B3.1 Mastery Quiz: Growth and Differentiation

Mark Scheme

Section A

Qu	Answer	Marks	Supporting information for fix-it tasks
1	C	1	Answering A suggests that students have understood the relationship between rate of diffusion and temperature but have not been able to apply the idea that a cup of tea will have a smaller concentration gradient than water by itself. *To fix it, ask students to define 'concentration gradient' and then explain why diffusion rate is slower in option A as compared to option C.* Answering B suggests a fundamental gap in knowledge about the effect of temperature on diffusion rate. *To fix it, reteach why diffusion happens faster when the temperature is greater and this can be demoed using a beaker of hot and cold water, place tea bags in both and observe the difference in diffusion rate.*
2	C	1	Answering B or C suggests a gap in knowledge about examples of prokaryotic and eukaryotic cells. *To fix it, ask students to write definitions for prokaryotic and eukaryotic, including an example organism for each.*
3	A	1	Answering B suggests that students can recall that plasmid and loops are in prokaryotic cells, however it shows in gap in knowledge that eukaryotic cells have genetic material stored in the nucleus. *To fix it, reteach the etymology of the words eukaryotic (true-kernal (nucleus)) and prokaryotic (before-kernal (nucleus)). Then ask students to describe how DNA is arranged in prokaryotic and eukaryotic cells.* Answering C suggests a confusion of eukaryotic and prokaryotic genetic material organisation. *To fix it, ask students to compare eukaryotic and prokaryotic cells.*
4	A	1	Answering B suggests some understanding that adult bone marrow cells can differentiate into blood cell types, but does show a gap in knowledge that only embryonic stem cells can differentiate into **any** cell type. *To fix it, reteach the difference between adult bone marrow stem cells and embryonic stem cells and then ask students to write their own definitions for these.* Answering C suggests a gap in knowledge about stem cells, since a zygote/fertilised egg cell is a single cell. *To fix it, ask students to explain what a stem cell is and where they are found.*
5	C	1	Answering A suggests a gap in knowledge because option A is an example of what students should **not** do. *To*

			fix it, students should annotate a microscope diagram with the steps they should follow to view cheek cells under the light microscope. Answering B suggests that students have confused the objective and eyepiece lens. *To fix it, students should label a microscope diagram with particular focus towards the different lenses and then students should describe the functions of the eyepiece and objective lenses.*
6	B	1	Answering A suggests that students have calculated the percentage of the original beaker mass of the final beaker mass instead of the percentage increase in mass. Answering C suggests that students have divided 50 by 250 (the final mass) instead of 50 divided by 200 (the original mass). *To fix it, students should be given a selection of calculations to complete which involve firstly calculating percentages, and then percentage increase and decrease.*
7	A	1	Answering B suggests the correct knowledge that energy is required, but the concentration gradient described is for diffusion. *To fix it, ask students to describe an example in an organism where active transport is used, ensuring they include the concentration gradient.* Answering C suggests some understanding, since the concentration gradient here is correct, however it identifies a gap in knowledge that energy is required. *To fix it, ask students to explain why energy is required in active transport.* Answering D suggests a confusion with the definition for diffusion. *To fix it, ask students to compare and contrast diffusion and active transport.*
8	B	1	Answering A suggests that students have a misconception that there is no osmosis when water is used. *To fix it, ask students to explain why the mass is the same when placed in 0.2 g/dm^3.* Answering C suggests that students know that osmosis would take place because of a difference in concentration but have incorrectly chosen the direction of water movement. *Give students more questions with writing down relative concentrations to practise choosing the direction of water movement.*
9	A	1	Answering B suggests the misconception that an increase in volume, increases the surface area : volume ratio. *To fix it, reteach, using diagrams, how the ratio decreases when the volume of the organism increases. Then give students*

			some values to calculate the ratio for a small and larger organism to compare. Answering C shows that students do not understand the relationship between SA:volume ratio and the rate of diffusion. *To fix it, ask students to describe and explain the different factors that affect the rate of diffusion.*
10a	C	1	Answering A suggests that students have not converted the values to have the same unit before performing the division calculation. *To fix it, ask students to practice converting values from mm to μm and cm to mm.* Answering B suggests an error in converting units for this calculation. *To fix it, ask students to write out how many mm in 1 cm, μm in 1 mm, etc to practise this.*
10b	B	1	Answering A shows some understanding of how an electron microscope works, but it shows a gap in knowledge in the greater magnifying power of the electron microscope. *To fix it, ask students to compare the magnifying power of the light and electron microscopes.* Answering C suggests a gap in knowledge about what resolution is because it would make it easier to resolve/tell apart two ribosomes so it would be beneficial to have a greater resolving power, like the electron microscope has. *To fix it, ask students to explain what is meant by magnification and resolution.*
11	A	1	Answering B or C suggests a fundamental gap in knowledge about the concentration gradient required for diffusion to happen. *To fix it, model this example using simple shapes for urea showing that there is more in the liver, less in the blood so more will diffuse into blood. Then ask students to explain why oxygen diffuses from alveoli into blood, including details about the difference in concentration.*
12	B	1	Answering A suggests a confusion with converting micro with milli. *To fix it, reteach the value of m, mm and μm, then ask students to write then units out from smallest to largest value, annotating the different in magnitude between each unit.* Answering C suggests the misconception that any value in micrometres is always 10^{-6} m. *To fix it, model why answer B is correct and then give students more similar practice questions.*
13	C	1	Answering A suggests that students have a gap in knowledge that one bacterium divides into two bacteria during cell division. *To fix it, ask students to explain why mitosis makes two cells from one parent cell.* Answering B suggests a misconception that simply multiplying the number of cells by the number of division

			events results in total cell number. *To fix it, model for students using circles and arrows, how many cells are produced at each division event. Then ask students to calculate how many cells would be present if there were 4 cells in the sample and there were 4 division events (answer = 64).*
14	A	1	Answering B suggests that students know one step involved in aseptic technique, however there are other steps involved in an aseptic technique method. *To fix it, ask students to describe how to transfer a fungal sample from a tube to a Petri dish using an inoculating loop, ensuring they include more steps than written in option B.* Answering C suggests that students have confused a specific practical investigation with aseptic technique in general. *To fix it, ask students to explain what would happen if a scientist growing one species of yeast on a Petri dish didn't use aseptic technique.*

Section B

Qu	Model answer	Supporting information ***Suggestions for fix-it tasks***
1	Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane	Students be confused with the many tier 3 words in this definition. *To fix it, annotate this definition, explaining what each part means. Then ask students to explain how osmosis is different to diffusion using the key words annotated.*
2	A lifestyle risk factor is a lifestyle choice that can increase the likelihood of a person developing a disease.	A potential error here might be the confusion with the inherited or genetic risk factor, since students will know that there is a genetic risk factor to cancer too. *To fix it, ask student to describe two types of risk factors that contribute to cancer.*
3	The cell cycle starts with a growth phase where the cell grows to double sub-cellular structures such ribosomes, cell membrane and DNA. During mitosis DNA, arranged into chromosomes, is pulled to separate ends of the cell ready for division. The final part of the cell cycle is when the cell membrane splits to produce two identical cells.	A common error here is to confuse mitosis with the cell cycle, so only mitosis could be described. *To fix it, show students the pie-chart diagram of the stages of the cell cycle and then ask them to rewrite their answer.*
4	See the exemplar graph below. Success criteria:	A common error is not drawing the line of best fit, or drawing it as a curved or smooth line like a 'dot-to-dot'. *To fix it, model how to draw the line of best fit for this data and*

	- x-axis scale regularly spaced - x-axis correctly labelled - 4 points plotted correctly - Line of best fit (straight line that aims to go through all the points)	*then ask students to peer assess each other's lines and give a www and ebi.*