

AQA – Cells – AS Biology P21. **No.1**

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Water has a high heat capacity and a large latent heat of vaporisation.

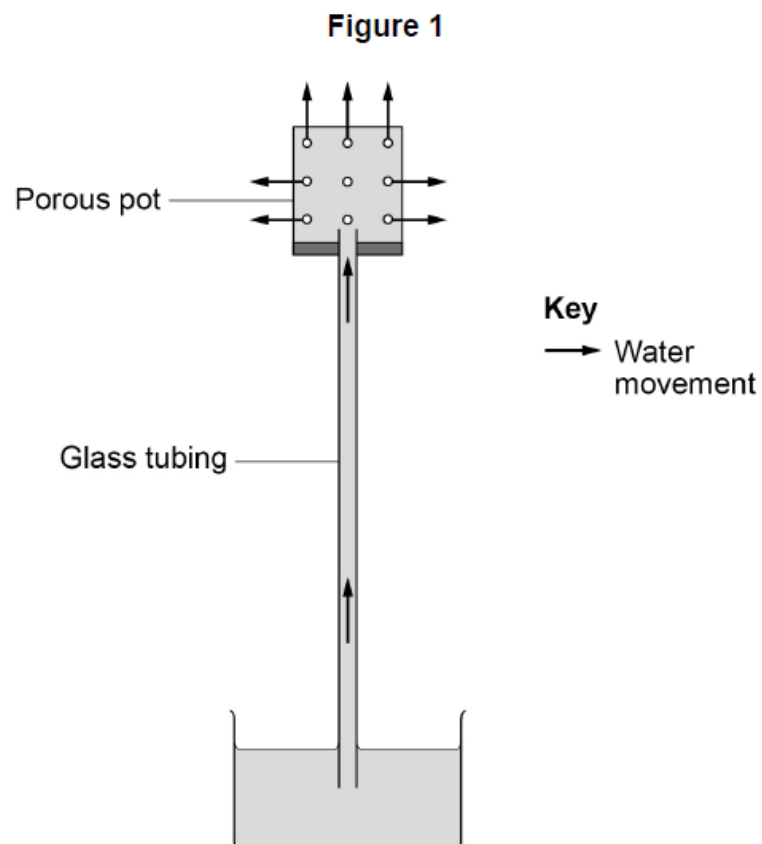
Describe the importance of each of these properties to living organisms.

[2 marks]

High heat capacity _____

Large latent heat of vaporisation _____

0	1	.	2
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Figure 1 shows that water loss from a porous pot can cause the upward movement of water.

Biologists have concluded that the experiment in **Figure 1** supports the cohesion–tension theory of water transport in the xylem.

Explain how this conclusion is supported by the experiment in **Figure 1**.

[3 marks]

0 1 . 3

An air bubble was introduced into the glass tubing in **Figure 1**. The air bubble moved a distance (d) of 1.5 cm in 120 minutes. The radius of the lumen (hole) of the glass tubing was 0.6 cm

Use this information and the formula $\pi r^2 d$ to calculate the rate of water movement in the glass tubing in $\text{cm}^3 \text{ hour}^{-1}$.

Use $\pi = 3.14$ in your calculation.

[1 mark]

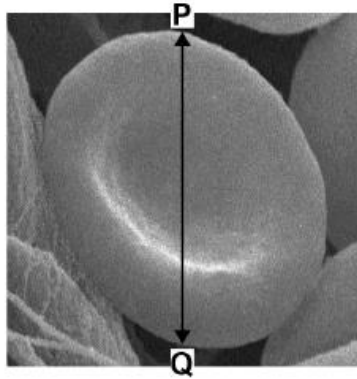
Answer _____ $\text{cm}^3 \text{ hour}^{-1}$

2. No.2

0 2 . 1

Figure 2 shows an image of a red blood cell at a magnification of $\times 5500$

Figure 2



Calculate the actual diameter in μm of the red blood cell between points P and Q.

Show your working.

[2 marks]

Answer _____ μm

0 2 . 2

A haemocytometer is a special microscope slide that can be used to determine the mean number of red blood cells in 0.004 mm^3 of blood.

- A researcher prepared a 10^{-3} dilution of a sample of blood from an adult.
- Using a haemocytometer, the researcher determined that the mean number of red blood cells in 0.004 mm^3 of the diluted blood sample was 21

The volume of blood in the body of the adult was 4.8 dm^3

Calculate the total number of red blood cells in the body of this adult.

Show your working.

[2 marks]

Answer _____

0 2 . 3

The solution used to dilute the blood had to have the same water potential as the blood.

Explain why.

[2 marks]

0 2 . 4 There are four main blood groups in the human ABO blood group system.

Table 1 shows the basis on which each of these blood groups is classified.

Table 1

ABO blood group	Antigens present on red blood cells	Antibodies present in blood plasma
A	A	Anti-B
B	B	Anti-A
AB	A and B	No anti-A and no anti-B
O	No A and no B	Anti-A and anti-B

A transfusion of blood from a blood group **A** donor to a blood group **B** recipient would cause agglutination of the donated red blood cells.

Use information in **Table 1** to explain why.

[2 marks]

0 2 . 5 Using **Table 1**, give the blood groups of people who could accept a donation of blood group **O** without causing agglutination of the **donated** red blood cells.

[1 mark]

Blood groups _____

3. No.4

0 4 . 1

Where does transcription occur in a eukaryotic cell?

[1 mark]

0 4 . 2

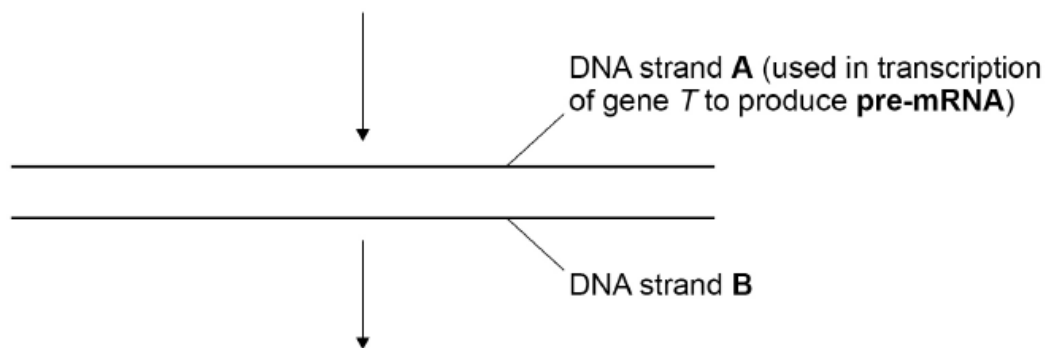
The genome of an adenovirus is a single, linear molecule of double-stranded DNA. Adenoviruses use eukaryotic host cells to transcribe their genes in protein synthesis. The process of transcription of adenovirus genes is similar to the process of transcription of genes in eukaryotes.

Scientists investigated the process of transcription of this viral DNA.

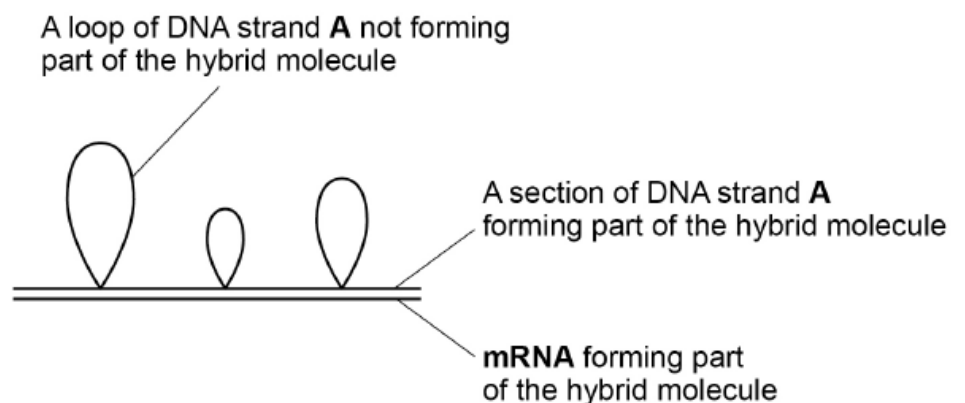
Figure 4 shows one of the experiments carried out by these scientists.

Figure 4

Gene *T* from an adenovirus was separated into two DNA strands, **A** and **B**



DNA strand **A** was then used to form a hybrid molecule with **mRNA** obtained from a eukaryotic host cell that had transcribed gene *T*



Looking at the results of the experiment in **Figure 4**, the scientists concluded that splicing had taken place.

Use **Figure 4** to describe and explain why the scientists' conclusion was justified.

[3 marks]

0 4 . 3

Describe and explain how the results of the experiment in **Figure 4** would differ if the scientists had used prokaryotic DNA.

[2 marks]

0 4 . 4

Errors in the precise location of splicing in the DNA molecule can lead to mutations.

Explain why.

[1 mark]

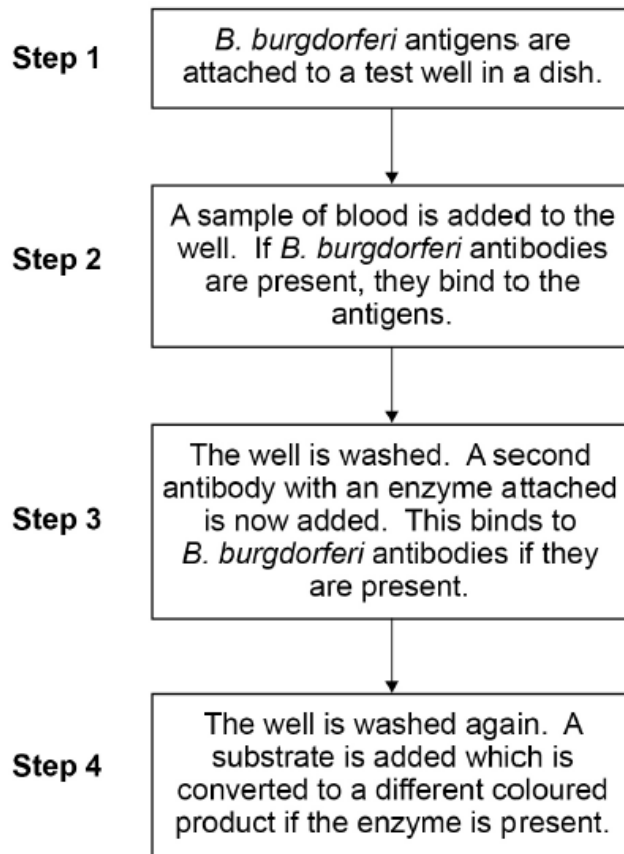
4. No.8

0 8

Lyme disease is most frequently caused by the bacterium *Borrelia burgdorferi*. Lyme disease can be difficult to diagnose.

Figure 5 shows an ELISA test that is used to find out if a person has antibodies to *B. burgdorferi*.

Figure 5



A false positive in this test is a result which incorrectly indicates that antibodies to *B. burgdorferi* are present.

0 8 . 1

Failure to thoroughly wash the well in **Step 4** can result in a false positive.

Explain why.

[2 marks]

08.2

A false positive can be produced if a person has been infected by another bacterium that causes a disease called syphilis.

Suggest why.

[1 mark]

08.3

A false **negative** in this test is often produced if a person is tested within 2 weeks of being infected with *B. burgdorferi*.

Explain why.

[2 marks]

08.4

Sometimes, symptoms of Lyme disease can persist for 6 months following antibiotic treatment. This condition is known as Post-Treatment Lyme Disease Syndrome (PTLDS).

Scientists investigated the symptoms experienced by a large number of PTLDS patients and a control group. During a 2-week period, they asked all the participants:

- if they had experienced symptoms of PTLDS
- to record the intensity of these symptoms.

The scientists used a statistical test to determine if there was a difference in the intensity of symptoms of PTLDS between these two groups.

Table 3 shows some of the scientists' results, including the probability (P) values obtained using the statistical test.

Table 3

Symptom	Percentage of PTLDS group experiencing symptom	Percentage of control group experiencing symptom	P value for difference in the intensity of symptoms
Fatigue	100	57	<0.001
Joint pain	96	32	<0.001
Depression	40	4	<0.005
Fever	35	3	<0.005
Muscle pain	86	62	<0.001

The scientists concluded that more PTLDS patients than the control group experienced:

- symptoms
- greater intensity of symptoms.

Evaluate the scientists' conclusions.

[4 marks]

[illegible]