$X^n Y$	1 mark for working out that was correct and 1 mark for correct conclusion.
	$X^N$	Y									
$X^N$	$X^N X^N$	$X^N Y$									
$X^n$	$X^N X^n$	$X^n Y$									

Question	Criteria	Mark
30	Three of – * Crossing over – two double-stranded chromosomes lie alongside each other and exchange alleles * random separation – which double-stranded chromosome goes to which daughter cell is a random process. * random separation – which chromatid from each double-stranded chromosome goes to which gamete is a random process. * random mating/fertilization – which male mates with which female is a random process. <i>If you said say “random segregation”, you needed to show what is meant by this to get a full mark.</i>	Three sources outlined for 3 marks

Question	Criteria	Mark
31	Needed to clearly mention the following – * Starting <u>population</u> contains <u>variation</u> – black and white moths ; * Changed environment – white lichen covered trees to black soot covered trees * Changed selective pressure – predator birds prey on more white moths * Gradual change to the proportions of white and black moths within the	Any concept not clearly stated → loss of a mark  3 marks

	population as a result of favourable characteristic to survive, reproduce and pass favourable characteristic onto offspring.	
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Question	Criteria	Mark
32	<b>Gene vs allele –</b> A gene is a sequence of nucleotides on a chromosome that codes for a protein or characteristic WHEREAS An allele is a form of a gene.	2 X 1 mark
(i)	<b>Diploid vs haploid –</b> A diploid cell contains two sets of chromosomes (2n) eg. human body cells contain 23 pairs of chromosomes WHEREAS A haploid cell contains one set of chromosomes (n) eg. human gamete cells contain one of each of 23 chromosomes.	2 X 1 mark

Question	Criteria	Mark
33 (a)	<b>Flow diagram –</b> <b>Tissue culture –</b> Meristematic root or shoot tips are taken from a genetically superior plant → the tissue is sterilized → each piece is planted into agar in a culture tube (the agar contains plant hormones and nutrients) → after several weeks a new plant has grown from the tissue. <b>Cloning an animal (Dolly) –</b> An egg is taken from a ewe and its nucleus is removed A mammary tissue cell is taken from the ewe to be cloned The mammary cell fuses with the egg cell → a spark stimulates cell division → a cluster of cells develops → the cell cluster is placed into a surrogate mother → a lamb that is a clone is produced.	Six steps or pieces of information for 3 marks (6 X ½ mark)
(b)	Problems with cloning – two of – * All clones are genetically identical and all could possess the same disease susceptibility and so a disease outbreak could rapidly devastate the whole crop. * There is no genetic diversity in a population of clones to allow some resistance to insect pests and diseases and so survive. * If all farmers use the same clone and don't grow other varieties of plants, genetic diversity would be lost. * Producing clones of complex animals, so far has proven to be expensive, mostly unsuccessful and of limited value. Cloned animals have aged quickly and died early.	Two for 2 marks

### Question 34 – Genetics – The code broken.

(a)	(i)	Marks allocated for <ul style="list-style-type: none"> <li>• A column graph ( a polygon/curve is not appropriate for this data)</li> <li>• Labelled axes including units and a title</li> <li>• Appropriate scales and axes used</li> <li>• Correct data entered</li> </ul>	4
	(ii)	Polygenic inheritance is determined by more than one gene.	1
	(iii)	Polygenic inheritance produces continuous variation in the phenotypes whereas Mendel's experiments produce discrete variation e.g either tall or short.	2
(b)	(i)	Gene expression needs to be controlled as not all genes need to be expressed in a differentiated cell for it to function. If all are expressed it cannot function.	1

	<p>Possible mechanisms for determining if a gene is expressed include:-</p> <ul style="list-style-type: none"> <li>• Chemicals such as methyl groups attached to the DNA inhibiting transcription.</li> <li>• The DNA remaining tightly wound</li> <li>• The presence of promoter proteins</li> </ul>	1 mark for each valid, max 2
(c)	<ul style="list-style-type: none"> <li>• Explanation of ABO blood type with conventional symbols of genotypes i.e. type A represented as <math>I^A i</math> and O as <math>ii</math></li> <li>• Explanation of Rhesus factor recognising + dominant to –</li> <li>• Suitable advice to the father that it is possible the daughter is his based on genetics.</li> <li>• For communication to be logical &amp; sequential and the use of conventional symbols</li> </ul>	<p>1</p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
(d)	<ul style="list-style-type: none"> <li>• DNA fingerprinting uses highly variable regions of the genome to obtain unique patterns of DNA fragments in a gel.</li> <li>• Each person (except identical twins) has a unique pattern and people associated with crime scenes can be identified from small samples gathered as forensic evidence.</li> </ul>	<p>1</p> <p>1</p>