

# A-Level Biology

## OCR-A

### 2024 Predicted Paper

Paper 3

Unified Biology



Scan me for  
walkthrough



Name:.....

Date:.....

**1 hour 30 minutes allowed**

You may use a calculator

#### Rough Grade Boundaries

These do not guarantee you the same mark in the exam.

A\* - 70%

A - 60%

B - 50%

C - 40%

D - 35%

E- 30%

Question	Possible Marks	Marks Gained
1	11	
2	9	
3	12	
4	14	
5	10	
6	14	
<b>Total</b>	<b>70</b>	





If you would like to **upgrade** to one of our Exam Masterclasses or Revision Bootcamps, which include our 2024 predicted papers **AND**:

- 2024 predicted paper video walkthroughs
- Live revision tutorials (exam masterclasses only)
- Easter Exam Prep Live tutorials with exam skills focus
  - Teaching videos
    - Quizzes
- 2023 predicted papers and walkthroughs (not all subjects)
  - Flashcards
  - Workbooks

... and so much more, please e-mail [Academy@primrosekitten.com](mailto:Academy@primrosekitten.com) and we will deduct the cost of the predicted papers you have already bought.

**Achieve more, stress less!**



**01** Muscles in the body can be under voluntary or involuntary control.

**a)** Describe one structural difference between voluntary and involuntary muscle cells.

**[1 mark]**

.....  
.....

**b)** Describe how students could investigate the effect of lifting a weight for increasing lengths of time has on the electrical activity in a muscle in the arm.

You should include the equipment used and details of how the students would ensure their data was reliable.

**[6 marks]**

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



- c)** Myotonic dystrophy is a genetic disorder that causes progressive muscle loss and weakness.

Mutations in the DM1 and DM2 genes in skeletal muscle cells can cause dysregulated splicing of the mRNA that codes for calcium ion carrier proteins.

- i)** Explain why primary mRNA must be spliced.

**[2 marks]**

.....

.....

.....

- ii)** Explain why one of the main symptoms of myotonic dystrophy is that muscles are unable to relax after contraction.

**[2 marks]**

.....

.....

.....



- 02** Giant tortoises are a keystone species of the Galapagos islands. In many of the Islands, the number of tortoises decreased after human colonists arrived. On the southernmost island of Española, the number of giant tortoises decreased to just 14 in the 1960s.



Laws, conservation efforts, and captive breeding programmes have now allowed the tortoise population on Española to increase to 3,000. The ecosystem is starting to return to savannah-like grasslands as the number of small trees is reduced by the feeding and trampling actions of the tortoises. Other endangered plant species such as the tree cactus are also increasing in number on the island.

- a)** Explain what is meant by the term keystone species.

**[1 mark]**

.....  
.....



- b)** Explain how reintroduction of the tortoises will help to increase biodiversity on the island.

**[2 marks]**

.....

.....

.....

- c)** Explain how the activities of humans caused the decline in tortoise numbers on the Galapagos islands and describe how laws and conservation efforts have allowed the successful reintroduction of the species on Española.

**[6 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

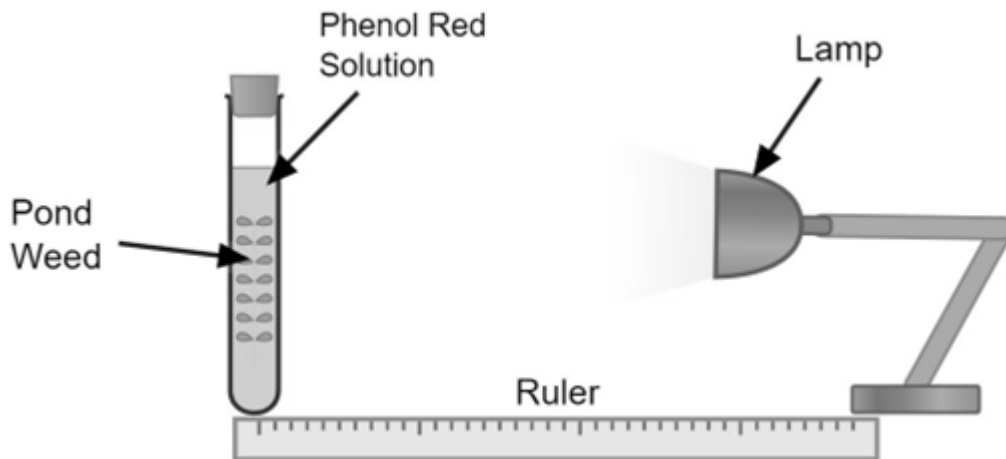
.....

.....



**03** Gas exchange in the lesser pond weed *Potamogeton pusillus* was measured by placing shoot sections in phenol red indicator solution.

In the experiment, researchers put the same amount of red phenol solution into four tubes. They sealed each tube with a cap and let them sit for 10 minutes. Then, they put plant shoots into tubes **A-C** and gave them different treatments according to the table below. After that, they placed the tubes in front of a lamp and left them there for an hour, as shown in the diagram below.



<b>Tube</b>	<b>Treatment</b>	<b>Phenol red colour at start</b>	<b>Phenol red colour after one hour</b>
<b>A</b>	Pondweed, tube uncovered	Orange	Red
<b>B</b>	Pondweed, tube covered with tinfoil	Orange	Yellow
<b>C</b>	Pondweed, tube covered with fine mesh (translucent)	Orange	Orange
<b>D</b>	No pondweed, tube uncovered	Orange	Orange

**a)** Explain the purpose of tube D.

**[1 mark]**

.....  
.....



**b)** Explain why students used the ruler.

**[2 marks]**

.....

.....

.....

The colour changes of phenol red are outlined in the table below.

<b>pH range</b>	<b>Phenol Red Colour</b>
< 6.6	Yellow
6.7-7.2	Orange
> 7.3	Red

**c)** Explain the results in tubes A-C.

**[4 marks]**

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





- d)** Explain why when the pondweed respire, the oxygen concentration in the water around it decreases.

**[3 marks]**

.....

.....

.....

.....

.....

- e)** Describe how the rate of photosynthesis could be measured during this experiment.

**[2 marks]**

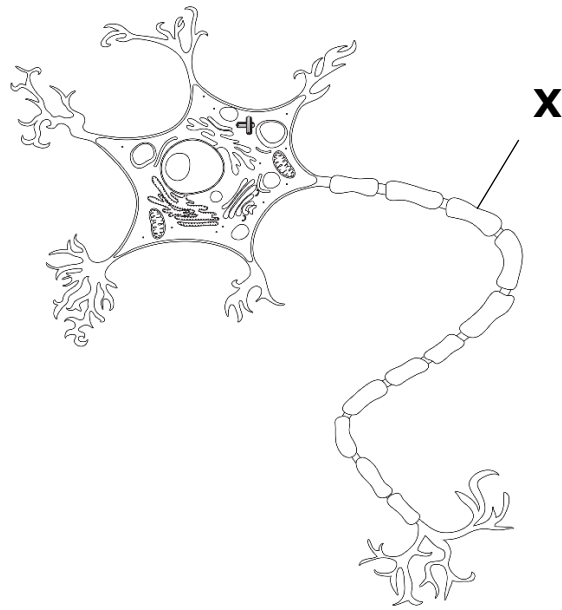
.....

.....

.....



**04** The diagram shows a neurone.



**a)** Give the name of the cell that forms part X and explain how it helps the neurone to carry out its function.

**[3 marks]**

.....

.....

.....

.....

.....



**b)** Explain how resting potential is maintained across the axon membrane.

**[3 marks]**

.....

.....

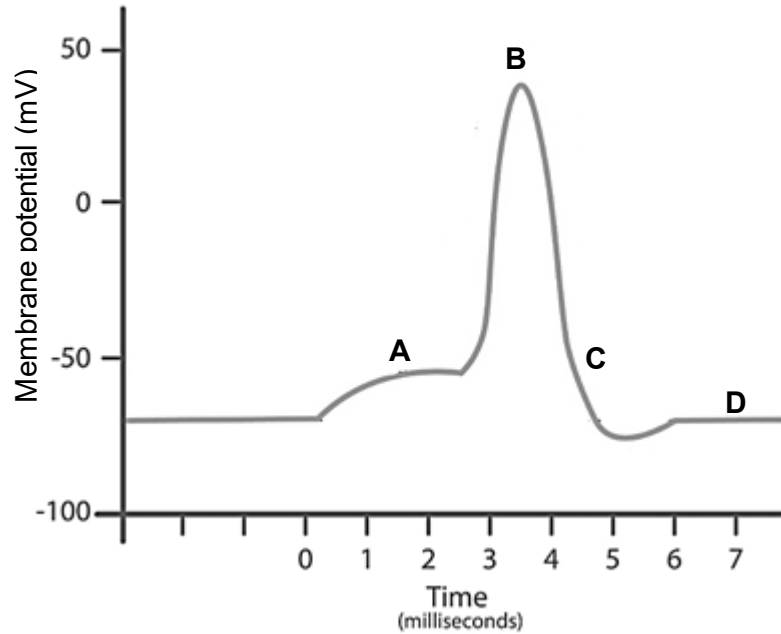
.....

.....

.....



The diagram shows the changes in membrane potential during an action potential.



c) The changes are due to the movement of ions across the membrane of the axon.

i) Explain what causes the change in membrane potential between points A and B.

**[2 marks]**

.....

.....

.....

ii) Name the stage between C and D.

**[1 mark]**

.....

.....



When an action potential reaches the end of one neurone, it must cross the synapse.

The average gap between two neurones is 32 nanometres and the average time it takes for the impulse to pass between neurones is  $1.6 \times 10^{-7}$ s.

- d)** Calculate the speed of the impulse crossing the gap between two neurones.

**[2 marks]**

.....  $\text{ms}^{-1}$

- e)** Parkinson's disease is a neurodegenerative disorder in which patients find information processing, attention, and memory difficulties. In patients with Parkinson's disease the speed of transmission of impulses across synapses, which use the neurotransmitter dopamine, is reduced.

Suggest why Parkinson's can be treated with drugs that brain neurones can use to make dopamine.

**[3 marks]**

.....

.....

.....

.....

.....



**05** Scientists have recently used human stem cells to form networks of small blood vessels that can connect to the existing circulatory systems in mice. It is thought that these could be used to treat heart tissue damaged by heart disease or a heart attack.

First, they took human pluripotent stem cells and used chemicals to induce them to differentiate into capillary endothelial cells. They then allowed these cells to multiply before placing them on a 3D gel mesh that replicates conditions inside the body. They grow on here to form a network of capillaries, this was then implanted into mice and within two weeks the capillaries were connected to the vascular system and allowed blood flow through them.

**a)** Name a source for the human pluripotent stem cells.

**[1 mark]**

.....  
.....

**b)** Stem cells can divide rapidly by mitosis.

**i)** The scientists took 100 $\mu$ L from their stock culture containing 1500 stem cells/ $\mu$ L to place on the 3D gel mesh. If the average division time for one stem cells is 18 hours, calculate the number of cells on the 3D mesh after 3 days.

Use the following formula:  $N=N_0 \times 2^{(t/T)}$

Where:

- $N_0$  = the initial number of cells
- T = division time
- t = time period

**[2 marks]**

.....



- ii)** Explain why it maybe a risk to insert rapidly dividing stem cells into humans.

**[2 marks]**

.....

.....

.....

- c)** Suggest how the growth of new blood vessels into damaged heart tissues could increase the rate of repair of heart muscle tissue.

**[3 marks]**

.....

.....

.....

.....

.....

- d)** Apart from growing tissues and organs to replace damaged ones give two other important ways scientists can use human tissues grown from stem cells.

**[2 marks]**

.....

.....

.....

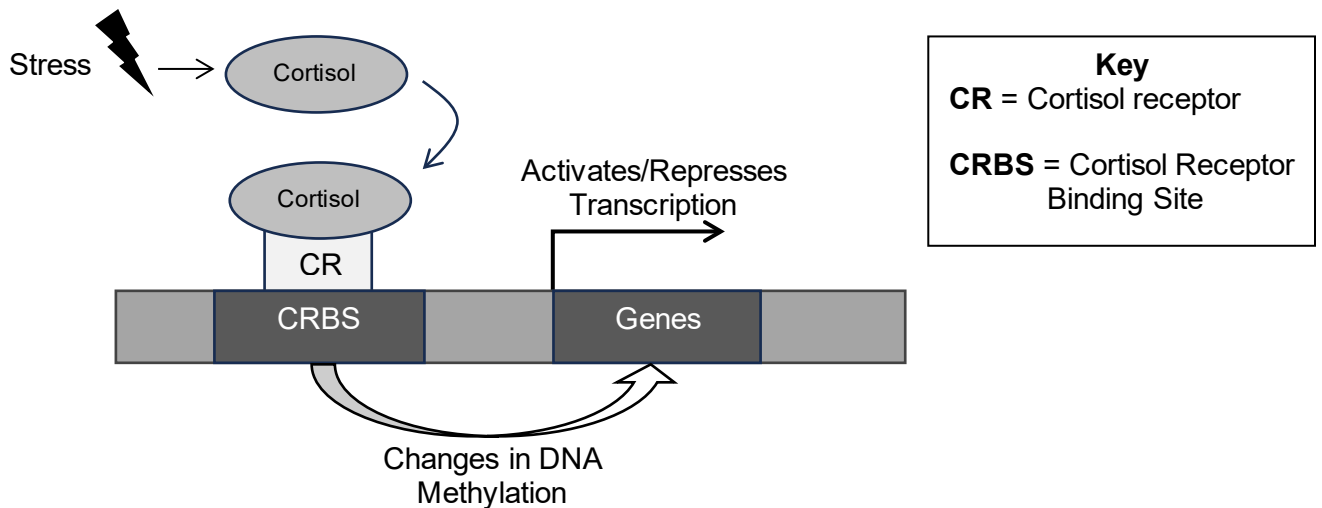


**06** Cortisol is a hormone released in response to stress. Cortisol has wide ranging effects and can influence gene function by binding and activating the cortisol receptor.

The activated cortisol receptor can affect transcription of other genes.

Chronic stress can result in prolonged activation of the cortisol receptor, resulting in changes in gene expression of key genes that play a role in cell division and structure.

The diagram summarises the interactions between cortisol, the cortisol receptor, and transcription.



**a)** Explain how the diagram provides evidence that cortisol is released from the adrenal cortex.

**[2 marks]**

.....

.....

.....





- b)** Explain why cortisol only causes changes in gene expression in target cells.

**[2 marks]**

.....

.....

.....

- c)** Explain why the cortisol receptor can be described as a transcription factor.

**[1 mark]**

.....

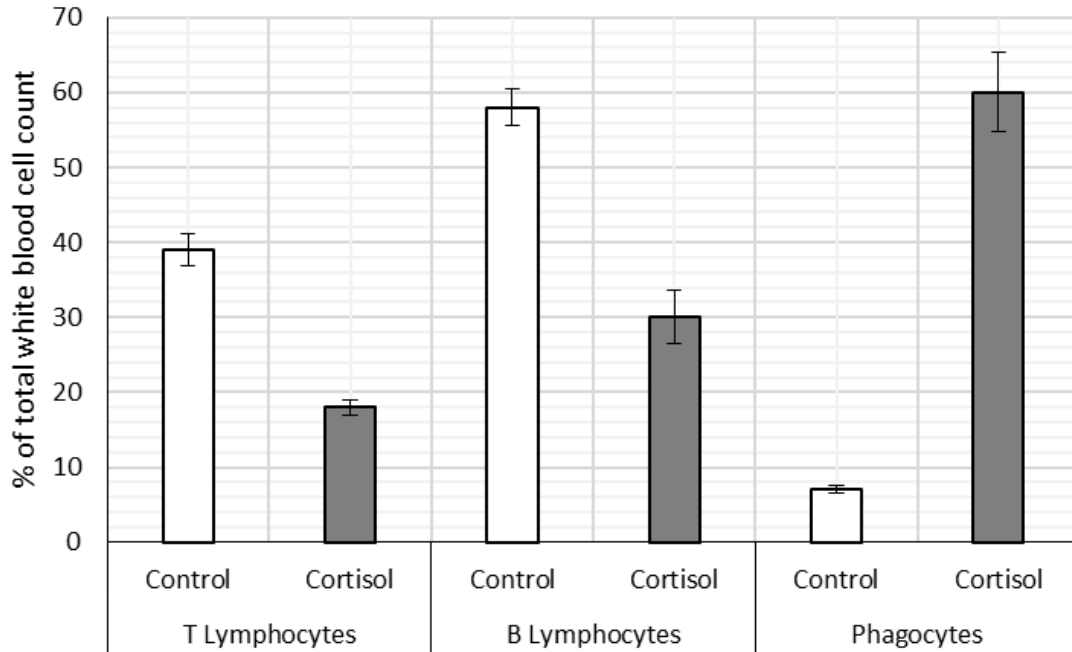
.....

Scientists wanted to investigate the effects of long-term cortisol exposure on the immune system because previous work has shown chronic stress to cause significant changes in the counts of lymphocytes, phagocytes, and platelets in blood.

They used male mice and added rodent cortisol hormone at a concentration of 100µg/ml with 1% ethanol to their drinking water for 4 weeks. They had a control group for comparison. Blood was extracted before and after the cortisol treatment and the number of T cells, B cells, and phagocytes was counted using Fluorescence-activated cell sorting (FACS). This is where fluorescent-tagged antibodies specific for each cell type are added to the blood and a laser beam is used to sort the cells.



The results are shown in the graph.



d) Suggest how the scientists treated the control group of mice.

**[1 mark]**

.....

.....

e) Explain why the fluorescently tagged antibodies would have been able to identify the different types of white blood cells.

**[2 marks]**

.....

.....

.....



- f)** Using the information in graph, explain why people are often more susceptible to viruses when suffering from long term stress.

**[3 marks]**

.....

.....

.....

.....

.....

- g)** Long term cortisol exposure has been linked to DNA damage and an increase in apoptosis in B cells.  
Explain how the binding of cortisol to the receptor binding site could have caused the changes seen in the number of lymphocytes.

**[3 marks]**

.....

.....

.....

.....

.....

**END OF QUESTIONS**