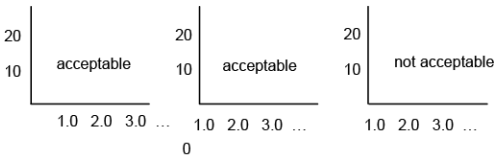
Mark scheme: Biological Molecules - PAG's

Question			Answer/Indicative content	Marks	Guidance
1			C ✓	1	
			Total	**1**	
2			C	1	
			Total	**1**	
3			D	1	
			Total	**1**	
4			A	1	
			Total	**1**	
5			*two from* add biuret / NaOH and $CuSO_4$, solution / reagent to urine (1) observe colour change (from blue to purple) (1) compare with, control / blank (urine containing no protein) (1)	2	**IGNORE** biuret test unqualified.
			Total	**2**	
6			*idea that* more than one leaf should be tested ✓ in case the leaf used was atypical ✓ sucrose is a non-reducing sugar ✓ if method is intended to measure sucrose then boiling with HCl in necessary s other sugars / glucose, also present in leaf ✓ chlorophyll / other pigments, in leaf ✓ green / colour, of pigments will interfere with colorimetry results ✓ blue filter is the wrong type of filter / should have used red filter ✓	4 max	
			Total	**4**	

7	a	i	1 appropriate scale chosen **and** x axis labelled glucose concentration (mmol dm^{-3}) **and** y axis labelled mean % absorbance ✓ 2 points plotted correctly ✓ 3 straight line of best fit drawn on graph (not extending beyond the plot points) ✓	**3 max**	**1 IGNORE** presence or absence of 0 at origin(s) unless either axis is deemed to have started above 0  **2** x axis glucose concentration (mmol dm^{-3}) | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 y axis mean % absorbance | 67 | 54 | 47 | 41 | 26 | 16 Centre of cross or dot within + or – half a small square Centre of cross or dot within + or – half a small square one error in the plotted points **ALLOW** one error in the plotted points Points for glucose concs 1, 3, 5 & 6 mmol dm^{-3} should be in a straight line. Points for glucose concs 2, 3 & 4 mmol dm^{-3} should be in a straight line with a shallower gradient **Note:** A bar chart will only be able to access mp 2 **Examiner's Comments** Few candidates scored all three marks. Those who failed to quote the y axis variable correctly as 'mean % absorbance', chose a scale that was too small for the available space or who used a non-linear scale were not awarded a mark. Point plotting was usually accurate and this mark was frequently awarded. As the data showed a calibration curve a line of best fit should have been drawn. Many extrapolated their line of best fit inappropriately. The following guidance can be found in the Mathematical Skills Handbook: 'Where the purpose of the graph is to present the data within the experimental range only (with the possibility for deriving predicted values through interpolation) no extrapolation is needed and the line should be confined to the range of the independent variable.'

		ii	find the absorbance (of the juice using the colorimeter) ✓ (from the graph) find the concentration that corresponds to this absorbance ✓ follow the, absorbance value / value on y axis, across to, line of best fit / (calibration) curve, and then down to the, concentration / x axis ✓	**2 max**	**ACCEPT** vertical and horizontal for x and y **Examiner's Comments** Candidates may have been unfamiliar with the use of calibration curves or else struggled to describe their use in a logical, step-wise answer, as the quality of answers was often poor. Few candidates integrated the information across all of the question and realised that they would have to find the absorbance values of **A**, **B** and **C** using the colorimeter before locating these values on the *y* axis, ruling a line across to the line of best fit and reading down to the *x* axis value for concentration. Some scored the mark for the general idea that the curve could be used to find the concentration that corresponds to a particular absorbance. Weaker answers described how the glucose concentration would affect the absorbance without attempting to answer the question.
	b	i	1. taste the fruit juices to see how sweet they are ✓ 2. place a sample of each fruit juice in a biosensor **and** take the reading **or** test each fruit juice with, Benedict's / diastix / clinistix / (diagnostic) test strip **and** observe colour(s) ✓ 3. obtain rank order for, sweetness / fruit juice glucose concentration	**4 max**	1. could be in the context of different juices **or** a series of dilutions of the same juice (to give different glucose concentrations) **or** a series of glucose concentrations 2. **ACCEPT** semi-quantitative test for reducing sugar Benedict's tests on each fruit juice **and** weigh mass of precipitate formed for each juice perform 3. **ACCEPT** plausible way of determining glucose concentration e.g. relative density / specific gravity / mass change as a result of osmosis Benedict's – blue to red with increasing concentration diastix – green / blue to red clinistix - green / blue to red **or** pink to (dark) purple

			4. compare rank orders (of fruit juices) for sweetness and glucose concentration ✓ 5. how a variable was controlled during, taste / glucose concentration, test ✓		4. **ACCEPT** the use of a statistical test if rank orders for both are numerical 5. e.g. use same, number of drops / volumes, of fruit juice cleanse palate between juices blind taste test / stated way to avoid bias tasted by a number of subjects (and results pooled) keep test strip in sample for same length of time add excess Benedict's heat for same length of time / at the same temperature (Benedict's only) filter precipitate in same way (semi-quantitative Benedict's only) **Examiner's Comments** Most candidates showed good knowledge of the Benedict's test though there was some confusion over whether it tests for a reducing or non- reducing sugar. A mark was often scored for controlling a variable during the test such as the volume of juice or Benedict's solution, or the heating time or temperature. Fewer candidates went on to describe a taste test, either of different juices (**A**, **B** and **C**), or of dilutions of a juice or of a range of glucose concentrations. Answers that discussed taste tests tended to do well and often achieved both the method mark and the idea of ranking the results to give an order of sweetness. Some discussed tasting the juices but did not state 'to see how sweet they were'. The most insightful answers compared the rank order of sweetness with the rank order found with the Benedict's test.
		ii	tasting is, subjective / (only) qualitative / not quantitative **or** hard to quantify sweetness **or** people may have different, judgement / opinion / taste buds ✓ colour judgement (in Benedict's) is subjective ✓	**1 max**	**IGNORE** accuracy / reliability **ACCEPT** ref to biased opinion

			(juice) may contain, sucrose / fructose / other (named) sugar / (artificial) sweetener ✓		**ACCEPT** sensible ref to acidity in juice masking sweetness **IGNORE** ref to 'other ingredients' unqualified **Examiner's Comments** Where candidates' train of thought had led them to discussing a taste test in the previous answer they almost always came up with a reason why the results might not support the hypothesis, due to different (non-glucose) sugars being present in the juice or other sweeteners or fruit acids affecting the perception of sweetness of the juice. The subjective nature of the taste test or of judging the final colour of the Benedict's test also scored a mark for many.
			Total	**10**	
8			**1** <u>zero</u> the colorimeter / set to <u>zero</u> ⟩ **2** using <u>blank</u> ⟩ **3** use red filter ⟩ **4** use known concentrations (of lactose) ⟩ **5** (produce) serial / series, dilutions ⟩ **6** construct calibration curve ⟩ **7** test unknown sample (using the same method) ⟩ **8** use / read from, graph / calibration curve, to determine (unknown) concentration ⟩	**4 max**	**ALLOW** calibrate to zero **3 ALLOW** red light / orange filter **4 ALLOW** a list of stated concentrations **5 ALLOW** clear description **6 ALLOW** plot concentration against, transmission / absorbance **8** Cannot be assumed from mp 6 **Examiner's Comments** This question differentiated well between candidates. Candidates should be familiar with this type of practical from the practical endorsement (PAG 5), and most ought to have carried out a similar practical activity. A large proportion of candidates began their answers with detailed descriptions of various aspects of the Benedict's test that were not relevant to the calibration process but then went on to score marks with relevant descriptions of the calibration procedure. Some focused on describing a Benedict's test or explaining the principle which they were not asked to do, and so did not receive much, if any, credit. All of the marking points were seen but serial dilutions were less commonly

					suggested despite these being a feature of OCR's PAG activities. It is worth noting that in order to construct a calibration curve, more than one known concentration needs to be used. Centres are reminded that the practical components of the syllabus are integral to students being able to apply their theoretical learning; performing these practical activities will enable candidates to relate to these elements when tested in the examinations.
			Total	**4**	
9			Phloem = B **AND** contains sucrose / non-reducing sugar ✓ non-reducing sugar / sucrose, hydrolysed / broken down, to monosaccharides ✓ Liver = A **AND** does not contain starch / gives negative result for iodine test ✓	**3**	**ALLOW** non-reducing sugars broken down to, reducing sugars / named monosaccharide **ALLOW** 'colour after iodine added was yellow' **Examiner's Comments** Many candidates identified tissue B as phloem since it contained sucrose, or a non-reducing sugar, which would result in a red precipitate with Benedict's reagent after treatment with hydrochloric acid. Fewer mentioned that this treatment would hydrolyse sucrose into its monosaccharide constituents. Some candidates lost the mark for stating that sucrose is a reducing sugar. Most candidates correctly identified tissue A as liver due to the fact that it contained no starch resulting in a negative result for the iodine test. Lower ability candidates identified C as the liver stating that it would contain both glycogen and reducing sugars such as glucose, but ignoring the fact that tissue C also contained starch.
			Total	**3**	
10		i	non-reducing , sugars / disaccharides ✓	1 (AO3.2)	**ALLOW** sucrose / cellulose / vitamins **IGNORE** minerals / ions / fibre **Examiner's Comments**

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>The majority of candidates gave ‘non-reducing sugar’ as the correct response for this part of the question with a few opting for ‘vitamins’ or the correctly named disaccharide, ‘sucrose’, which were also credited.</td></tr>
<tr><td></td><td></td><td>ii</td><td>
<table>
<tr><th>Test tube</th><th>Observations</th><th>Conclusion</th></tr>
<tr><td>1</td><td>(pale) purple / lilac / violet / mauve</td><td>Protein present</td></tr>
<tr><td>2</td><td>Yellow colour</td><td>reducing sugar (present)</td></tr>
<tr><td>3</td><td>Pale brown colour</td><td>no / very little , starch (present)</td></tr>
<tr><td>4</td><td>(turns) white / cloudy / milky
OR
(forms white) suspension / emulsion</td><td>Fat present</td></tr>
<tr><td>5</td><td><u>pink</u></td><td>Glucose concentration small (15 mg dm^{-3})</td></tr>
</table>
✓ ✓</td><td>2 (AO3.2)</td><td>1 mark per correct column

IGNORE monosaccharides

DO NOT ALLOW precipitate

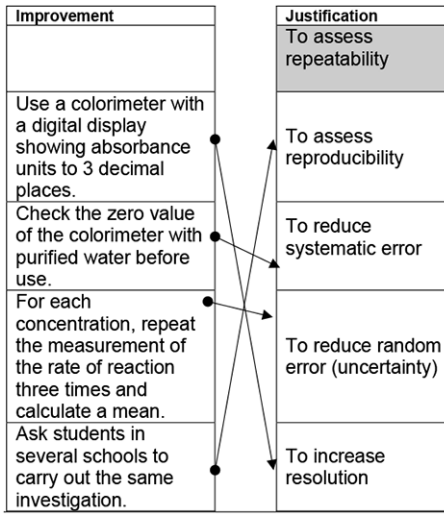
IGNORE any qualifications / shades of colour

<u>Examiner’s Comments</u>

There were some excellent responses from candidates who were able to complete both ‘observation’ and ‘conclusion’ columns demonstrating good knowledge of tests for biological ‘food’ molecules. However, some candidates did confuse the different tests with a common error to give brick-red precipitate for the expected observation in Tube 1.

OCR support

Practical work should be an integral part of the study of Biology. The practicals provided by OCR to support the practical endorsement include Practical Activity Group (PAG) 9 in which there are a series of qualitative tests. PAG activities are available on OCR interchange: https:/interchange.ocr.org.uk/Downloads/PAG9.zip</td></tr>
<tr><td></td><td></td><td>iii</td><td>(result using colorimeter will be)
<u>quantitative</u>
OR
not subjective / less affected by human error / no bias ✓</td><td>1 (AO3.4)</td><td>IGNORE accurate / valid
ALLOW is objective</td></tr>
</table>

					Examiner's Comments The majority of candidates understood the use of the colorimeter in giving quantitative or non-subjective results. However, there are still many candidates using the terms accuracy and precision in the wrong context (such as here) when responding to AO3 practical-based questions. **OCR support** Appendix 4 of the Practical Skills Handbook, provides information on terms used in measurement and conventions for recording and processing experimental measurements. This is in line with the 'The Language of measurement' booklet: https:/www.ocr.org.uk/Images/294468-biology-practical-skills-handbook.pdf
			Total	**4**	
11				4 (AO2.3)	**One mark per correct line** **DO NOT ALLOW** more than one line per box
			Total	**4**	
12			(carry out) Benedict's test / described ✓ (if test for reducing sugar negative) boil with (dilute) HCl and (re)test (with Benedict's) ✓	2 (AO2.7)	**ALLOW** 'add Benedict's (solution)' **Examiner's Comments** Most candidates answered (b)(ii) and (c) well, showing a good understanding of the Krebs cycle and chemiosmosis. Among some

					candidates, there was some confusion of how the proton gradient is established and few candidates mentioned that energy provided by the flow of protons through ATP synthase is used to join ADP and Pi to form ATP. Very few candidates scored 2 marks for (a). This question required a candidate to describe performing the Benedict's test for a reducing sugar which would produce a negative result and then repeating the test after boiling with Hydrochloric acid. Boiling with Hydrochloric acid before performing the first Benedict's test would not enable you to differentiate a positive test for a reducing sugar from a positive test for a non – reducing sugar. Very few candidates understood the meaning of the RQ values in Fig 4.3. Most candidates linked the RQ value to the amount of respiration taking place or the relative amounts of carbon dioxide being released compared to oxygen consumed. Few were able to link the RQ value to the type of respiratory substrate mainly being used at 0W and 50W, although many realised the high RQ value at 250W indicated that anaerobic respiration was taking place.  **AfL** As well as calculating RQ values, encourage candidates to interpret RQ values in terms of types of respiratory substrate being used and whether respiration is aerobic or anaerobic.
			Total	**2**	