



**CHEMISTRY ONLINE**  
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# BIOLOGY

## ORGANISMS EXCHANGE SUBSTANCES

Level & Board	AQA (A-LEVEL)
TOPIC:	SURFACE AREA VOLUME RATIO
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	5
TOTAL MARKS	26

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## Surface Area to Volume Ratio - 1

1.

(a) Larger cells have a smaller surface area to volume ratio so it takes longer for oxygen to diffuse as diffusion distance is longer.

2.

(a) Large animals benefit from specialized systems for oxygen uptake to sustain their metabolic functions. This is due to the fact that surface area-to-volume ratio decreases with increasing body size, making diffusion of oxygen across body surfaces insufficient.

(b)

- Water has lower oxygen partial pressure/concentration than air so, system on outside gives large surface area in contact with water.
- Water is denser than air so, water supports the system gills.

(c)

12.48: 0.096

3.12: 0.024

Mean lung volume = 0.72

$3.12/0.72 = 4.3$  times greater

**Explanation:** Provides more oxygen for respiration

3.

(a)

Metabolic rate =  $63 \times \text{BM}^{-0.27}$

BM = body mass in grams

body mass in grams =  $23^{-0.27}$  and  $550000^{0.27}$

$63 \times 23^{-0.27} = 27.019$

$63 \times 550000^{0.27} = 1.7759987$

$27.019 / 1.7759987 = 15.2$  times faster

**(b)** mouse has a higher surface area to volume ratio so the mouse loses heat at a much quicker rate means the mouse must have a higher metabolic rate to replace the energy lost as heat to the surroundings. A faster rate of respiration releases more heat.

**4.**

**(a)** As the size of an organism increases, its volume increases faster than its surface area. This means that the surface area to volume ratio decreases as the organism gets larger.

**(b)**

$$\text{Surface area} = 4\pi r^2$$

$$\pi = 3.14$$

$$\text{Mean surface area} = 9.73 \text{ mm}^2$$

$$4 \times 3.14 = 12.56$$

$$9.73 \div 12.56 = 0.88$$

$$0.88 \times 2 = 1.76 \text{ mm}$$

**(c)**

He used micro mol in units to measure small uptake of oxygen.

**OR**

Avoids use of powers of ten

**(d)**

More accurate

**OR**

Fewer measurements

**(e)** Oxygen is used in respiration that provides energy in the former of ATP.

**OR**

Oxygen consumption and carbon dioxide production are used as an indirect measure of metabolic rate. This works because oxygen is used to break

down food during cellular respiration, whilst water, carbon dioxide and energy are produced.

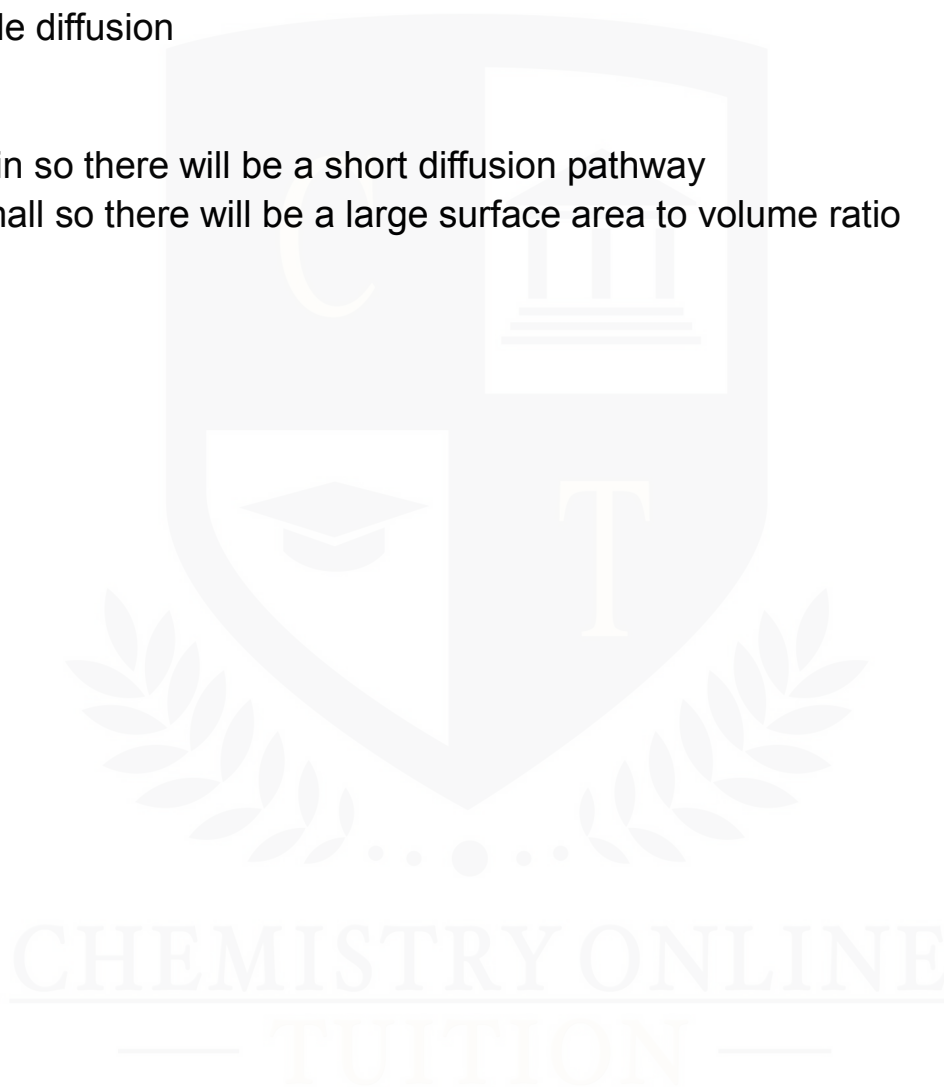
(f) The egg stage of development had no information. They cannot compare all stages in table 2 and there is no statistical information.

**5.**

(a) Simple diffusion

(b)

- Thin so there will be a short diffusion pathway
- Small so there will be a large surface area to volume ratio



I am Sorry !!!!!



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- Completed Medicine (M.B.B.S) in 2007
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