

## Mark schemes

**Q1.**

- (d) 1. Large(r) cells have small(er) surface area to volume ratio;  
 2. (Takes) longer for oxygen to diffuse (to mitochondria)

**OR**Less/no oxygen diffuses (to mitochondria)**OR**Diffusion distance/pathway is long(er);*Accept converse for all marking points.*

2

**Q2.**

- (a) 1. Large(r) organisms have a small(er) surface area:volume (ratio);

**OR**

Small(er) organisms have a large(r) surface area:volume (ratio);

2. Overcomes long diffusion pathway

**OR**Faster diffusion;*Accept short diffusion pathway**Accept for 'faster', more*

2

- (b) Mark in pairs, 1, **and** 2 OR 3. **and** 4.

1. Water has low(er) oxygen partial pressure/concentration (than air);

2. So (system on outside) gives large surface area (in contact with water)

**OR**

So (system on outside) reduces diffusion distance (between water and blood);

3. Water is dense(r) (than air);

4. (So) water supports the systems/gills;

2

- (e) 1. and 2. Correct answer for 2 marks, 4.3 (times greater);;

Accept for 1 mark,

4.333333333 (correct answer not given to 2 significant figures)

**OR**

Evidence of 130 (cm<sup>3</sup> kg<sup>-1</sup>) **and** 30 (cm<sup>3</sup> kg<sup>-1</sup>)

Correct explanation for 1 mark,

3. Provides more oxygen for respiration;

3

### Q3.

- (b) Correct answer of 15 (times faster) = **2marks** ;;

If  $\geq 3$ sf given, accept answers in the range 15.0 to 15.4 (times faster)  
= **2marks**;;

Incorrect answer 1 mark for evidence of:

$23^{-0.27}$  divided by  $550\,000^{-0.27}$

**OR**

0.42888777

**OR**

0.02819045

**OR**

Between 27 and 27.1

**OR**

Between 1.77599861 and 1.8

**OR**

0.06

*Accept any number of significant figures  $\leq 2$ , if rounding correct.*

2

- (d)

*Accept converse answers in relation to the horse.*

Mouse

1. (Smaller so) larger surface area to volume ratio;  
*Accept larger SA:V.*  
*Must be comparative.*
2. More/faster heat loss (per gram/in relation to body size);  
*Ignore heat lost more easily/readily.*  
*Must be comparative.*
3. (Faster rate of) respiration/metabolism releases heat;  
*Accept respiration/metabolism replaces heat.*  
*Reject produce/generate heat/energy.*

3

**Q4.**

- (a) As size increases, ratio (of surface area to volume) decreases;

*Accept converse.**Comparison required, e.g., smaller organisms have a larger ratio*

1

- (b) Two marks for correct answer in range of 1.75 to 1.76032;;

*Accept for 1 mark, incorrect answer using radius  
0.87 / 0.88 / 0.880 / 0.8802 / 0.88015;***OR***Accept for 1 mark, incorrect answer with correct  
rearranged equation, e.g.,*

$$\text{Radius} = \sqrt{(\text{surface area} \div 4\pi)}$$

**OR**

$$= \sqrt{9.73 \div 12.56}$$

**OR**

$$= \sqrt{0.77} / \sqrt{0.774} / \sqrt{0.775}$$

**OR**

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

**OR**

$$r^2 = 9.73 \div 12.56$$

**OR**

$$r^2 = 0.77 / 0.774 / 0.775$$

2

- (c) (Measures) small uptake / amount / quantity / volume / concentration / rate (of oxygen uptake);

**OR***Avoids use of powers of ten / standard form / many decimal places;**Ignore weight / accuracy*

1

- (d) More accurate / less error (in measuring mass);

**OR***Causes less distress / damage to animal (to measure mass);***OR***Easier / quicker (to find mass) **because** irregular shapes;***OR***Fewer measurements / calculations;**Ignore references to **human** error**Accept converse if reference made to volume**Reject if comparison is made with surface area.*

1

- (e) (Oxygen used in) respiration,
- which**
- provides energy / ATP;

**OR***(Oxygen is used in) respiration, **which** is a metabolic process /  
chemical reaction;*

*Reject produces energy*  
*Reject references to anaerobic respiration*

1

- (f) 1. No information about egg;
2. So cannot compare all stages (in Table 2);  
*Idea of comparing all three stages needed*
3. No statistical information / test / t-test / comparison of standard deviations;  
**OR**  
 No measure of significant differences;  
*Reject statements that "results" are not significant*  
*Reject references to chi squared or correlation coefficient*

3

**[9]****Q5.**

- (a) (Simple) diffusion;  
*Reject: facilitated diffusion.*
- 1
- (b) 1. Thin/small **so** short diffusion pathway;  
*Reject: thin membrane/wall/cells.*
2. Flat/long/small/thin **so** large surface area to volume ratio/surface area : volume;  
*Accept: small volume to surface area ratio.*
- 2