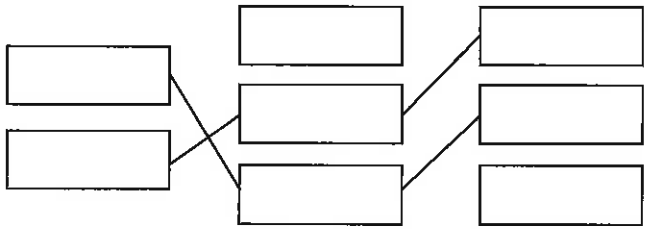
Question			Answer	Marks	Guidance
1	(a)		$6CO_2 + 6H_2O$ (1) $C_6H_{12}O_6 + 6O_2$ (1)	2	**allow any order** formulae must be correct including correct use of subscripts **allow** an unbalanced equation as long as all four compound formulae are correct = 1 mark
	(b)	(i)	C (1)	1	
		(ii)	***(confident because):*** the (mean) values are the same/similar/very close/closest (1) the results were repeated (ten times) (1) (repeats mean) results are repeatable/reliable/valid (1) ***(not confident because):*** size of bubbles vary (1) difficulty counting bubbles (1) size of pondweed might be different (in the two tubes) (1) the temperature might be different (in the two tubes) (1) need more data/tests (to be sure) (1)	2	**mark whole answer crediting any two points** must imply both values **ignore** accurate **ignore** ref to different species of pondweed (as given in the question) **allow** any other reasonable difference in variables **ignore** idea of human error **ignore** idea that data is wrong/inaccurate

Question			Answer	Marks	Guidance
		(iii)	***any TWO from:*** control/measure the (water) temperature in the test tubes; control pH; control length/mass/amount/size of pondweed / number of leaves; control carbon dioxide levels; control volume/amount of water; control distance from light source; use more light intensities / measure the light intensity ; leave experiment for a longer time; allow plant to equilibrate before measuring bubbles; collect the (oxygen) bubbles in a measuring cylinder / gas syringe / ref to measuring volume of oxygen (as more accurate than bubbles);	1	**two points required for one mark** **ignore** ref to repeats / using more species of pondweed (both given in question) **do not allow** extensions to the investigation, i.e. where a new variable is changed **do not allow** use different light intensities
	(c)		<table><tr><th>role in photosynthesis</th><th>cell structure</th></tr><tr><td>contains the genetic code for making the enzymes needed</td><td>nucleus</td></tr><tr><td>allows oxygen to pass out of the cell</td><td>(cell) membrane/(cell) wall</td></tr><tr><td>contains chlorophyll and enzymes</td><td>chloroplast(s)</td></tr></table>	1	**both answers required for one mark**

Question			Answer	Marks	Guidance
	(d)	(i)	(cell) membrane; respiration;	1	**both answers required for one mark**
		(ii)	***(link between respiration and energy):*** anaerobic respiration/less aerobic respiration so less energy/ATP released (1) no/less energy for active transport/active uptake (1)	2	**do not allow** 'no energy' **allow** 'produced'
			Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
3	a		2880 / 150 ; 19.2 / 19 / 19.2:1 / 19:1 / 96:5 ;	2	**Accept** 1440/75 or 960/50 or 288/15 or 96/5 or 480/25 **for first MP** Correct answer = 2 marks **Ignore** units
	b		Type A provides a lot of energy / type B provides little energy; To prevent / reduce production of lactic acid / type B produces lactic acid ;	2	 **Accept** prevent cramp / pain
	c	i	A no correlation or description ; B positive correlation or description ; C negative correlation or description ; D positive correlation or description ;	4	e.g. In A / 1st section / 0 – 30 mins, one goes up and one stays the same e.g. In B / 2nd section / 30 – 60 mins, both go up e.g. In C / 3rd section / 60 – 75 mins, one goes up , the other goes down e.g. In D /4th section /75 – end, both go down
		ii	Repeat the same training a number of times. ✓ Repeat her training but only run for 60 minutes. Run more slowly so that her heart rate does not rise too much. Repeat the same experiment on other runners.	1	One tick one mark Each extra tick negates one correct tick
			Total	[9]	

Question	Answer	Marks	Guidance
1 (a)		2	3 or 4 lines correct = 2 marks 2 lines correct = 1 mark 5 lines = 1 mark max. 6 or more lines = 0 marks
(b)	phytoplankton 1		**accept** phonetic spellings **accept** named phytoplankton or photosynthetic bacteria **accept** idea of the micro-organism with chlorophyll **accept** plankton (unqualified) **reject** yeast **ignore** ref. to green/unqualified algae
(c)	**any two from** enzyme/substrate has a certain **shape**/enzyme has an **active site** ; substrate/molecule **fits into** the shape/lock and key model ; other substrates **will not fit**	2	 **ignore** molecule/substrate has an active site **accept** correct ref. to complementary (shapes)
(d) (i)	66.67 (%) (2) 50 – 30 **OR** 20 within the working (1)	2	**accept** range 66 – 67 (2)
(ii)	**any two from** **increased** amount of light/higher light intensity ; **more**/increased (rate) **photosynthesis**/increased **reaction rate** ; light is a limiting factor	2	**accept** increased temperature/heat **accept** increased enzyme activity/increased reaction rate **accept** sunlight = light **ignore** unqualified ref. to energy/sun **ignore** making more food/glucose/sugar **ignore** references to values

Question	Answer		Marks	Guidance
1 (d)	(iii)	**description** amount produced = amount used/ it is the same (1) **explanation** respiration releases carbon dioxide which is used by photosynthesis (1)	2	**accept** compensation point **accept** amount/rate of respiration = photosynthesis (1)
(e)	(i)	the higher the temperature the greater the rate of reaction/positive	1	**reject** heat **ignore** references to values
	(ii)	**any two from** use more replicates/repeats ; plot more temperature values/obtain data across more temperatures/intermediate temperatures ; reproducibility/others do **same** experiment ; check/improve accuracy of equipment	2	 **ignore** 'do more experiments'/excluding outliers/use of control **accept** compare the experiment with others/ look at secondary data **ignore** reference to peer assessment
	(iii)	**any two from** increasing/getting higher/faster ; active site ; permanent/irreversible/fixed ; denatured/broken down/destroyed	2	3 or 4 correct responses (2) 2 correct responses (1) 1 or 0 correct responses (0) **accept** inactive/deformed **reject** killed
	(iv)	lock and key	1	**accept** induced fit
		Total	**17**	

Question			Expected Answer	Marks	Additional Guidance
1	(a)	(i)	*any two from* starch; cellulose; (named) protein / amino acids / enzymes; chlorophyll; DNA/ RNA /nucleic acids; fats / lipids / fatty acids / glycerol ;	2	**ignore** ref to functions
		(ii)	carbon dioxide / CO_2 ; Protection / shelter / safety / (suitable) habitat ;	2	
	(b)		**Level 3 (5-6 marks)** Explanation uses ideas from: photosynthesis, temperature and enzymes Quality of written communication does not impede communication of the science at this level **Level 2 (3-4 marks)** Explanation uses ideas from two of : photosynthesis, temperature and enzymes Quality of written communication partly impedes communication of the science at this level **Level 1 (1-2marks)** Makes ref. to either photosynthesis OR temperature OR enzymes Quality of written communication impedes communication of the science at this level **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit	6	**This question is targeted at grades up to C** **Indicative scientific points may include** **Photosynthesis** • (If enzymes do not function) the rate of photosynthesis drops /stops • If there is no photosynthesis less/no glucose will be made • Less / no respiration • idea of (temp) limiting factor for P/S **Temperatures** • temperature is **too,** hot/ high / low / cold, (algae die) **Ignore** ref to figures • Reaction slows (photosynthesis) • fewer collisions / ref to kinetic energy changes N.B. Credit 'reaction slows' only once(either temperature or photosynthesis)

Question			Expected Answer	Marks	Additional Guidance
					Enzyme • enzyme works best / fastest at optimum temperature • enzyme is damaged /denatured / changes shape(at **high** temperatures); **Ignore** Killed / dies • Ref. To active site • ref to lock and key / substrate no longer complementary A
		c	*any three from* sample or look at different areas of coral (where algae dead and alive) ; measure / change temperature; measure / change UV / light record amount of living / dead algae ; ref. to correlation between either factor and dead algae;	3	**Award marks for natural habitat OR experimental situation** **Accept** coral for algae throughout **Accept** appropriate sampling techniques **e.g.** more UV, less algae

Question			Answer	Marks	Guidance
3	(a)		4 (1)	1	
	(b)	(i)	negative correlation/rate of reaction drops as temperature increases **and** then the rate levels off/rate is zero at temperatures higher than 68/70 °C (1)	1	OWTTE **accept** correct references to the data to support the explanation **accept** rate slows down and then stops at 70 °C = 1 mark **accept** rate slows down and then no reaction after 70 °C = 1 mark
		(ii)	(increasing) temperature causes enzyme (molecule) to change shape/be denatured (1) substrate/molecule no longer fits (so well) into active site/no enzyme-substrate complex formed (1) so enzyme cannot catalyse/speed up the reaction/the rate decreases (1)	3	OWTTE **accept** correct references to the lock and key model **reject** enzyme dies/killed **ignore** enzyme does not work any more
	(c)		pH changes the shape of the active site (which affects the rate of reaction) (1)	1	**accept** another correct factor eg concentration of substrate/enzyme molecules, if explanation is appropriate **accept** denatured
			Total	**6**	

Question	Answer	Marks	Guidance
3	**Level 3 (5–6 marks)** A good description of **all three** pieces of equipment. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** A good description of **two** pieces of equipment **OR** a basic description of **all three** pieces of equipment. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** A good description of **one** piece of equipment **OR** a basic description of **two** pieces of equipment. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** **Indicative scientific points may include:** **Quadrats** • a quadrat is a square frame/defined area • put quadrat on ground • plant counts in quadrat • random/grid distribution of quadrats • use of a transect line • estimate % plant cover • take several readings in/across the two areas **Light meter** • measures light levels/intensities • hold equipment at ground level • take a reading • take several readings in/across the two areas **Identification key** • compare plants seen to description/image in key • use to find names/species of plants • in each quadrat • compare plant types/species between the two areas • binary/dichotomous choices within key **Additional scientific point** • use a statistical test to support differences • data processing/graphs/mean values **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	6	

Question			Answer	Marks	Guidance
2	(a)		correctly plots points to within ± 1 scale division AND draws line of best fit(1)	1	must look like a straight line by eye
	(b)		from graph [to within ± 1 scale division] (1) idea of no [%] change in length /no osmosis takes place at that concentration (1)	2	 **accept** it is where the line crosses the axis
	(c)		**Either** **one improvement plus reason** [Reproducibility / repeatability] **OR** **any two improvements** repeat the experiment use more cylinders make sure all the cylinders are from the same potato use more concentrations; take the average	2	**ignore** 'confidence' [stem] and 'fair test' **ignore** 'use more accurate equipment'/ use higher sugar concentration / use cylinders of different length / leave for longer / measure change in mass **accept** reference to improved reliability / accuracy **accept** look for outliers **accept** use longer cylinders "repeat – to see if the pattern is the same" = 2
			Total	**5**	

Question			Answer	Marks	Guidance
2	(a)		carbon dioxide + ethanol (1)	1	**both answers required for one mark** **allow any order** **allow** correct formula for carbon dioxide (CO_2)
	(b)		(animal cells) produce lactic acid (1)	1	**do not allow** lactic acid **if** given with carbon dioxide/oxygen **ignore** references to lack of oxygen / use of glucose as the substrate / ref to energy/ATP released
	(c)	(i)	1500(%) (1)	1	**if no response in the table, check whole page for the answer**
		(ii)	***(link between oxygen and respiration):*** more oxygen means more aerobic respiration in B / less oxygen means anaerobic respiration/less aerobic respiration in A (1) ***(link between energy and cell division):*** more energy in B means more cell division/growth / less energy in A means less cell division/growth (1)	2	'B has oxygen and is aerobic respiration' = 0 marks 'B has oxygen and is aerobic respiration. A does not have oxygen and is anaerobic respiration' = 1 mark **do not allow** 'reproduction' (as given in the question)

Question			Answer	Marks	Guidance
		(iii)	**(Level 3)** Answer describes the effect of adriamycin on the cell cycle and includes a detailed explanation of this effect. Explanation is logically sequenced and includes most key points. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **(Level 2)** Answer describes the effect of adriamycin on the cell cycle and includes some explanation of this effect. Explanation may not be logically sequenced or may be missing some key points. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **(Level 1)** Answer may describe the effect of adriamycin on the cell cycle and includes some attempt at an explanation of this effect. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **(Level 0)** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **do not allow** idea that adriamycin stops the chromosomes copying (this is given in the stem) **Indicative scientific points include:** **description:** • rate of growth/reproduction/number of new yeast cells produced will stop/be reduced/stay the same • more cells will die than be produced • this will happen quickly/immediately **explanation:** • (copying of chromosomes) is part of the cell cycle • it takes place during the phase of cell growth • chromosome replication / DNA copying • two strands of DNA / chromosomes separate • nucleus divides • new (daughter) cells are formed • mitosis • adriamycin prevents this happening • cell division/mitosis can not take place **ignore** ref to individual cell growth **ignore** ref to meiosis
	(d)		oxygen; methane; fuel;	2	3 correct responses = 2 marks 2 correct responses = 1 mark 1 or 0 correct responses = 0 marks
			Total	**13**	