AS Level Biology A

H020/01 Breadth in Biology

Question Set 11

1. The Titicaca water frog, *Telmatobius culeus*, is an aquatic amphibian found in Lake Titicaca in sub-tropical South America. The water frog has an unusual appearance with large folds of skin asshown in Fig. 21.1.

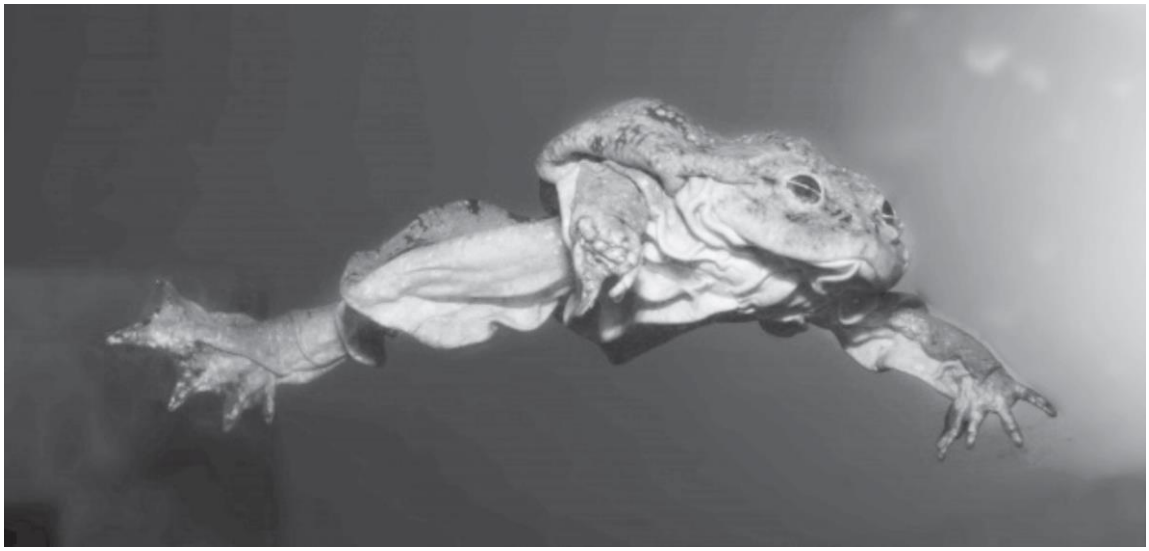

Fig. 21.1

(a) Name the genus of the Titicaca water frog. Telmatobius **[1]**

(b) Outline the properties of water which make it an ideal habitat for an amphibian. **[2]**

Water has a high specific heat capacity. This means the temperature of water bodies is relatively stable, making it an ideal habitat for ectothermic amphibians. It also has a high density enabling many amphibians to float.

(c) Like all amphibians, frogs are able to absorb oxygen through the skin as well as their lungs.

(i) Suggest why the Titicaca water frog has evolved the unusually large folds of skin seen in Fig. 21.1. **[2]**

To provide a large surface area for oxygen absorption as oxygen levels in the water are low.

(ii) When out of the water, the Titicaca water frog is able to use its lungs to absorb oxygen.

Lungs contain specialised gaseous exchange surfaces.

Describe and explain how **one** feature of the lungs provides an efficient gas exchange surface. **[2]**

Squamous epithelial layer of alveoli one cell thick, providing a short diffusion distance.

(d) A student was investigating the effect of cell size on the rate of diffusion into model cells.They had two cubes of agar containing phenolphthalein indicator as shown in Fig. 21.2.

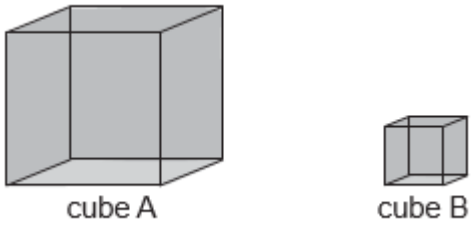

Fig 21.2

The student placed the cubes in beakers of dilute hydrochloric acid, which caused the indicatorto become colourless. They then measured how much of each cube became colourless overtime.

(i) State **two** ways the student could have ensured they had confidence in their results. **[2]**

1 Repeat the experiment three times and calculate a mean

2 Identify and remove any anomalous results.

(ii) In Fig. 21.2, Cube A is 10 mm along each side and Cube B is 4 mm along each side. Calculate the surface area to volume ratio (SA:V) for both cubes A and B.

Show your working. Give your answers to **one** decimal place. **[2]**

Cube A: $SA = 10^2 \times 6 = 600\,mm^2$, $V = 10^3 = 1000\,mm^3$

$600 : 1000$, $0{\cdot}6 : 1$

Cube B: $SA = 4^2 \times 6 = 96\,mm^2$, $V = 4^3 = 64\,mm^3$

$96 : 64$, $1{\cdot}5 : 1$

Cube A 0·6 : 1

Cube B 1·5 : 1

(iii) Explain why the surface area to volume ratio of an organism determines whether it needs a circulatory system. **[3]**

Larger organisms possess a smaller surface area to volume ratio. Diffusion is too slow and is insuffient to provide all body cells with the required oxygen and nutrients. A specialised circulatory system is therefore required for efficient delivery of oxygen and nutrients and removal of waste products.

Total Marks for Question Set 11: 14