3.3.2 Gas Exchange Question Pack Mark scheme 2016

**M1.**         (a)     (i)     Diffusion;

*Ignore references to structures, membrane components etc*

*Allow simple diffusion*

*Reject facilitated diffusion*

**1**

(ii)     1.      (Thin / flat body) so short distance for diffusion / short diffusion pathway;

*Ignore references to membrane, wall, body surface*

2.      (Thin / flat body so) large surface area to volume ratio;

*‘It’ refers to flatworm’s body*

**2**

**[3]**

**M2.**(a)     1.      Water and blood flow in opposite directions;

*Accept: diagram if clearly annotated*

2.      Maintains concentration / diffusion gradient / equilibrium not reached / water always next to blood with a lower concentration of oxygen;

*Must have the idea of ‘maintaining’ or ‘always’ in reference to concentration / diffusion gradient*

*Accept: constant concentration / diffusion gradient*

3.      Along whole / length of gill / lamellae;

*Accept: gill plate / gill filament*

**3**

(b)     1.      (Thicker lamellae so) greater / longer diffusion distance / pathway;

***Q*** *Neutral: ‘thicker’ diffusion pathway*

2.      (Lamellae fuse so) reduced surface area;

*Accept: reduced SA:VOL*

**2**

(c)     (i)      Correct answer of **5.1** or **5.14(2857)** (dm3) = 2 marks;;

*Allow 1 mark max for an answer of* ***5*** *if the correct answer of* ***5.1*** *or* ***5.14(2857)*** *is* ***not*** *shown*

One mark for incorrect answers that show **36** or **0.4 × 90** or **90 ÷ 7;**

**2**

(ii)     1.      Increased metabolism / respiration / enzyme activity;

*Accept: enzymes work more efficiently*

2.      Less oxygen (dissolved in water);

*Neutral: references to increased kinetic energy (of water molecules)*

**1 max**

**[8]**

**M3.**(a)     Correct answer of 342.8 − 343 = 2 marks;;

Credit incorrect answers that show the numerator as 144 (or 186-42) or denominator as 42 for 1 mark;

**2**

(b)     1.      More air / oxygen enters / air / oxygen enters quickly / quicker;

*1. Accept: converse for carbon dioxide*

*1. Can be in any correct context eg insect, tracheoles, muscle*

*1. Neutral: air / oxygen enters*

(So) maintains / greater diffusion or concentration gradient;

**2**

(c)     Large(r) SA:VOL / short(er) diffusion distance (to tissues);

*Accept: thin diffusion pathway*

**1**

(d)     6 / 6.6 / 6.7 / 7 / 7.5 / 8 = 2 marks;;

*Different answers given for different interpretations of the graph*

Award 1 mark for incorrect answers that have divided 60 by any number;

**2**

(e)     Less / no water lost / (more) water retained;

*Accept: less dehydration / less evaporation*

***Q*** *Reject: less ‘transpiration’*

***Q*** *Reject: less water lost by osmosis*

**1**

(f)     1.      Greater surface area exposed to air;

*Neutral: shorter diffusion distance*

2.      Gases move / diffuse faster in air than through water;

*2.* ***Q*** *Neutral: ‘harder to diffuse’*

*2. Accept gases diffuse directly, rather than through water*

3.      Increases volume / amount of air;

**1 max**

**[1]**

**M4.**(a)     1.      The more recent the sample the greater the concentration;

*Accept converse*

*This could be expressed by reference to time e.g. ‘concentration has increased since 25 000 years ago*

2.      Increases most in last 5000 years / more or less constant / slight increase between 30 000 and 15 000 years ago;

**2**

(b)     1.      Variation in data / spread of data;

*Reject references to range e.g. ‘range of data’*

2.      Around the mean;

*Both marks are possible in the context of using the data*

**2**

(c)     1.      Yes as pine leaves not in organic matter of the same age;

2.      No as organic matter would be the same age as the pine leaves;

*Accept either approach*

**1 max**

(d)     Can get more CO2 for photosynthesis;

*More CO2 enters leaf is insufficient.   
Accept light-independent (reaction) as equivalent*

**1**

(e)     Any **three** from:

1.      (Overall data show) negative correlation;

*Do not allow description of correlation because in question stem*

2.      Little change in number of stomata in last 10 000 years;

3.      Small sample size;

4.      Only one species studied;

5.      Other factors / named factor may have affected number of stomata;

6.      Evidence does not support the conclusion between 30 000 and 25 000 years ago / between 5000 years ago and present day;

*Accept reference to either one of these age ranges*

7.      Appropriate reference to standard deviations (in comparing means);

*E.g. no overlap between 15 000 and 10 000 years ago*

**3 max**

(f)     Any **three** from :

1.      Thick cuticle;

2.      Small leaves / low surface area;

*Accept other ways of describing ‘small’, e.g. ‘needle-like’*

3.      Hairy leaves;

4.      Sunken stomata;

5.      Rolled leaves;

**3 max**

**[12]**

**M5.**          (a)     235–240;;  
*(one mark for an answer between 200-300  
based on 2 - 3 stomata in 0.01mm2Alternatively, one mark for calculating the area of the  
rectangle correctly as 0.016 – 0.017mm2)*

**2**

(b)     grows in arid / dry conditions;  
less surface area;  
(rate of) transpiration / water loss would be reduced;

**3**

**[5]**

**E1.**         (a)      (i)      The term diffusion was known well, with the majority of students answering correctly.

(ii)     This question was successfully answered by the vast majority of students. Where students failed to gain a mark it was because they referred to the flatworm having a large surface area rather than a large surface area to volume ratio.

(b)     (i)      Many students could recall that an organ is a group of tissues.

(ii)     Few students gained all three marks for this question but most achieved one or two marks in clearly appreciating that carbon dioxide enters a leaf through the stomata. Students clearly understood the process of diffusion but failed to gain credit where they stated that diffusion occurs across or along, rather than down, the gradient.

**E2.**Parts (a), (b) and (c)(i) proved to be good discriminators.

(a)     60% of students scored at least two marks. This was usually for appreciating that water and blood flow in opposite directions to maintain a concentration or diffusion gradient. However, relatively few students mentioned that this occurs along the whole length of the gill. Those who scored zero often gave an account of how the gills are adapted for efficient gas exchange, or did not convey the importance of *maintaining* a concentration or diffusion gradient. There were also some lengthy descriptions of ventilation in fish. It should be noted that this topic is not included in the specification content for BIOL2.

(b)     70% of students scored full marks for linking thicker lamellae to a greater diffusion distance and the fusion of lamellae to a reduced surface area. However, some failed to pick up a second mark due to a lack of precision; for example, ‘less diffusion occurs’ and ‘the diffusion pathway is thicker’.

(c)    (i)      A third of students obtained the correct answer of **5.14** and scored both marks outright. However, many students obtained the principle mark for showing 90 × 0.4 or 90 ÷ 7 in their method.

(ii)     Very few students obtained the marks by suggesting that an increase in the temperature of the water would increase the fish’s metabolism, or rate of respiration, or cause less oxygen to dissolve in the water. The majority of students referred to an increase in kinetic energy, or that water molecules would be moving faster.

**E3.**(a)        This proved to be a good discriminator. One-third of students used the correct formula and generally had little difficulty in gaining both marks. Of the remaining two-thirds, most obtained one mark for using the correct numerator or denominator.

(b)     Most students gained at least one mark. This was usually for the idea of maintaining a concentration or diffusion gradient. Surprisingly, relatively few students appreciated that abdominal pumping would result in more air entering, or that air would enter quicker. Many simply stated that air was 'forced in'.

(c)     Most students gained this mark by referring to a large surface area to volume ratio. Relatively few mentioned a short diffusion distance. Unfortunately, a minority of students suggested that a small size provides a *small* surface area to volume ratio.

(d)     Different interpretations of the graph resulted in most students obtaining a correct answer. A common incorrect response was '5'. This was due to students incorrectly measuring the time between the spiracles opening as 12 seconds.

(e)      Most students appreciated that an insect opens its spiracles at a lower frequency in dry conditions and that this reduces water loss.

(f)      It was disappointing that only one-fifth of students obtained this mark. Correct responses usually always mentioned that gases move faster in air than in water. Relatively few mentioned an increase in the volume of air but instead mentioned an increase in the concentration of oxygen. Similarly, references to surface area were often in the wrong context. They suggested that the surface area of the tracheoles increased, rather than the surface area of the tracheoles *exposed to air.*

**E4.**(a)     In general, students made good use of the data, as required, answering this question. Weaker answers only identified the overall trend.

(b)     There was some misinterpretation of this question by students. All that was required was a description of what standard deviation shows, namely, the variation in, or spread of data about, the mean value. Some attempted to discuss standard deviation values related to the data obtained but there was no specific direction to do so in this case.

(c)     Given that two possible approaches to this question were possible, the majority of students were able to make one acceptable line of reasoning.

(d)     The link between carbon dioxide and photosynthesis was not apparent to a large number of students. Thus, they failed to gain the mark for this question.

(e)     Although all responses were seen within the work that was moderated, most students could not make three relevant points – the mark allocation was the key for this – to justify whether the results supported the conclusion. It was rare to see recognition of a negative correlation, although some described such but were only repeating the question stem and, for doing so, there is no credit. This type of question reflects a weakness with the assimilation of resource material. The likelihood of another factor being responsible was the most common point made, but this supports the idea that many students produce rehearsed answers without showing a comprehension of what is in the resources.

(f)     Many students finished strongly with a question relying on recall. The Marking Guidelines specifically referred to “thick” cuticle but some assessors credited reference to ‘waxy’ as an alternative.

**E5.**          (a)     Very few candidates correctly worked out the area as 0.0167mm2 and many seemed to have a basic problem with calculating areas. It was common to see 0.1 x 0.1 = 0. l mm2. Many candidates failed to gain credit by carrying out calculations that were not clearly identified. A common approach was to estimate the number of stomata in an area 0. 1mm x 0. 1mm, which gained credit if done correctly. Many gave answers that were clearly incorrect, such as 20-25 or even 0.25!

(b)     Most candidates picked up the 2 marking points but some failed to gain the second point by incorrectly stating that ‘fewer stomata prevent water loss’. Few answers referred to the idea of there being a reduced surface area.