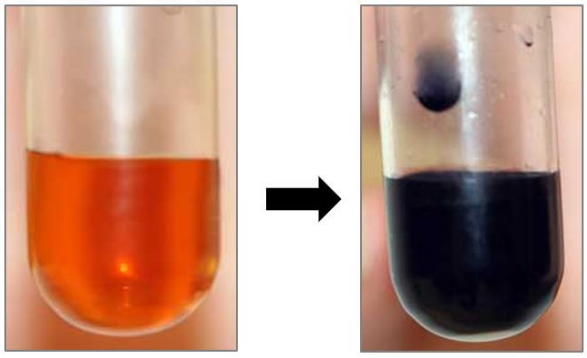
Q	Mark Scheme		NOTES
1 (a)	idea of withdrawing a sample to test aspect of appropriate method described	1 1	Iodine affects the activity of Amylase. If the students would add Iodine solution to test-tubes W and C for testing starch, the Iodine would remain in the solution thereafter and affect the activity of Amylase. This would introduce an error in the measurements as the focus of the experiment is to measure the effect of temperature on the activity of Amylase and not of Iodine. The students would remove samples of the Starch – Amylase mixture from test-tubes W and C using the dropping pipette onto two different watch glasses/ or in micro test-tubes and add a drop of Iodine to each sample. Colour change of Iodine from orange-brown to blue-black would indicate the presence of Starch. 

Q	Mark Scheme		NOTES
1 (b)	1 one table with ruled lines for at least 6 rows and 3 columns 2 a column / row, with header: time / min 3 two, columns / rows headings as, colour / observation, W / C 4 correct completion of information into table	4	

Time/minutes	**Change in colour of Iodine solution upon addition to –**	
	liquid from test-tube W	liquid from test-tube C
0	Blue-black	Blue-black
2	Dark brown	Blue-black
4	Orange-brown	Blue-black
6	Orange-brown	Dark brown
8	Orange-brown	Dark brown

(c) (i)	idea of equilibration	1	The students waited for 5 minutes at step 4 for equilibration – they wanted the starch solution in W to attain the temperature of the warm water and that in C to attain the temperature of the Ice water.
(ii)	idea of minimising contamination idea of allowing simultaneous measurement	max 1	The students used separate dropping pipettes for test-tubes W and C to **prevent mixing** of solutions from W and C (way to maintain accuracy!) Using separate pipettes was important to be able to carry out tests on W and C **simultaneously** instead of one after the other for a fair comparison.
(d)	(blue-black shows) starch present at, 0 min / start (dark brown shows) some starch present at 2 min (orange-brown shows) no starch present, after 2 min / from 4 min	3	

Q	Mark Scheme		NOTES
1 (e)	**yes** C stayed blue-black for longer / slower colour change or reverse argument OR **no** there is not a large enough range of temperatures	max 1	The liquid from test-tube W (warm water bath) turned orange-brown at 4 minutes and remained at that thereafter, suggesting that all the starch was completely broken down by 4 minutes. The liquid from test-tube C (ice water bath) turned dark-brown at 6 minutes and remained dark-brown at 8 minutes suggesting there was some starch still left to be broken down. The activity of Amylase in test-tube W was definitely greater than that in C. The students' conclusion may therefore be considered correct. The mark scheme allows 'NO' as a valid answer if tied to a suitable argument. The students used warm water and ice water only. They could have used water over a wider range of temperatures for a conclusive result.
(f) (i)	drop/dropping pipettes, are imprecise/volume of amylase may vary shaking can, cause spillage / inconsistent mixing	max 1	
(ii)	appropriate apparatus to measure precise volume; e.g. syringe / burette / graduated pipette / measuring cylinder **Guidance**: Ignore miscounting (of drops) appropriate apparatus to stir carefully / consistently; e.g. (magnetic) stirrer / glass rod / bung / test-tube shaker	max 1	Use of apparatus with calibrations/markings would have enabled the students to control the sample volumes and minimise errors arising thereof.

Q	Mark Scheme		NOTES
1 (g)	Reject improvement if it contradicts error Accept errors and improvements 2 and 3 if not already awarded in 1(f)		

Source of error	*Improvement*
experiment was done only once ;	repeat entire experiment (at least 3 times in total) to calculate an average ;
shaking, can cause spillage / inconsistent mixing ;	(magnetic) stirrer / glass rod bung / flask to swirl;
drops / dropping pipettes, are imprecise / volume of amylase may not be the same ;	use syringe / burette / graduated pipette / measuring cylinder ;
(long) intervals between testing / AW ; **A** reaction finishes between points	test, more often / every minute / 30 seconds;
colour changes are subjective ; **A** endpoint hard to judge	colour chart / standards / control with no starch / colorimeter ;
trying to do, **W** and **C** simultaneously ;	do **W** and **C** separately / second person to do second tube ;
(water) temperature changes ;	insulate beakers / use (thermostatically controlled) water-bath ;
AVP ; e.g. contents in pipette might contaminate spotting tests	AVP ; e.g. use clean pipettes each time

Q	Mark Scheme		NOTES
1 (h)	**1** test at 40°C **2** test at least one temperature below 40°C and one above **3** use of water-bath (to maintain different temperatures) / Alternative Wording **4&5** named controlled variables **6** measure time taken until iodine becomes orange brown / no longer changes colour **7** by repeated sampling at interval of less than 2 mins **8** repeat entire experiment / replicates **9** relevant stated safety procedure **Guidance** Units must be stated correctly once 4&5 – e.g. equilibration time; pH; volume / concentration, iodine / amylase / starch; Ignore amount / quantity Ignore regular	max 6	
(i)	Benedict's solution turns (brick) red **Guidance**: Accept orange / yellow / green with heat	1 1	The students could test samples of the starch-amylase mixture (once the starch had been completely/partially broken down) with Benedict's solution. Change in colour of benedict's solution from blue to brick red (or to orange/yellow/green) **upon heating in a boiling water bath** indicates the presence of a reducing sugar. 

Q	Mark Scheme		NOTES
2 (a) (i)	A axes labelled with units, in correct orientation S linear scale for plotted points to cover half or more in both dimensions P all plotted points accurate to ± half small square L smoothed line passing through all points L line with no extrapolation **Guidance** **A** x: distance / cm y: bubbles per min OR bubbles / min **Reject** m for min **S** origin must be stated at least once **P** R bar chart / histogram **L** R feathering / thick line	1 1 1 1 1	X–axis = independent variable: distance of lamp from plant / cm Y–axis = number of bubbles of oxygen produced per minute
(ii)	line drawn from 6 bubbles to trend line, and then to the distance axis correct reading from their graph **Guidance** ecf for wrong trend line in 2(a)(i) R if wrong units		

Q	Mark Scheme		NOTES
2 (a) (iii)	**1** at higher light (intensity) rate of oxygen production is higher; ora **2** at shorter distance from lamp rate of oxygen production is higher; ora **3** comparative data quote with units stated at least once; **4** idea that there is a non-linear relationship / not (directly) proportional; **Guidance** **Accept**: A faster photosynthesis for higher rate of oxygen produced.	max 2	As the light intensity decreases, the rate of Oxygen production also decreases as can be seen from **table 2.1** . However, the decrease in light intensity **is not directly proportional** to the corresponding decrease in rate of production of Oxygen. For instance, when the distance of the lamp from plant is changed from 40cm to 20cm, that is, halved, the number of Oxygen bubbles decreases from 29 to 16 which is nearly half, but not exactly half.
(iv)	prevents (lamp) heating up, plant / water	1	The focus of the experiment is to measure the effect of light intensity on the rate at which the leaves of a pond plant produced bubbles of oxygen gas. The water bath shielded the plant from heating effect of the lamp and helped in **maintaining a constant temperature** throughout the investigation.
(b) (i)	O ‑ clear outline S ‑ size larger than Fig. 2.2 D ‑ detail (3 or 4 layers shown) proportions must be: thin → thick → medium moving inwards **Guidance** **O** – R any cell detail drawn / feathering / shading / drawn with a compass **S** ‑ R if smaller than 8 cm diameter	3	

Q	Mark Scheme		NOTES
2 (b) (ii)	L – stele labelled and label line touches or enters the stele	1	
(iii)	69 ±0.5 (mm) (= 69 / 7.5) 9 (times / x) **Guidance** **Accept** 6.9 cm ecf correct calculation to nearest whole number from wrong measurement **Reject** if wrong units stated	2	Length of **AB** on Fig. 2.2 = 69 mm The actual diameter of the section is 7.5 mm. Magnification = $\frac{\text{length of AB}}{\text{actual diameter of the section}}$ Magnification = $\frac{69}{7.5}$ = 9.2 Magnification = 9 (to the nearest whole number) **Figure 2.2 has been magnified almost 9 times.**

END OF DOCUMENT