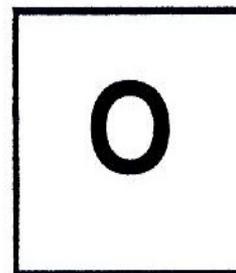




NAVAL BASE SECONDARY SCHOOL  
PRELIMINARY EXAMINATION 1, 2017



Name: \_\_\_\_\_ ( ) Class: \_\_\_\_\_

SCIENCE (BIOLOGY)

5078/04

Paper 4

5 May 2017  
1 hour 15 minutes

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class at the top of the page and on all the work you hand in. Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

**Section A (45 marks)**

Answer all questions.

Write your answers in the spaces provided on the question paper.

**Section B (20 marks)**

Answer any two questions.

Write your answers on the spaces provided and, if necessary, continue on separate answer paper.

At the end of examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	45
Section B	
Q .....	10
Q .....	10
Total	65

Parent's/Guardian's Signature

This document consists of 19 printed pages and 1 blank page.

## Section A

Answer all questions in the spaces provided.

- 1 Fig. 1.1 shows two different cells (not drawn to scale) found in the human alimentary canal.

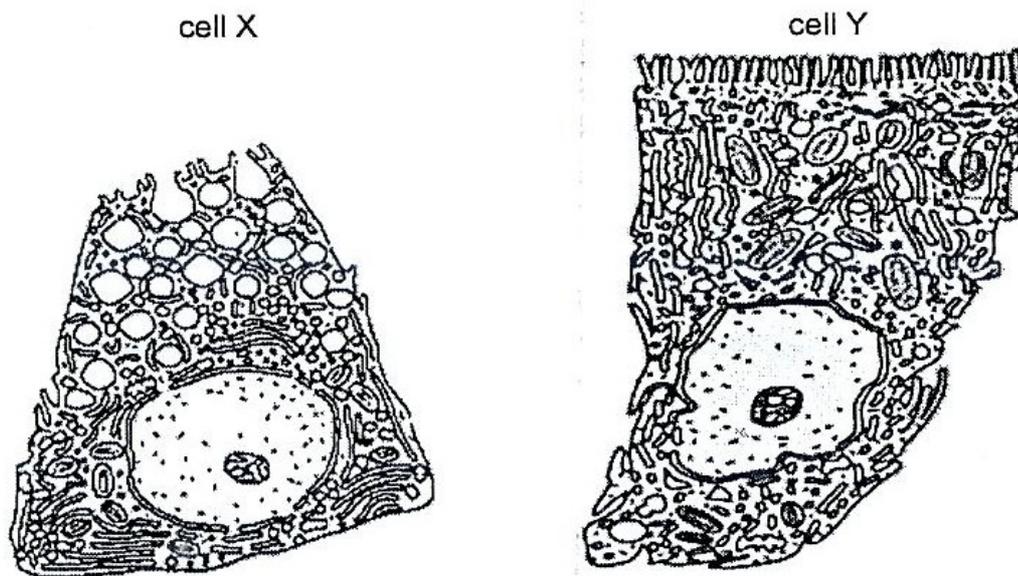


Fig. 1.1

Cell X secretes a large amount of enzyme into the stomach.  
Cell Y is responsible for the uptake of soluble products of digestion.

- (a) Name the organ in which cell Y is found.

..... [1]

- (b) Describe two structural differences between cell X and cell Y.

.....  
 .....  
 ..... [2]

(c) With reference to Fig. 11, explain how cell Y is adapted for its function.

.....

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.....

.....

[2]

[total: 5 m]

- 2 Six identical cylinders of fresh potato (A to F), each weighing 10 g, were immersed in salt solutions of different concentrations for two hours. They were removed and reweighed.

The change in mass of each potato cylinder was recorded in a bar graph as shown in Fig. 2.1.

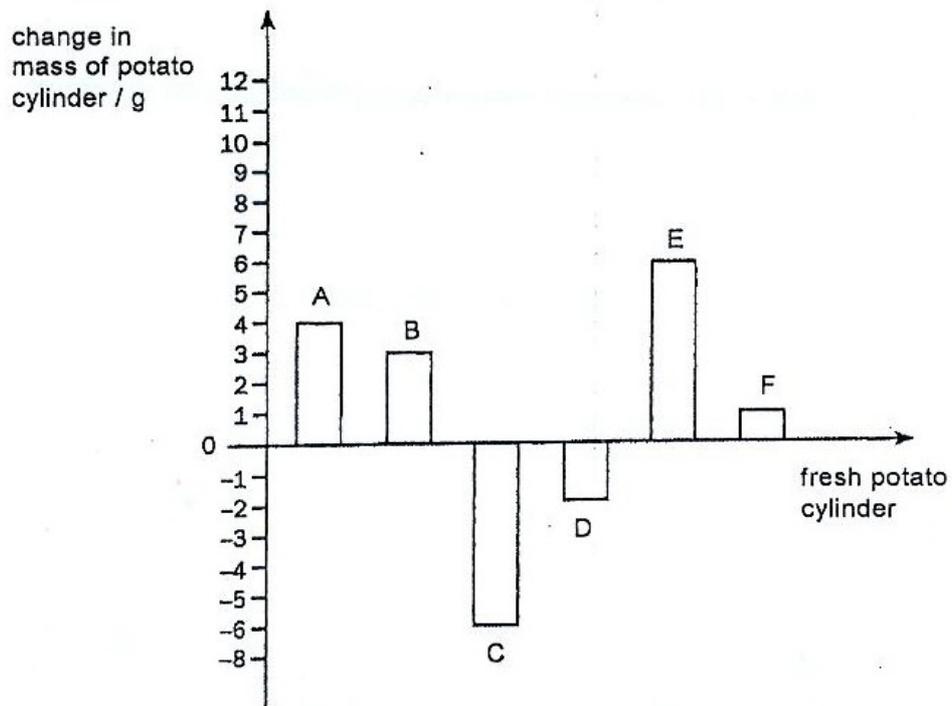


Fig. 2.1

- (a) Identify the process that results in the changes observed in Fig. 2.1.

..... [1]

(b) With reference to Fig. 2.1, identify and explain which potato cylinder has been immersed in

(i) distilled water,

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

(ii) concentrated salt solution.

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

[4]

(c) Suggest what would happen if the potato cylinders were boiled before the experiment. Explain your answer.

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

[2]

[total: 7 m]

- 3 An investigation was conducted to find out the effect of temperature on lipase activity. The enzyme lipase was extracted from digestive juices produced by organ X, and organ X is part of the human alimentary canal. A mixture of vegetable oil, lipase and a pH indicator was put into a test-tube. The tube was placed in water bath of 35 °C and the colour of the mixture was recorded at 5-minute intervals. The pH indicator changes from blue to yellow at pH 5 or less. The investigation was repeated at other temperatures and the results are shown in Table 3.1.

Table 3.1

time / minutes	water bath temperature / °C					
	5	15	25	35	45	55
5	blue	blue	blue	blue	blue	blue
10	blue	blue	blue	yellow	blue	blue
15	blue	blue	yellow	yellow	blue	blue
20	blue	yellow	yellow	yellow	yellow	blue
25	blue	yellow	yellow	yellow	yellow	blue

- (a) (i) Identify organ X.

..... [1]

- (ii) Explain for the change in colour of the pH indicator.

.....  
 .....  
 ..... [2]

- (b) With reference to Table 3.1, describe and explain the results in the tubes that were placed in 15 °C and 35 °C.

.....

.....

.....

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.....

.....

..... [4]

- (c) After 25 minutes, the tubes originally incubated at 5 °C and 55 °C were then incubated at 30 °C for a further 20 minutes.  
The final colour seen in these test tubes is recorded in Table 3.2.

**Table 3.2**

	results after 25 minutes at original temperature	results after a further 20 minutes at 30 °C
tube originally at 5 °C	blue	yellow
tube originally at 55 °C	blue	blue

Explain why the tube incubated at 55 °C did not turn yellow in the end.

.....

.....

..... [2]

[total: 9 m]

- 4 Fig. 4.1 shows an experiment setup to investigate photosynthesis.

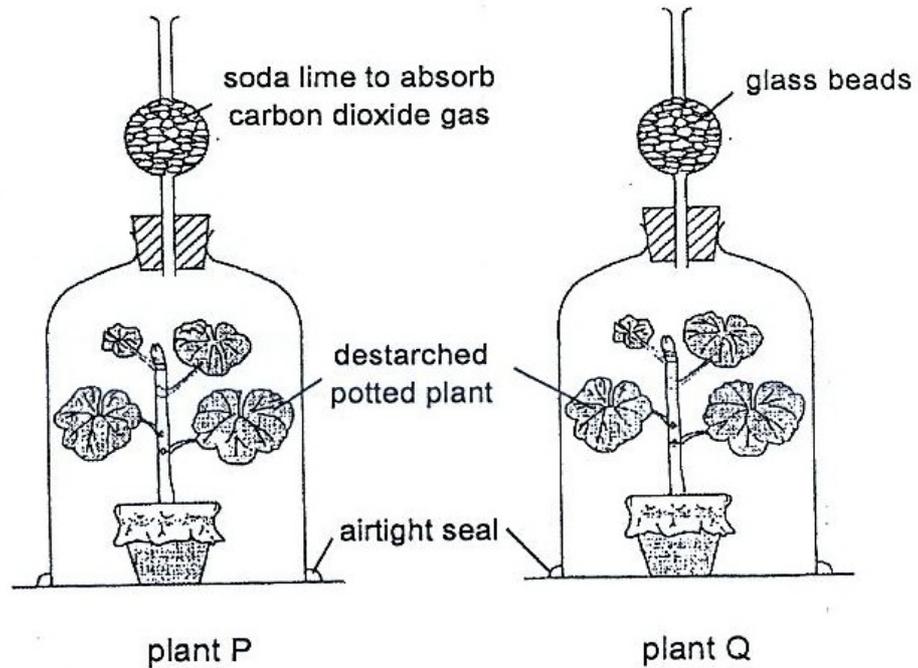


Fig. 4.1

- (a) Both plants were destarched before the experiment started. Explain why this step is necessary.

.....  
 ..... [1]

- (b) Describe the function of plant Q in the experiment.

.....  
 ..... [1]

- (c) Both plants were left out in the sunlight for 12 hours. After that, a leaf was taken from each plant and iodine test was performed on the leaves. Describe and explain the results obtained from each plant.

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.....

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[3]

- (d) List one other factor that affected the rate of photosynthesis.

.....

[1]

[total: 6 m]

- 5 (a) Write the word equation for aerobic respiration.

..... [1]

- (b) Table 5.1 shows the effect of breathing air containing different concentrations of carbon dioxide.

**Table 5.1**

percentage of carbon dioxide in inhaled air / %	volume of each breath / cm <sup>3</sup>	breathing rate / breath per minute
0.03	520	14
1.00	750	16
3.00	1200	18
5.00	2200	25

- (i) Calculate the total volume of air entering the lungs per minute when breathing in air containing 3% carbon dioxide. Show your working.

..... [2]

- (ii) Describe and explain the effects of breathing air containing different concentration of carbon dioxide.

.....  
 .....  
 .....  
 .....  
 ..... [3]

- (c) Describe how the alveolus is adapted to enable gases exchange to take place efficiently.

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[2]

[total: 8 m]

- 6 (a) Compare the difference between how a reflex action differs from a voluntary action.

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.....  
.....  
..... [2]

- (b) (i) Karen woke up in the middle of the night, she turned on the lights. Describe how her eyes respond when bright light is shone into them.

.....  
.....  
.....  
..... [3]

- (ii) Give a reason why her eyes responded the way described in (b)(i).

.....  
..... [1]

[total: 6 m]

7 Fig. 7.1 shows a food chain in a temperate forest.

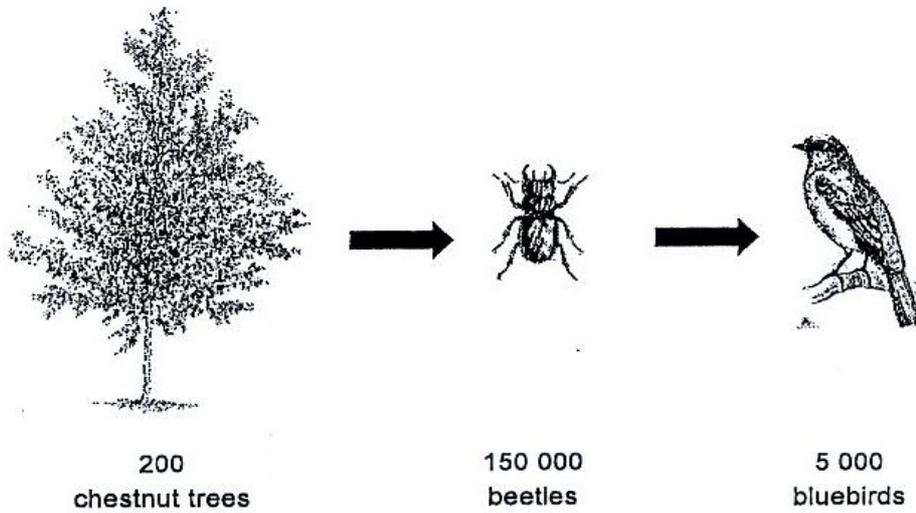


Fig. 7.1

(a) Draw and label a pyramid of numbers for the food chain shown in Fig. 7.1.

[2]

(b) Explain why not all of the energy in the primary consumers is passed on to the secondary consumers.

.....

.....

.....

.....

[2]

[total: 4 m]



(b) Explain why the graph for sugar concentration in the stem has a similar shape as the graph representing sugar concentration in leaves.

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

[2]

(c) How will the sugar, being transported by the stem, be used?

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

[2]

[total: 10 m]



- (ii) If the ovum is not fertilised, describe and explain what happens to the unfertilised ovum and make reference to the hormones involved.

.....

.....

.....

..... [2]

- (b) The process of fertilisation takes place in both plants and humans in order to produce offspring.  
Explain how the process is different in plants and in humans.

.....

.....

.....

..... [2]

[total: 10 m]



- (i) Explain why two tabbies with blotched stripes cannot produce a kitten with parallel stripes.

.....

.....

.....

..... [2]

- (ii) Draw a genetic diagram to show the probability of getting a kitten with blotched stripes when two parallel heterozygous cats were mated.

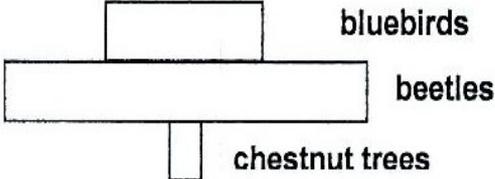
[4]

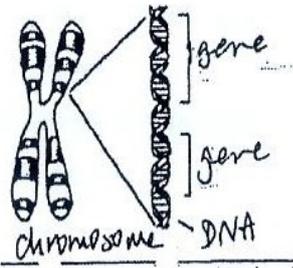
[total: 10 m]

End of Paper

4E5N Sci Biology Prelim 1 2017		
Qn	Answer	Marks/remarks
1a	small intestine/ ileum	1
1b	Cell Y has a lot of mitochondria while cell X has lesser mitochondria; Cell X does not have microvilli while Cell Y has many microvilli present; Cell X has many vacuoles while Cell Y has very few vacuoles.	any two 1 1
1c	Cell Y has microvilli. To <u>increase the surface area</u> for <u>absorption</u> of digested food.	1, 1
2a	osmosis	1
2bi	E. The diluted salt solution will have a <u>higher water potential</u> than the potato cells. Water molecules <u>diffused into</u> the potato cells by osmosis. The mass of the potato cylinder <u>increases</u> .	0.5 0.5 0.5 0.5
2bii	C. The concentrated salt solution will have a <u>lower water potential</u> than the potato cells. Water molecules <u>diffused out</u> of the potato cells by osmosis. The mass of the potato cylinder <u>decreases</u> .	0.5 0.5 0.5 0.5
2c	boiling <u>destroys partially permeable membrane</u> and thus there will be <u>no osmosis</u> / no net movement of water molecules	1 1 rej: mass remains the same
3ai	duodenum /small intestine;	1
3aaii	lipase had digested the oil into <u>fatty acids and glycerol</u> ; fatty acids lower the pH/ more acidic	1 1
3b	At <u>15 °C</u> , the time taken for the tube to turn yellow, took <u>20 min</u> , enzymes/lipase are <u>less active/inactive</u> . At <u>35 °C</u> (optimum temperature), the time taken for the tube to turn yellow, took <u>10 min</u> , enzymes/lipase are the <u>very active</u> .	Must QD 1 1 0.5 1 1 (max 4)
3c	Lipase's <u>active site is destroyed</u> and the lipase is <u>denatured</u> at 55°C;	1, 1
4a	Destarching removes all starch from the leaves to ensure <u>accurate results</u> / ensure that starch formed during the experiment is accurately recorded	1
4b	Serves as a control, to show that carbon dioxide is required for photosynthesis.	control – 0.5 1

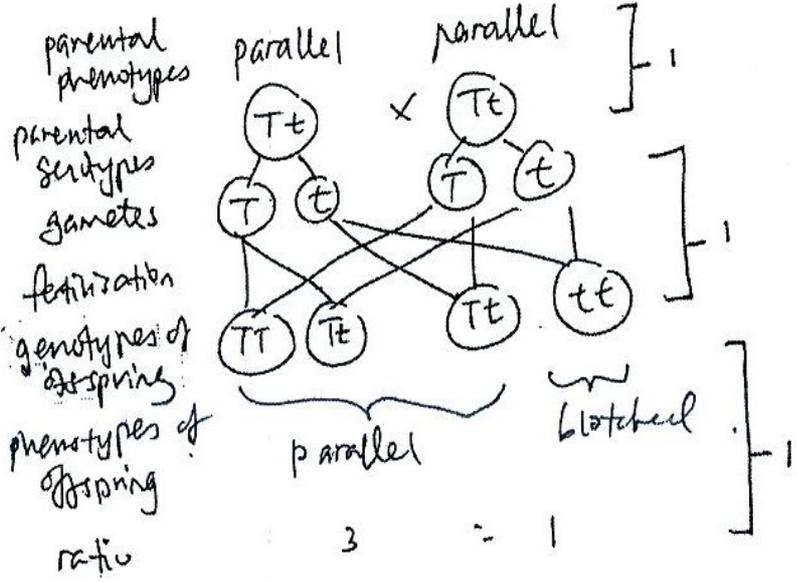
4c	<p>The leaf from plant P - iodine solution remains brown; As carbon dioxide is absorbed by the soda lime, none is available to the plant, so no photosynthesis occurs.</p> <p>The leaf from plant Q - iodine solution turns blue-black ; All the materials and conditions required for photosynthesis are available, so the plant is able to produce glucose which is converted to starch.</p>	<p>0.5 1 (must show relationship) 0.5 1 (must show relationship)</p>								
4d	temperature / light intensity / amount of chlorophyll	1								
5a	glucose + oxygen → carbon dioxide + water + (large amount of energy)	1								
5bi	Total volume= 1200 x 18 = 21 600 cm <sup>3</sup>	1 1								
5bii	<p>Increasing carbon dioxide concentration increases the rate of breathing per minute. OR</p> <p>Increasing carbon dioxide concentration increases the volume of breath taken / deeper breaths</p> <p>Breathing deepens - Take in more air (oxygen) into lungs</p> <p>Breathing rate increases – helps to remove carbon dioxide</p>	1 1 1 1								
5c	<p>One cell thick epithelium → Short distance for fast gaseous exchange</p> <p>A layer of moisture lining the alveolus → for oxygen gas to dissolve before diffusing into the blood</p> <p>Richly supplied with blood capillaries → to maintain a (steep) concentration gradient for fast diffusion of gases</p>	<p>must have corresponding structure and function</p> <p>1 x 2</p>								
6a	<table border="1"> <thead> <tr> <th>Reflex action</th> <th>Voluntary action</th> </tr> </thead> <tbody> <tr> <td>immediate response</td> <td>takes a longer time to complete</td> </tr> <tr> <td>takes place with a stimulus</td> <td>takes place with or without a stimulus</td> </tr> <tr> <td>does not involve conscious thought</td> <td>involves conscious thought</td> </tr> </tbody> </table>	Reflex action	Voluntary action	immediate response	takes a longer time to complete	takes place with a stimulus	takes place with or without a stimulus	does not involve conscious thought	involves conscious thought	<p>any 2</p> <p>1 x 2</p> <p>no 0.5 m</p>
Reflex action	Voluntary action									
immediate response	takes a longer time to complete									
takes place with a stimulus	takes place with or without a stimulus									
does not involve conscious thought	involves conscious thought									
6bi	<p>When bright light is shone into the eye, the <u>circular muscles of the iris will contract</u>, while the <u>radial muscles of the iris will relax</u>.</p> <p>This helps to <u>constrict the pupil</u>, to reduce the amount of light entering the eyes.</p>	1 1 1								
6bii	This helps to prevent excessive light from entering the eye and <u>damaging the retina</u> .	1								

7a		drawing – 1 label -1 (must be drawn to scale)
7b	<p>Energy can be lost in the following ways:</p> <ul style="list-style-type: none"> <li>• as <u>heat during respiration</u> at every trophic level</li> <li>• in uneaten body parts</li> <li>• through undigested matter egested by consumers</li> <li>• through waste products excreted by consumers (E.g. urea)</li> </ul>	Any 3 1 x 3
8a	<p>From 0000 to 0600 h, sugar concentration in the leaves decreases. No sunlight during the period, photosynthesis did not occur/ sugar in the leaves was oxidised/ used during respiration.</p> <p>From 0600 to 1500 h, sugar concentration in the leaves increases to <u>maximum of 20 units/</u> highest.</p> <p>As light intensity increases to noon, the rate of photosynthesis increases. Thus, more sugar is produced.</p> <p>From 1500 to 2400 h, sugar concentration in the leaves decreases. Light intensity decreases in the night, rate of photosynthesis decreases. Thus, lesser sugar is produced.</p>	1 1 (either 1) 1 1 (must show relationship) 1 1 (must show relationship)
8b	<p>When more sugar is made in the leaves, more sugar will be present in the stem.</p> <p>More sugar will be <u>translocated/transported</u> to other parts of the stems through the <u>phloem</u> in the stem. This causes the increase in the sugar in stem.</p>	1 1
8c	<ul style="list-style-type: none"> <li>- oxidised to released <u>energy during respiration</u></li> <li>- component of cellulose cell walls</li> <li>- combined with mineral salts to form amino acids</li> <li>- stored as starch</li> </ul>	any 2 1 x 2

9ai	<p><u>Oestrogen</u> is important for the <u>repair and growth</u> of the uterine lining.</p> <p>High levels of <u>oestrogen stimulates ovulation</u>.</p> <p><u>Progesterone</u> increases to <u>stop ovulation</u> and maintains the uterine lining by <u>further thickening</u> to prepare for <u>implantation</u> of the ovum.</p> <p>(must show relationship btw hormone and events)</p>	<p>1</p> <p>1</p> <p>1</p> <p>1, 1 (max 2 for progesterone)</p> <p>hormone 1 x 2</p>
9aii	<p>If ovum is not fertilised, the levels of the <u>oestrogen and progesterone will decrease</u> resulting in the <u>next menstrual cycle/menstruation</u> to occur.</p>	<p>1</p> <p>1</p>
9b	<p>Any one</p> <p>In plants, the pollen grain reaches the ovum via the <u>growth of a pollen tube</u>. In humans, the <u>sperms are motile and they swim</u> towards the ovum.</p> <p>In plants, site of fertilisation is in the <u>ovule</u> which is <u>within the ovary</u>.</p> <p>In humans, site of fertilisation is in the <u>oviduct</u> which is <u>not within the ovary</u>.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>must show comparisons</p>
10a	<p>A chromosome is a <u>DNA that is highly coiled</u> and condensed around proteins.</p> <p>A DNA is a <u>double-helix</u> made of 2 strands of polynucleotides.</p> <p>A gene is a <u>short segment of DNA</u> that codes for a <u>specific polypeptide</u>.</p> 	<p>1</p> <p>1</p> <p>1</p> <p>diagram – 1</p>
10b	<p>Both tabbies with blotched stripes are <u>homozygous recessive</u> and carry only the recessive allele for blotched stripes.</p> <p>They are <u>unable to contribute any dominant allele for parallel stripes</u>.</p>	<p>1</p> <p>1</p>

10c

Correct labels



probability = 1/4 or 0.25

genetic diagram - 3

probability - 1

Label wrong - deduct 1 m

nv circle - deduct 1 m

nv draw the cross - deduct 0.5 m