Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a) (i)	water;		1
(ii)	• allows urea to pass; • prevents other larger molecules from passing;		2
(iii)	• breaks down urea; • to produce ammonium ions; • to react with/stimulate sensor;		3
(b)	• temperature affects enzyme; • higher temperature, higher rate of reaction; • more ammonium ions produced; • higher reading;	ORA for lower temperature	4
(c)	any two from • can be reused; • products not contaminated; • enzymes more stable;		2
			Total 12 marks

Q2.

Question number	Answer	Notes	Marks
(a) (i)	• reference to platelets; • fibrinogen converted to fibrin; • (fibrin) mesh/crosslinks/fibres formed;		3
(ii)	• reduced blood flow to heart/cardiac muscle / tissue/cells; • less oxygen/glucose delivered; • less (aerobic) respiration/energy released (by cardiac tissue);		3
(b)(i)	size of blood clot/volume of water /aspirin solution used/temperature/shape of blood clot/width of straw;	Allow valid alternatives	1
(ii)	use water without aspirin dissolved;		1
(iii)	• the more tablets dissolved the more solution collected; • the more tablets dissolved the quicker the solution is collected; • aspirin dissolves/acts on blood clot; • size of blood clot reduced more quickly with more tablets/blood clot dissolves/breaks down faster with more tablets;		Max 3
(c)	Any four from: • aspirin binds to enzyme/aspirin competes (with substrate) for active site; • active site of enzyme changed/blocked; • less/no substrate binds (to enzyme); • reaction involving release of chemicals reduced/stopped; • platelets do not stick together;		Max 4
		Total question = 15 marks	

Q3.

Question number	Answer	Notes	Marks
(a) (i)	• allows protein to stay longer in stomach/gut (1) • gives time for full digestion (1)		2
(ii)	• diet largely/entirely milk when young (1) • changes to solids when older (1)		2
(iii)	• biuret test (1) • add reagent to solid (1) • blue to lilac/pale purple (1)		3
(b) (i)	• temperature (1) • volume of milk (1) • volume/concentration of chymosin (1)		3
(ii)	$\frac{238 + 232 + 241 + 229}{4}$ (1) = 235 (1)		2
(iii)	not included when calculating mean (1)		1
(iv)	bubbles of different sizes/volume of CO_2 variable (1)		1
		Total for this question = 14 marks	

Q4.

Question number	Answer	Mark
(a)(i)	An explanation that makes reference to the following linked points: • similar/same shape to the substrate (1) • therefore complementary in shape to the enzyme (1) • binds to the active site (1) • enzyme is lock and substrate is the key/according to lock and key hypothesis (1)	3

Question number	Answer	Mark
(a)(ii)	A description that makes reference to any two of the following points: • lowers activity (of enzyme) (1) • takes longer to reach maximum rate of reaction (1) • no effect at maximum substrate concentration (1)	2

Question number	Answer	Mark
(b)	A description that makes reference to any three of the following points: • this is non-competitive inhibition (1) • binds at a place on the enzyme other than the active site (1) • changes shape of enzyme/active site (1) • substrate cannot bind to enzyme/active site (1) • irreversible (1)	3

Question number	Answer	Additional guidance	Mark
(c)(i)	Process: (3 900 000 000 ÷ 100) × 21 (1) = £820 000 000 (1)	award 2 marks for correct final answer allow £819 000 000 for both marks	2

Question number	Answer	Mark
(c)(ii)	B	1

Question number	Answer	Mark
(d)	A description that makes reference to the following points: • immobilised enzyme bound to cardboard strip (1) • urine passed over strip including the enzyme (1) • glucose binds to immobilised enzyme if present converting it to hydrogen peroxide/gluconic acid (1) • causes a colour change/visible colour to appear (1)	4

Q5.

Question number	Answer	Notes	Marks
(a) (i)	C; (lipase)		1
(ii)	A; (carbon, hydrogen, oxygen)		1
(iii)	C; (liver)		1
(b)	• show effect of enzyme (1) • show that bile salts on their own don't break down fat (1)	Ignore control	2
(c)	• create alkaline/optimum pH (1) • for enzyme to work quickly (1)	Allow increases/adjusts pH	2
(d)	• increase rate of digestion (1) • with no bile salts change occurred after 15 minutes/digested more slowly in tube A (1) • occurred after 5 minutes with bile salts present/digested more quickly in tube B (1)		3

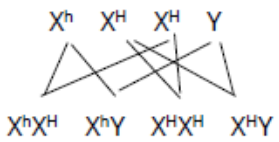
Q6.

Question number	Answer	Notes	Marks
(a) (i)	A (amino acids); B and D are components of lipids C is a carbohydrate		1
(ii)	• add Biuret solution to test solution; • mauve/lilac, protein present; • remains blue, protein absent;		3
(b) (i)	• suitable axes labels; • suitable scale; • correct plots; • suitable curves; • curves labelled;	max 3 for bar chart accept key	5
(ii)	• denaturation; • loss of shape of active site/enzyme; • substrate no longer fits/decreases rate of activity;		3
(iii)	any three from • B is much more active/works faster; • over whole temperature range; • higher optimum temperature for B/works fastest at 80°C; • active over a greater range of temperatures;		3
			Total 15 marks

Q7.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a) (i)</td><td>
<table>
<tr><th>Conditions</th><th>Result/no/scale of bubbles</th></tr>
<tr><td>Room temperature</td><td>5</td></tr>
<tr><td>Alkali added</td><td>3</td></tr>
<tr><td>Acid added</td><td>2</td></tr>
<tr><td>3°C</td><td>1</td></tr>
<tr><td>70°C</td><td>0</td></tr>
<tr><td>no hydrogen peroxide added</td><td>0</td></tr>
</table>
• two column table;
• headings;
• correct order of results (high to low/ORA);
</td><td></td><td>3 marks</td></tr>
<tr><td>(ii)</td><td>• no repeats/only done once;</td><td></td><td>1 mark</td></tr>
<tr><td>(iii)</td><td>• results based on judgement/subjective/qualitative;</td><td></td><td>1 mark</td></tr>
<tr><td>(iv)</td><td>• repeats;
• measure volume of oxygen;
• using gas syringe/other suitable apparatus;</td><td></td><td>3 marks</td></tr>
<tr><td>(b) (i)</td><td>untreated/room temperature;</td><td></td><td>1 mark</td></tr>
<tr><td>(ii)</td><td>control;</td><td></td><td>1 mark</td></tr>
<tr><td>(iii)</td><td>• reduced/low enzyme activity;
• not at optimum pH;
• active site changed;
• fewer enzyme substrate complexes/substrate won't fit;</td><td></td><td>4 marks</td></tr>
<tr><td colspan="4">Total 14 marks</td></tr>
</table>

Q8.

Question number	Answer	Notes	Marks
(a) (i)	A (the inheritance of two different alleles, both of which are expressed) B is incorrect as one allele is not expressed in codominant inheritance C is incorrect as the ABO inheritance does not involve the inheritance of multiple alleles D is incorrect as ABO inheritances does not involve the inheritance of multiple alleles		1
(ii)	I^AI^A and I^Ai^o		1
(b) (i)	• blood group O contains no antigens; • antigens removed/digested (by enzyme); • carbohydrase digest carbohydrates; • protease digest proteins;		Max 3
(ii)	reduces need to find donor/cheaper/blood readily available/less chance of transfusing incorrect blood group/less risk of disease/infection;		1
(c) (i)	parent genotypes X^hX^H and X^HY;	One mark for parent genotypes and one mark for gametes **and** linkage	1
	gametes and linkage X^h X^H X^H Y		1
	 		
(ii)	1 in 4/25%/quarter/1/4 /1:3/0.25;		1
		Total question = 9 mark	

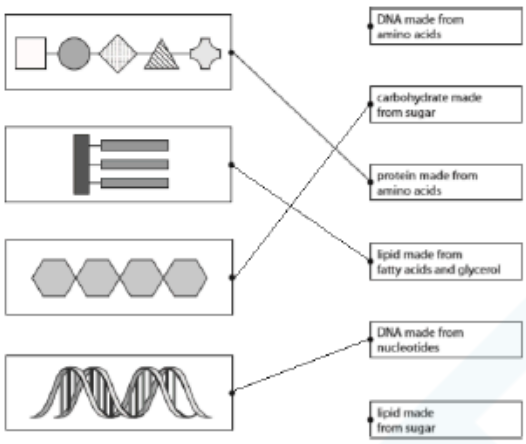
Q9.

Question number	Answer	Notes	Marks
(a) (i)	sucrase/invertase (1)		1
(ii)	• enzyme is a protein (1) • biuret test (1) • purple if protein present/remains blue if absent (1)		3
(iii)	• reusable (1) • stable (1)		2
(b) (i)	• allows glucose molecules to pass (1) • prevents larger/other molecules/ blood cells from passing (1)		2
(ii)	• breaks down/converts glucose (1) • into hydrogen peroxide (1) • which activates electrode (1) • more glucose results in more hydrogen peroxide (1)		4

Q10.

Question number	Answer	Notes	Marks
(a)	• bell-shaped line (1) • peak at 37°C ± 3°C (1)		2
(b)	• increase in temperature (1) • molecules have more (kinetic) energy (1) • more collisions (1) • more enzyme-substrate complexes formed (1) • greater rate of activity (1)		5
(c)	• hot (1) • because optimum temperature is between 60-75°C (1)		2
		Total for this question = 9 marks	

Q11.

Question number	Answer	Notes	Marks
(a) ( )		Do not allow more than one line from each structure	3
(b)	**D** stomach;		1

(c)	(i)	3/three		1
	(ii)	not washing equipment/transfer of food containing protein into distilled water;	Allow any valid alternative	1
	(d)			

Hazard	Reducing risk	
Broken glass - cuts	Clear up breakages using a dustpan and brush/keep equipment away from edge of tables;	Ignore wear gloves 1
Biuret reagent - irritant	Wear goggles/wash hands after use/don't use if skin is sensitive;	Ignore wear gloves 1

Total question = 8 marks

Q12.

Question number	Answer	Notes	Marks
(a) (i)	**C** green vegetables and red meat		1
(ii)	• (iron) needed for production of haemoglobin(1) • (haemoglobin/red blood cell) binds to/transports oxygen(1) • oxygen needed for (aerobic) respiration/energy(1) • for growth of fetus(1)		4
(b) (i)	Any four from: • take temperature of water (at the start) (1) • reference to measuring mass of food(1) • place food on holder(1) • burn food(1) • reference to time (for burning food)(1) • take temperature of water after burning/once food is completely burnt/measure change in temperature(1)	Allow amount for mass Allow food is heated/set alight	4
(ii)	Any three from: • add a lid(1) • reference to stirring/even heat distribution(1) • insulate the copper can/move food closer (to the can/water) (1) • reference to preventing heat loss(1)	Allow cover the beaker	3
	Total for question = 12 marks		

Q13.

Question number	Answer	Notes	Marks
(a)	4 of • add powder to water (in a test tube); • add Benedict's reagent/solution; • heat tube in a water bath; • observe any colour change/description of colour change; • wear goggles;		4 max
(b) (i)	powder Y;		1
(ii)	• powder W; • powder Z;		2
(iii)	powder X;		1
(iv)	protein;		1
			Total 9

Q14.

Question number	Answer	Mark
(a)	A graph showing: • vertical axis scale half grid and linear (1) • lines drawn connecting points (1) • horizontal axis labelled hours and vertical axis labelled grams (1) • points plotted correctly (1) • key for amylase Q/amylase P (1)	5

Question number	Answer	Mark
(b)(i)	An explanation that makes reference to the following points: • starch digested/broken down to glucose (1) • therefore causes water to enter tubing (1) • by osmosis (1)	3

Question number	Answer	Mark
(b)(ii)	An explanation that makes reference to the following points: • substrate/starch concentration reduced (1) • less for enzymes to digest (1)	2

Question number	Answer	Mark
(b)(iii)	An explanation that makes reference to the following points: *concentration* amylase will change the rate of reaction (1) *pH* enzyme activity changes with pH (1)	2

Question number	Answer	Mark
(c)	To ensure that the mass is not affected by water	1

Question number	Answer	Mark
(d)	Salivary glands (1) Pancreas (1)	2

Question number	Answer	Mark
(e)	A description that makes reference to three of the following points: • Benedict's test (1) • heat sample (1) • brick red/orange colour shows presence of glucose (1)	3

Q15.

Question number	Answer	Notes	Marks
(a) (i)	better transfer of heat to water (1)		1
(ii)	any two from • safety goggles/glasses (1) • water may spit (1) • use test tube holder (1) • to avoid burning hands (1)	reason linked to precaution	2
(b) (i)	• 28 x 12 x 4.2 (1) • 1411/1411.2J (1) • 1400J (1)	error carried forward full marks for correct answer	3
(ii)	• some energy lost to air/absorbed by tube/needle (1) • some converted to light (1) • food not fully burnt;		3
(c)	• use same mass of food (1) • same volume of water (1) • use same thin tube (1) • burn food same distance from tube (1)		4

Q16.

Question number	Answer	Notes	Marks
(a) (i)	• safety glasses/goggles; • care using sharp needle; • care to avoid burns; •		3
(ii)	• mass of food; • volume of water; • distance of burning food from tube;	reject amount	3
(iii)	any five from • not all food burns to release energy; • not all heat transferred to water; • some lost to atmosphere; • some heat lost to needle/glass tube; • uneven distribution of temperature in water; • because lack of stirring;		5
(b)	any four from • use of oxygen; • allows complete combustion; • enclosed/lid so no heat escapes; • heat transfer coil so all heat is used to increase temp of water/transferred to water; • stirrer to distribute heat;		4
			Total 15 marks