GCE

Applied Science

Mark Scheme for June 2010

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Planning Exercise

Investigate the effects of incubation temperature on the yield of juice after enzyme treatment from one variety of English apple.

Marking of the plan:
1   Read the material presented.

2   Then *award 1 mark* if *scientific terminology* has been used appropriately. Record using the letter Y.

3   Then re-read, this time point marking up to 24, by placing letters A to X in the margin where you see evidence of the marking criteria.

4   The same piece of evidence can be used to award one criterion only.

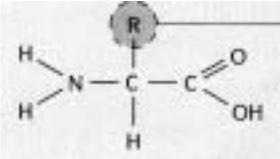| Marking Point	Marking Criteria	Mark	Additional notes
A	easily recognised safety procedures highlighted; At least 3 from: glassware; enzyme allergy; sharps (knives); electrical (water baths/blenders); burns (boiling water)	1	Evidence of something that is going to make doing the investigation safer – an active document, a working document related to the plan: ref to allergic reactions & enzymes
B	prediction made; R = ref to 'body temperature' R = ref to tinned apples	1	A statement related to effect of temperature on juice yield.
C	with justification; Accept ref to enzyme activity & temp if linked to research or insert; R ref to 55°C as optimum.	1	Statement related to enzyme activity: inactivity/denaturation of enzyme; possible link to molecular structure of protein; molecular movement; lock & key model; kinetic energy;
D	description of preliminary work;	1	e.g. how to prepare tissue (do not credit twice) / mass of tissue to be used / dilution of enzyme(s)/ volume of enzyme/ type of enzyme/ source of enzyme/ range of temperatures to use / incubation time/ source of tissue /age of tissue;
E	clear and in detail;	1	Explain how to do it.
F	reason (for doing it) explained;	1	Explain why it's necessary for completion of the whole investigation.
G	clear and in detail;	1	Extra information.
H	at least two secondary sources of information identified;		State at least 2 references (allow OCR ... rt as one source). ... website address needed. ... description of named text
I	relevance explained;		... explanation as to how ...ences helped in the planning.
J	basic practical skills and accuracy;		...ble method / list of instructions. ... 'Is it a feasible approach?'
K	sound practical skills and accuracy;	1	Could someone follow the instructions unaided? Are quantities shown? Is it repeatable to appropriate degree of accuracy?

Source & preparation of tissue pulp; treatment with pectinase; control of temperature; incubation; time; Filtration; clarification; Measurement of juice volume;

Marking Point	Marking Criteria	Mark	Additional notes
L	range of appropriate equipment listed; R = tinned apples;	1	List of names of main items of equipment and materials needed for the investigation. Generic terms: beakers, flasks etc are OK here.
M	full range of appropriate equipment listed; List **must** include apples	1	Qualifications noted. Indication of number of each, specific sizes, e.g. 250 cm^3 beaker, 1dm^3 flask. If any major item missing do not award (i.e. apples; pectinase; method of temperature control)
N	appropriate number of measurements stated;	1	Mentions **at least 2** replicates / repeats
O	need for range of measurements stated;	1	Statement: e.g. 'To enable comparison to be made (to identify optimum temperature which gives maximum yield of juice)
P	appropriate range stated;	1	Related to prediction made – accept at least 4 different temperatures (5 ideal)
Q	relevant variables are identified (stated); Need to identify controlled variables;	1	At least 2 from: Control variables age of tissue / mass of tissue / source of fruit / variety of fruit / source of extract / volume of extract / dilution of extract / cold stored or not / time in cold storage/ incubation time/ type of enzyme/ concentration of enzyme/; Independent/dependent: incubation temperature/ volume of juice;
R	how variables to be controlled explained;	1	How for at least 2 of the variables.
S	one suitable method to display data;	1	One display of results e.g. Table. (Clear headings & units in headers)
T	additional method to display data;	1	Any **different** display e.g. graph (with appropriate units).
U	simple data handling;	1	mean / colour comparison / use of graph data
V	possible conclusions; Accept use of graph & reading off (i.e. 'optimum temperature of max yield')		Statements of expectations or observations to confirm or reject prediction made in **B**. What would your results need to show to confirm or reject your prediction?'
W	recognises sources of error	1	At least two examples: equipment / materials / specific human error (limit to 1 human error)
X	suggests methods for improving accuracy and or validity;		Accuracy: relate to '**W**' or use of alternative technique(s). D / OR R = ref to body temp for improvement dity: state aspect of collected data to compared with secondary sources.
Marks	Maximum for plan = 25		ific terminology)

(callout V) temperature fluctuations of water baths; residue of pulp in glassware; equipment % error

(callout X) A = Repeat using narrower temp range around optimum;
 A = Repeat using increased enzyme conc;

Question			Expected Answers	Marks	Additional Guidance

1	a		**advantages:**
			magnifies objects (over 500 000 times) /
			    higher magnification / can see cell ultra-structure ✓
			has a higher, resolving power/resolution /
			    possible to investigate greater depth of field ✓
				2	**accept** 'shows up more organelles than a light microscope'

			disadvantages - any **two** from:
			cost ✓
			special accommodation ✓
			needs skilled operative / difficult to operate ✓
			preparation of specimens lengthy/complex /tissue sample thin/
			    ref to dehydration process/ complex staining ✓
			material may be distorted / produces artefacts or distorts image
			    ✓
			high vacuum required ✓
			living material cannot be viewed / ORA ✓
				2	**ignore** ref to B & W images or does not show true colour image;

	b	i	65mm (accept range 64 to 66) ✓	1	**allow** correct measurement of maximum diameter in mm
		ii	correct conversion to µm ✓ division by magnification value ✓	2	**accept** answer range 9.4 – 9.7 (µm) award two marks for correct answer **allow** ecf from **b(i)**; Limit to 1 mark if calculation method correct but answer incorrect; 64 = 9.4; 65 = 9.6; 67 = 9.7 (µm)
	c	i	**X** = Golgi (body/apparatus) ✓ **Y** = mitochondrion / matrix ✓	2	**ignore** crista
		ii	**X** = makes secretory vesicles / lysosome formation / produces, glycoproteins/mucin, / transports lipids / stores lipids / modifies glycolipids ✓ **Y** = aerobic respiration / production of ATP/ Krebs Cycle / TCA cycle / oxidative phosphorylation / link reaction ✓	2	**accept** 'receives proteins and modifies them'. for **Y accept** reference to electron transport chain
			Total	11	

Question			Expected Answers	Marks	Additional Guidance
2	**a**		**starch:** iodine/iodine KI, solution ✓ **protein:** Biuret (reagent) / sodium hydroxide (solution) **and** dilute copper sulfate (solution) ✓ purple/lilac ✓ **lipid/fat:** ethanol **and** water ✓ **non reducing sugar:** dilute HCl **and** sodium bicarbonate **and** Benedict's (reagent) ✓ Green / yellow / Orange / red (precipitate) ✓ 	a	1 mark for each correct box, test reagent (s) must be complete for the mark. Accept ref to 'iodine in potassium iodine' owtte **reject** ethanol test/ emulsion test / ethanol; **accept** sodium hydrogen carbonate instead of bicarbonate; **accept** ref to any alkali **accept** any appropriate colour change i.e brown / brick red)
	b	**i**	NH$_2$ group ✓ –COOH group ✓	2	**accept** diagram without bonds shown within NH$_2$ and COOH groups
		ii	peptide (bond) ✓	1	
		iii	hydrolysis ✓	1	

Question			Expected Answers	Marks	Additional Guidance
2	**b**	**iv**	**primary structure:** <u>sequence</u> / <u>order</u>, of amino acids (in a polypeptide) ✓ **secondary structure:** Coiling/folding, of the, polypeptide/chain of amino acids/peptide chain/primary structure, / (α) <u>helix</u> / (β) pleated <u>sheet</u> / hydrogen bonds / between amino acids in (same) chain / (between) –NH and –CO / AVP e.g. random coiling ✓	2	**reject** ref to protein chains/structures joining together
			Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
3	**a**	**i**	correct plots ✓ ✓	2	5 correct plots = 2 marks 3 - 4 correct plots = 1 mark (Accept accurate dots; tolerance +/- ½ square)
		ii	appropriate line of best fit ✓	1	smooth curve, no hairy/tram lines (tolerance +/- ½ square) accept graph lines which follow IoB guidelines: *Points may be joined with a curve of best fit if values are likely to fall on such a curve.* *Alternatively points may be joined with straight lines if the position of intermediate points can not be predicted reliably.*
	b	**i**	correct data quote from graph = 5.6 (cm^3) ✓	1	**accept** 5.7 (cm^3)
		ii	$5.6 \div 0.5$ ✓ 11.2 (cm^3 min^{-1}) ✓ If 5.7 used from b(i): $5.7 \div 0.5$; 11.4 (cm^3 min^{-1})	2	**allow** ecf from b(i); 1 mark for conversion of time to minutes in rate formula 1 mark for correct answer *Alternative:* 1 mark for volume per sec (volume ÷ 30) = 0.187 (cm^3 sec^{-1}) 1 mark for conversion to rate per min i.e. 0.187 x 60 = 11.2 (cm^3 min^{-1}) **accept** tangents drawn on graph for calculation of rate

Question			Expected Answers	Marks	Additional Guidance
3	**d**		**[Level 1]** Candidate shows a high level of understanding & includes a detailed <u>description & explanation</u> of two effects of temperature on enzyme activity, including at least four valid points, expressed clearly and logically. *(4 - 5 marks)* **[Level 2]** Candidate shows some understanding & includes a <u>description & limited explanation</u> of <u>two</u> effects of temperature on enzyme activity, expressed clearly and logically. *(2 - 3 marks)* **[Level 3]** Candidate shows some understanding & includes a description & limited explanation written in a sentence. *(1 mark)*	5	*valid points may include:* ref to enzyme binding to active site/lock & key/active site specificity✓ reference to 'optimum temperature' ✓ slow activity/reaction at low temperatures ✓ suitable ref movement/energy, of, molecules/enzyme/substrate, related to low temperature ✓ few collisions (between enzyme & substrate) / enzyme-substrate complex formed at low temperature✓ more frequent collisions (between enzyme & substrate) / enzyme-substrate complex formed as temp increases ✓ (in warm temp) collisions (occur with more energy) to break bonds✓ at high temperatures enzymes are denatured ✓ ref to enzyme/substrate complex can not form ✓ molecule vibrates breaking bonds (within enzyme molecule) / tertiary structure changed ✓ AVP e.g. suitable sketched graph ✓
			Total	**11**	

Question			Expected Answers	Marks	Additional Guidance
4	**a**	**i**	**P** = (eye piece) graticule ✓ **Q** = (stage) micrometer ✓	2	
		ii	*any three from:* line up scales of P with Q ✓ use Q to calibrate P before use / ref to calibration ✓ Scale Q is in mm/ cm / detail on scale (at specific magnification) ✓ convert divisions on P to actual measurements ✓ stage micrometers are usually calibrated for set magnification ✓	3	**accept** reference to calculations from Fig 4.1 *any three from:* 100 epg units = 25 x 0.1 mm / 2.5 mm ✓ 1 epg unit = 0.025 mm or 25 μm ✓ diameter of cell = number of epg units ✓ actual diameter of cell = diameter in epg units x 2.5μm ✓ **ignore** ref to 'measure cell' since this uses epg.
	b	**i**	**diagnosis:** anaemia ✓ **explanation:** fewer red blood cells observed / very few / paler red blood cells / less haemoglobin / irregular shaped red blood cells ✓	2	award diagnosis & explanation independently; explanation must link to photographs. **reject** 'few'
		ii	**diagnosis:** (lymphocytic) leukaemia ✓ **explanation:** large(r) numbers of **lymphocytes**/**white** blood cells / irregular shaped **white** blood cells / enlarged nuclei of, **lymphocytes**/**white** blood cells ✓	2	

Question			Expected Answers	Marks	Additional Guidance
4	**c**		*any **two** from:* reliability of test / possibility of error arising during testing ✓ human rights issues including, employment/insurance/mortgage facilities ✓ whether or not to pursue abortion ✓ how serious a defect has to be before abortion might be considered ✓ cost effectiveness of screening ✓ whether or not to risk starting a family ✓ AVP ✓ ✓	2	AVP e.g. religious issues / cultural issues AVP 'right to life of unborn foetus'
			Total	**11**	