Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1		i	stopwatch / timer ✓ thermometer / water bath ✓ measuring cylinder / pipette / syringe ✓ ruler ✓	max 2	**IGNORE** beaker **Examiner's Comments** The question was well answered with candidates recognising the relevance of the investigation title to complete the list of apparatus required. Some answers referred to cuvettes which, although required, is not contributing to a controlled investigation.
		ii	**1** add glucose (solution) to the, dialysis tubing / model cell ✓ **2** knot / secure dialysis tubing, before / after, addition of glucose ✓ **3** place (tubing) in a water bath and remove sample (around tubing) at, certain / specified / set, time interval(s) ✓ **4** add Benedict's (solution) to sample to test for glucose ✓ **5** use colorimeter to obtain, absorption / transmission, values ✓ **6** use calibration curve to estimate the concentration of glucose ✓ **7** repeat at / use, different temperatures ✓	max 4	**ALLOW** Visking tubing for dialysis tubing throughout **1 ALLOW** tubing containing glucose (solution) **3 ALLOW** glucose solution for 'sample' **3 IGNORE** remove sample from inside the dialysis tubing **3 ALLOW** dialysis tubing added to, test tube/beaker, of water **4 IGNORE** adding Benedict's to the dialysis tubing **4 ALLOW** look at colour with Benedicts to see how much glucose is present **Examiner's Comments** This was a good discriminating question. Most candidates were able to recognise the need for different temperatures, often suggesting relevant temperatures to use. Some answers referred to the calibration and use of the colorimeter. Few candidates were familiar with the use of dialysis tubing to form a model cell. This restricted their ability to elaborate on their answer. Many incorrect answers referred to potato or beetroot cylinders as the model cell. Candidates often discussed the dialysis tubing in terms of a covering for the test tubes. **Assessment for learning**

					The Examiners' reports are an excellent source of information for candidates when refining their understanding of certain techniques and methodology. **OCR support** The practical activity groups provided by OCR are an excellent teaching tool even if the practical is not feasible or an alternative activity has been assessed from a practical perspective. Providing a copy of all the activities to the students will broaden their understanding and knowledge of the practical techniques discussed at A level. Also the practice PAG materials can be used to reinforce indirect assessment of practical skills.
			Total	**6**	
2		i	GP was the only compound seen after 1 , sec(ond) / s ✓ TP appears after 5 , sec(onds) / s ✓	2	**ALLOW** glycerate 3 -phosphate for GP and triose phosphate for TP **ALLOW** AW for compound e.g. molecule / product **ALLOW** e.g. GP and no other products were seen after 1 second **IGNORE** any other products after 5 seconds **Examiner's Comments** Good responses used the diagram to formulate a response that included times at 1s and 5s. Some candidates did not gain credit for marking point 1 as, although able to state when GP was first seen, they did not mention that it was the only compound seen at 1s.
		ii	(TP is) converted into / source of, sugar phosphates / (named) amino acid(s) / citrate / sucrose / RuBP ✓	1	**must be idea of synthesis into / AW not breaking down into** **ALLOW** glutamic acid / serine / glycine / aspartic acid for named amino acids **DO NOT ALLOW** GP **Examiner's Comments** Generally answered well as candidates knew the fate of TP in the Calvin cycle. Some candidates lost the mark for referring to break down or hydrolysis of TP.

			Total	**3**	
3		i	**FIRST CHECK ON ANSWER LINE** **If answer = 0.6 award 2 marks** 3.6/6 ✓ = 0.6 ✓	2	**ALLOW** 0.58 – 0.62 3.5/6 = 0.58 3.7/6 = 0.62 **ALLOW** ecf for correct calculation and correct rounding after incorrect measurement of valine position and / or solvent front Allow answers to two decimal points, if more decimal points used max 1 mark **Examiner's Comments** This was very well answered in the majority of cases. Candidates were able to measure the correct distances from the examination paper and then knew what to do with the figures. A few candidates lost credit as they did not round to a suitable number of decimal places. In some cases candidates calculated the Rf value for Leucine rather than Valine.
		ii	different , polarity / charges / functional groups ✓	1	**ALLOW** serine more polar ORA **IGNORE** 'chemical properties different' **IGNORE** ref to size (of R group), **IGNORE** ref to solubility (of R group) **Examiner's Comments** Only a few candidates gained a mark in this question. Many candidates simply described differences in size or solubility and a lot described one amino acid as being more or less hydrophilic than the other. Candidates should appreciate that separation of amino acids in thin layer chromatography uses organic solvents and the distance travelled depends on relative interactions with the mobile phase and the stationary phase.
			Total	**3**	
4		i	stain(s) / dye(s) ✓ (exposure to) UV light ✓	1 (AO2.7)	**ALLOW** any named stain **Examiner's Comments** Most candidates gained this mark. Mistakes included the use of 'a solvent' or the suggestion that a 'chemical' or 'tagged

					antibody', should be attached to the vitamins before the chromatography is performed (which would affect R_f values).
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.3 award two marks** 2.4/8 ✓ = 0.3 ✓	2 (AO2.8)	**ALLOW** 0.29 – 0.31 for 2 marks 2.5 /8 = 0.31 2.3 /8 = 0.29 Answers given to more than 2 sig figs = max 1 **Examiner's Comments** Most candidates attempted this question, the majority scored both marks, although a few candidates did not score any marks. Those scoring no marks usually did so because of an incorrect calculation of 8/2.4. or measured the wrong vitamin, outside the range of 2.3 – 2.5. Some candidates lost 1 mark as they answered to more than 2 significant figures.
			Total	**3**	
5	a	i	add Biuret (instead of sodium hydroxide) ✓	1 (AO3.4)	**ALLOW** add copper sulphate (solution) **IGNORE** ref to changing temperature **Examiner's Comments** This question was well answered with candidates clearly knowing how to test for proteins. Some answers did refer to Benedict's reagent. The spelling of Biuret varied greatly. **Assessment for learning** Scientific spelling of words that can easily morph into other scientific words should be emphasised and discussed. Phonetic spelling out of words is very important to help candidates visualise the word and not confuse it with other words, e.g. biuret with burette. **OCR support** Always encourage candidates to check their spelling, especially for scientific terms, at the end of a test/exam/question practice. The OCR guide to examinations is a document that should be referred to throughout the teaching of A Level Biology to

					make sure a well-structured approach to exams is part of the teaching ethos.
		ii	OH-✓ **One** from catalyses reactions ✓ determines/regulates, pH (of body fluids) ✓ neutralise acids (from stomach)✓ determining shape of proteins✓	Max2 (AO1.2)	**IGNORE** hydroxide **DO NOT ALLOW** any additional ion **ALLOW** ecf for correct function related to an incorrect anion stated for mp1 **ALLOW** pH buffer **ALLOW** proton acceptor **<u>Examiner's Comments</u>** Few candidates named an anion. Those candidates who did state hydroxide often referred to a role as hydrolysis, a clear confusion with water.
	b		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Full and detailed description of the tests for both biological molecules correctly described, including reagents, some apparatus, and correct results in accordance with the table. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2 (3–4 marks)** A clear account of both tests for both biological molecules	6 (AO1.2×3) (AO2.7×2) (AO3.2×1)	For highest band correct tests for both biological molecules are required. Reagents correctly named. Some apparatus mentioned **Indicative points can include:** <u>Lipids</u> **Apparatus** test tube/AW filter paper and funnel pipette **Emulsion test + Reagents** **- add** test solution to, **ethanol** / alcohol - mix with water. - can filter and add water to filtrate **Result.** (from clear/colourless to) cloudy/ milky (suspension) **OR** **Apparatus** test tube/AW pipette **Sudan lipid test + Reagents** add test solution to water. **add** few drops of **Sudan** III and mix **Result.** (from clear/colourless to) red layer (on top of solution) <u>Starch</u>

			and correct results in accordance with the table **OR** a full and detailed description of one of the tests with limited account for the other. There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1–2 marks)** A limited account of one of the tests for biological molecules with correct result. There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant. **0 marks** No response or no response worthy of credit.		**Apparatus** spotting tile/test tube pipette/dropping bottle **Iodine test + Reagents.** to test solution add a few drops of Iodine/Iodide solution **Result.** (from brown/orange to) blue-black/ dark blue/black/purple **Examiner's Comments** Most candidates attempted this question with many gaining Level 3. More successful candidates made clear reference to the apparatus used and the colour changes that would occur for a positive result. Candidates often omitted the addition of water to the emulsion test or added a heating step. Some candidates struggled to remember the words for spotting tiles, referring to them as white tiles. A few candidates discussed crushing up samples before doing the tests so had not appreciated the 'sample of unknown liquid' as stated in the stem of the question. Candidates who did not state the correct test often confused the starch test with the test for reducing sugars. A few candidates referred to the Sudan test for lipids. Some answers added in an extra test. Candidates should be reminded that answers should focus on the information provided and not to add in extra information that does not enhance the question.  **Assessment for learning** When preparing for questions on practical methodology it is useful to write each stage on a separate line, cut out each line and ask candidates to put the steps in the correct order. When demonstrating food tests before the candidates performing the experiment, show what would happen if you omitted a step so they can see it would not work effectively without that step. Exemplar 2

					 This answer is Level 3 and scored 6 marks. This candidate is writing as if they are setting their experiment up in the laboratory. It shows a clear use of the relevant apparatus, the steps involved and the result expected. Each step is set out as a set of instructions, this has enabled the candidate not to miss out a step in each test. Volumes are stated which, although not required to score full marks, shows a thorough understanding of the tests and the relevance of the apparatus stated, e.g. 5cm3 is a suitable volume to use in a boiling tube.
	c	i	*Any three from:* **1** zero/calibrate, colorimeter with distilled water ✓ **2** add, 600nm/red, filter (to colorimeter) ✓ **3** place, samples/water, in a cuvette ✓ **4** use a range of known (glucose) concentrations ✓ **5** measure, percentage transmission / (light) absorption of, glucose solution(s)/sample(s)✓	3 (AO2.7×1) (AO2.8×1) (AO3.3×1)	**ALLOW** test solution for glucose solution **1 DO NOT ALLOW** calorimeter for 'colorimeter' **1 ALLOW** reset for 'zero/calibrate' **1 IGNORE** restart for 'reset' **2 ALLOW** set colorimeter to, red/600nm **<u>Examiner's Comments</u>** This was a discriminating question. Many candidates were familiar with a colorimeter and referred to light absorbance and the use of distilled water as a way of calibrating the machine. Some candidates stated the use of cuvettes but many could not remember the word and referred to them as 'special tubes'. A few answers referred to the initial Benedict's test being performed without appreciating that the question focuses on the use of the colorimeter only.
		ii	**FIRST CHECK ON ANSWER LINE** **If answer = 3.5**	2 (AO2.8)	**ALLOW** range 3.4 to 3.6 (mmol dm^{-3}) for 2 marks. **ALLOW** evidence from graph for '45%

			award 2 marks 45% absorption on graph = 0.0035 (mmol cm^{-3}) ✓ x 1000 = 3.5 (mmol dm-3) ✓		absorption' **ALLOW** range of 0.0034-0.0036 **Examiner's Comments** The majority of candidates achieved 1 mark for correctly estimating from the graph. Few candidates recognised that the units on the graph were mmol cm⁻3 and a unit conversion was required. Those that did appreciate that a conversion was required then divided by 1000 without realising that it was asking for the number of mmol in dm3, not just cm3 being converted into dm^3. **OCR support** Candidates should not limit their unit conversions to simply mm to nm for example but realise what happens when you have concentrations in different units. So although converting cm to dm would be dividing by 1000, if you have x mol in 1 cm3 then the number of moles in 1 dm^3 would be 1000 x more. Unit conversion help can be found in the maths for biology information guide.
			Total	**14**	
6		i	1 zero the colorimeter ✓ 2 use known (concentration of protein) solutions ✓ 3 plot calibration curve / absorbance vs concentration ✓ 4 measure absorbance of (unknown) sample ✓ 5 compare (absorbance of) sample with (calibration) graph ✓	4 max(AO1.2)(AO2.5)(AO3.3)	**1 IGNORE** calibrate / blank / tare **1 ALLOW** reference to 100% only if explicitly measuring transmission **3, 4** and **5 ALLOW** 'transmission' as AW for 'absorbance' **6 ALLOW** use , green / yellow , filter **Examiner's Comments** This question differentiated well between candidates, with many being given full marks, and each of the first five marking points was regularly seen. Where a filter was mentioned, it was usually red, which would have been appropriate for Benedict's reagent, but which was the wrong filter for the context of the question. Some candidates spent

			use appropriate 6 filter for , (shade of) purple / biuret ✓		unnecessary time giving detailed step-by-step instructions, including serial dilutions and suggestions for a range of known concentrations. The command word in this question was 'outline' so this level of detail was not needed.
		ii	biosensor ✓	1(AO1.2)	**ALLOW** compare with colour chart / chromatography / mass spectrometry / UV absorbance **Examiner's Comments** Less than a quarter of responses gained a mark here. The most common of the incorrect responses was 'Benedict's test' but 'universal indicator' and 'titration' were not uncommon answers. Candidates need to focus carefully on the stem and question – it was not looking for a different reagent, but what other method you could use other than a colorimeter. This was the most often-omitted question on the paper.
			Total	**5**	
7			**D** ✓	1	**Examiner's Comments** Many candidates recognised that the t-test was the most appropriate test to compare two mean values. However, fewer were able to select between paired and unpaired tests correctly. **OCR support** The use of paired and unpaired t-tests is described in the Mathematical Skills Handbook available at: https:/www.ocr.org.uk/Images/294471-biology-mathematical-skills-handbook.pdf OCR has also additional support on statistics: https:/www.ocr.org.uk/Images/346170-graphs-tables-and-drawings-student-checklists.doc https:/www.ocr.org.uk/subjects/science/maths-for-biology/handling-data/

			Total	**1**	