1. (a) (i) Carbon + hydrogen and oxygen in 2: 1 ratio/same proportions as in water; 1

(ii) Needs to be hydrolysed/glycosidic bond broken;
Product is a reducing sugar/glucose/fructose/monosaccharide;
Frees aldehyde/carbonyl/ketone group; max 2

(b) (i) Many different sorts of proteins;
Different primary structures/sequences of amino acids;
Tertiary structure;
Shape; allowing formation of receptor/binding site/site into which substance/substrate fits; max 3

(ii) Glucose and maltose soluble/starch insoluble; 1

(iii) Have similar molecular shape/structure / similarly positioned chemical groups;
so bind to/fit receptors; 2

(c) (i) Doesn't contaminate product/stays in reactor at finish/re-use/allows continuous reaction; 1

(ii) At low temperatures/9°C;
Relatively little kinetic energy/molecules only moving slowly;
Fewer collisions with enzyme;
Slower rate of reaction/takes longer for lactose to be reduced/some substrate goes through unchanged;

or

Enzyme concentration limiting;
Substrate in excess;
Saturation of active sites/all occupied;
Some substrate goes through unchanged; max 3

(d) (i) Fewer substrate/lactose molecules/lactose concentration falls;
Therefore less chance of collision with enzyme/forming enzyme substrate complex; 2

(ii) Economic reason such as

low levels of lactose not harmful/would take too much time/
high cost involved in removing all lactose; 1

[16]

2. (a) (i) Energy put in to <u>get</u> reaction <u>started</u> (Look for idea of getting started); 1

(ii) Curve showing energy levels at start and finish the same;
and lowered activation energy; 2

(b) Benedict's / Fehling's reagent and heat;
orange / red / brown / yellow / green; 2

(c) (i) Acid hydrolyses starch / breaks glycosidic bond; 1

(ii) Not specific / forms by–products / alters pH / corrosive; 1

(d) (i) Molecules would have less (kinetic) energy;
move slower;
fewer collisions / fewer E–S complexes form; max 2

(ii) Change in pH alters charge / shape;
distorts active site / tertiary structure of enzyme / denatures enzyme;
substrate will no longer fit active site; 3

[12]

3. (a) (i) Less substrate (molecules) present;
Due to them being used up in reaction;

OR

Product inhibits reaction;
Allosteric / competitive / non-competitive inhibition; 2

(ii) Double;
Increase of 10°C doubles rate of reaction;

OR

Increase;
Increased KE/ increased energy of molecules / increased movement; 2

(b) To show that enzyme was responsible for conversion, (no other factor); 1

[5]

4. (a) (i) Transfers phosphate; 1

(ii) Enzyme - active site;
Substrate – Complementary shape/structure
Shape/structure allows fitting/bending/
formation of E-S complex; 2

(b) Water/solute potential in cells of lens becomes more negative/decreases;
water enters by osmosis/diffusion; 2

(c) (i) Both involve loss of water molecule/condensation; 1

(ii) $C_{12}H_{22}O_{11}$; 1

(d) Diagram showing phospholipid bilayer, molecules correctly orientated,
2 tails labelled;
protein passing through the membrane;
carbohydrate attached to one side of protein; 3

[10]

5. (a) (i) Divide amount of product produced by time taken /
calculate gradient / slope of graph;
(***R*** *Numerical answer without supporting calculation*) 1

(ii) Higher temperatures means molecules have more (kinetic) energy;
(*Look for idea of molecules.*)
Move faster;
Greater chance of collision (between enzyme and substrate);
More chance of enzyme-substrate complex being formed; max. 3

(b) At 65°C enzyme has been denatured / description of denaturing; 1

(c) To maintain a constant pH; 1

[6]

6. (a) (i) More (kinetic) energy;
(Molecules) moving faster;
R references to vibrating **I** activation energy
Greater chance of collision
More E-S complexes formed; max 3

(ii) Bonds/specified bonds break; **R** peptide bond
Tertiary structure disrupted / denatured / active site destroyed;
Substrate no longer fits / binds with active site / ES complex
not formed: 3

(b) Lysosomes contain enzymes / lysozyme;
Break down proteins;
When they burst; max 2

[8]

7. (a) (i) The receptor / glucagon will have a particular shape / tertiary structure;
The other will fit / bind because of its shape; 2

(ii) Cells in other parts of the body do not have these receptors /
Liver cells have these receptors; 1

(b) Side chains / R-groups are different; 1

(c) Tertiary structure changes / enzyme denatured / bonds broken;
Will affect active site (of enzyme);
Starch cannot bind / fit / form enzyme-substrate complex; 3

(d) Keeps pH constant;
So proteins / enzymes in mitochondria not denatured / affected; 2

(e) 1 Some proteins pass right through membrane;
2 Some proteins associated with one layer;
3 Involved in facilitated diffusion;
4 Involved in active transport;
5 Proteins act as carriers;
6 Carrier changes shape / position;
7 Proteins form channels / pores;
8 Protein allows passage of water soluble molecules / charged particles / correct named example; 6 max

[15]

8. (a) A molecule which stimulates an immune response / antibody production / surface protein / glycoprotein / non-self protein; 1

(b) (i) Plasma cells; 1

(ii) Memory (B) cells; 1

(c) Carried (an immunological) memory of the specific antigen;
Produces large amounts of plasma cells quickly if the same antigen is encountered a second time;
Rapid production of antibodies;
Not just 'bigger immune response' 2 max

(d) 3 max

Measles	Influenza
One antigen/ unchanging	Several antigens/ changing
One type of memory cell/ antibody needed;	Several types of memory cell/ antibodies needed;

[8]

9. (a) (i) (Polypeptide is) coiled / folded; 1

(ii) Way in which whole molecule is folded / globular shape / folding of secondary structure / further folding /
Do not accept 3D shape if not further explained.
Structure held by ionic / disulphide bonds; *reject hydrogen bonds / peptide bonds only*. 1

(iii) Causes bonds which hold the tertiary structure / named bond;
To break;
Shape no longer maintained / protein denatured; 2 max

(b) (i) 5; 1

(ii) Substrates / active sites with shapes;
Active site / substrate with complementary (shape);
Fitting / binding / forming E-S complex; 3

[8]

10. (a) (i) Activation energy / amount of energy required for reaction; 1

(ii) Curve starting and finishing at correct energy levels;
Activation energy lower (i.e. less than x); 2

(iii) Energy in products less (than in substrate / hydrogen peroxide);
Energy given off / lost as heat / exergonic / exothermic; 2

(b) (Molecules have) less (kinetic) energy;
Move slower;
Fewer collisions / fewer enzyme-substrate complexes formed; 2 max

[7]

11. (a) (Molecules) with little (kinetic) energy;
Move slowly;
Few collisions (between enzyme and substrate)/fewer enzyme-substrate complexes formed; 3
(Note: Question refers to slow rate at 5°C and answer must be in this context.)

(b) Heating would cause bonds (maintaining tertiary structure)/named bonds to break:
Denaturing enzyme/ altering tertiary structure;
Altering shape of active site; max 2
(Note: if answers clearly relate to lactose, they are incorrect)

[5]

12. (a) Mauve/ purple/ violet/ lilac;

It is a protein; 2
[*Reject: blue or pink colour*]

(b) (i) Fell <u>as</u> it was used up/ broken down/ changed; 1

(ii) Substrate becomes limiting/ falls/ gets less;
Fewer collisions/ complexes formed; 2

(iii) 1nitial rate slower;
Levelling out at same value; 2

(c) Enables a comparison to be made;
As the rate/concentration changes as reaction progresses;
Cells/ catalase may become damaged/affected by heat; max 2

[9]

13. (a) (i) Curve rising and levelling out; 1

(ii) Substrate becomes limiting/falls/gets less;
Fewer collisions/complexes formed; 2

(b) To keep pH the same / optimum pH / so change in pH does not affect reaction; 1

(c) (i) For temperature up to 40 – 50°C has no effect;
Over temperature (of 40 – 50°C) reduces rate of reaction; 2
Note. Award one mark for general statement about the longer the incubation time, the slower the rate of reaction.

(ii) Bonds (holding tertiary structure) broken;
More enzyme denatured / tertiary structure destroyed;
Active sites lose shape/no longer fit;
Fewer enzyme-substrate complexes formed; max 3
Note. Award marks if clearly in the context of more denaturation.
Allow credit here for converse relating to exposure for 5 minutes.

(d) 1 Statement about two types, competitive and non-competitive;
Note. Award points 2 –5 only in context of competitive and non-competitive inhibition
Competitive
2 Similarity of shape of inhibitor and substrate;
3 Inhibitor can enter/bind with active site (of enzyme);

Non-competitive
4 Affect/bind to enzyme other than at active site;
5 Distorts shape of active site;

Inhibitors
6 Prevent entry of/binding of substrate to active site;
7 Therefore fewer/no enzyme-substrate complexes formed; max 6

[15]

14. (a) (i) Hydrolysis; 1

(ii) Water enters fungus (by osmosis);
Increases pressure inside fungus;
Cell wall no longer strong enough/present so cannot withstand this; max 2

(iii) Cell wall (of plant) not made of chitin/made of cellulose;
Enzyme is specific to chitin / will not break down cellulose; 1

(b) Way in which the whole protein/polypeptide is folded / shape adopted by whole protein molecule / further folding of 2° structure; 1

Do not credit unqualified reference to three-dimensional shape.
Reject third level /third sort.

(c) (i) More (kinetic) energy;
Bonds/specified bonds (holding tertiary structure) break; 2

(ii) Change amino acids;
Allowing formation of more hydrogen bonds/disulphide bridges; 2

(d) 1 Sequence of amino acids gives shape;
2 This is tertiary structure;
3 Has similar shape to substrate;
4 Fits / competes for active site;
5 Fits at site other than active site;
6 Distorting active site;
7 Therefore substrate will not fit (active site); max 6

[15]

15. (a) (i) (Grinding) breaks open cells / increases surface area (of liver);
Releases catalase/enzyme/more catalase /
allows more hydrogen peroxide into liver; 2

(ii) Heating causes bonds (maintaining tertiary structure) to break;
Denatures / changes tertiary structure;
Active site changed;
Substrate no longer fits / ES complex not formed; max 3

(b) (Control) to show that sand did not affect reaction (with ground liver); 1

(c) (i) Lower activation energy / less energy required to bring about reaction; 1

(ii) Energy in products/water and oxygen less than energy in substrate/ reactants/hydrogen peroxide;
(Difference) given out as heat / exothermic; 2

[9]

16. (a) (i) (Molecule) made up of many identical/similar molecules/monomers/ subunits; 1
Not necessary to refer to similarity with monomers.

(ii) Cellulose / glycogen / nucleic acid / DNA / RNA; 1

(b) (i) To keep pH constant;
A change in pH will slow the rate of the reaction / denature the amylase / optimum for reaction; 2

(ii) Purple/lilac/mauve/violet; 1
Do not allow blue or pink.

(iii) Protein present;
The enzyme/amylase is a protein;
Not used up in the reaction / still present at the end of the reaction; max 2

[7]

17. (a) diagram showing molecule **A** fitting in inhibition site; distortion of active site; 2

(b) molecules moving less/slower; reduces chance of collision (between enzyme and substrate)/of enzyme-substrate complexes being formed;
(reject converse) 2

(c) these bonds hold/maintain tertiary/globular structure (of enzyme);
enzyme denatured/tertiary structures destroyed; (shape of) active site distorted/changes;
substrate no longer fits/enzyme-substrate complex not formed; 3 max

[7]

18. (a) Lilac/purple/mauve/violet;
Xanthine oxidase is a protein; 2

Reject pink or blue as the resulting colour with biuret.

(b) Substrate has specific shape;
Allows binding/fitting/forms ES complex with active site;
Or
Active site has specific shape;
Allows binding/fitting/forms ES complex with substrate; 2

Accept structure ≡ shape

(c) Xanthine <u>similar</u> shape to drug;
Drug fits active site/competes for active site/is a competitive inhibitor;
Less/no uric acid formed; 3

[7]

19. (a) (i) 150; 1

(ii) 27; 1

(b) 100;
number of peptide bond hydrolysed = total number present / all peptide bonds have been hydrolysed; 2

accept calculation showing same number top and bottom.

(c) curve rising to peak at pH 2 and falling to zero by pH 6; 1

(d) (change in pH) leads to breaking of bonds holding tertiary structure / changes charge on amino acids;
enzyme/protein/active site loses shape/denatured;
substrate will not bind with/fit active site;
fewer/no ES complexes formed; 3 max

(e) more resistant to changes in pH and washing conditions variable/
works in alkaline pH and washing powders alkaline; 1
mark awarded for indicating aspect of effect of pH <u>and</u> advantage of this in terms of washing powder and conditions in wash.

(f) *maximum of three marks for specificity, points 1 - 4.*
Can only be given credit in context of specificity
1 each enzyme/protein has specific primary structure / amino acid sequence;
2 folds in a particular way/ has particular tertiary structure;
3 active site with unique structure;
4 shape of active site complementary to/ will only fit that of substrate;
maximum of three marks for inhibition, points 5 – 8
5 inhibitor fits at site on the enzyme other than active site;
6 determined by shape;
7 distorts active site;
8 so substrate will no longer fit / form enzyme-substrate complex; 6 max

[15]

20. (a) Shape drawn that resembles the active site;
drawn in the active site / clearly going to the active site; 2

(b) Substrate concentration not limiting / enzyme concentration limiting;
all active sites of enzyme full / enzyme at maximum turnover rate; 2

(c) (More substrate than inhibitor so) more likely to form enzyme-substrate complex;
more likely for substrate to enter the active site: 1

(d) Correctly named bonds broken / water removed;
tertiary / globular shape of enzyme changed;
shape of <u>active site</u> affected; 3

[8]

21. (a) amino acid; 1

(b) violet/purple/mauve/lilac; 1

(c) Amino acid/substrate shape/structure changed;
Active site of enzyme;
No longer fits/ no longer complementary /
enzyme: substrate complex not formed; 3

[5]

22. (a) enzyme has an active site;
with a complementary shape to the substrate molecules;
enzyme-substrate complex formed;
lowering the (activation) energy for the reaction;
glycosidic bond formed/bringing together hydroxyl groups/water molecule removed;
products leave the active site;
enzyme unchanged; max. 4

(b) enzymes involved;
formation of the enzyme-substrate complex reliant on the correct pH;
pH affects the active site;
by disrupting bonds/altering charge;
lowering temperature will reduce pH;
enzymes have optimum pH;
pH change will slow the rates of reactions; max. 5

[9]

23. (a) (i) Oxygen given off/is a gas/spray lost; 1

(ii) Less substrate/hydrogen peroxide/substrate becomes limiting;
Less collisions with enzyme active sites; 2

(b) Curve showing steeper fall;
Reaches same final mass; 2

(c) No, would show that there was nothing else in the potato that produced the reaction; 1

[6]

24. (a) COOH;
NH_2. 2

(b) (Chain folded into) tertiary structure / particular 3-D shape (*not just globular*);
active site formed;
substrate molecules fit this site:
reduce activation energy for reaction 3

(c) Walls made of different materials / peptidoglycan or murein v. cellulose;
specificity of active site / substrate does not fit. 2

[7]

25. (a) (i) maltose. 1

(ii) Activation energy reduced;
starch attached to active site / formation of enzyme-substrate complex;
less energy required to bring (substrate) molecules together / to break bonds;
reaction occurs in small(er) steps;
change in shape of enzyme molecule (induced fit) brings molecules together / allows bonds to break / causes overlapping of electron orbits of substrates. max 3

(b) Enzyme (molecules) denatured at 60°C / high temperature, or description of denaturing (e.g. vibration disrupts enzymes);
change (in shape) of active site;
change in tertiary/'3D'structure / hydrogen bonds broken;
substrates no longer fit;
loss of activity of enzyme in water bath due to slow denaturing. max 4

[8]

26. (a) Cyanide binds to enzyme molecule away from active site;
shape of active site changed.
OR: cyanide attaches permanently to active site;
active site blocked. 2

(b) (i) Protein (receptors) / antigen / glycoprotein / glycocalyx. 1

(ii) Enzyme + antibody attaches (to membrane);
of cancer cells only;
Enzyme breaks down (injected) linamarin;
Cyanide released disrupts respiration/metabolism of cancer cells. max 3

[6]

27. (a) Active site; 1

(b) Substrate enters active site;
Complimentary shapes / Lock and Key;
(Binding) to form enzyme-substrate complex;
Lowering of activation energy;
Conformational / shape change;
Breaking of bonds in substrate;
Products no longer fit active site and so are released; 4

(c) **Molecule A** binds at site away from active site / allosteric site;
Causes enzyme / active site to change shape;
Molecule B can enter / competes for active site;
Prevents substrate from entering / no enzyme-substrate complex formed / active site blocked; 4

(d) (i) Optimum pH is 7 / neutral / between 6 and 8 / between 7 and 8; 1

(ii) Max rate = $\frac{\text{Distance}}{\text{Time}} / \frac{11}{4} / \frac{11}{4 \times 60}$; 2

[Correct answer = 2 marks (*IGNORE units*)
e.g. 2.75 mm / hour, 0.046 mm/min, 4.6×10^{-3} mm/min
1 mm/ 21.8 mins, 23.76mm^2/hour]

[12]

28. (a) Temperature
Rate of reaction increases;
Increasing temperature increases rate of movement of molecules/ kinetic energy;
Collide more often/substrate enters active site more often/more enzyme-substrate complexes formed;
Up to optimum;
Rate of reaction decreases;
High temperatures cause denaturation/loss of tertiary structure/3D structure;
By breaking specified bonds (not peptide bond);
Active site altered/substrate cannot bind/fit/

N.B. If graphically explained, axes must be labelled or scores 0 marks. 6

(b) (i) Inhibitor is a different shape to substrate;
Binds at position other than active site/allosteric site;
Alters shape of active site;
Substrate cannot bind/enzyme-substrate complex not formed; 4

(ii) Competitive inhibition;
Ethanol/ethylene glycol compete for same active site;
Molecules similar shape (not same)/both complementary to/both fit active site;
Prevents/slows production or build up of oxalic acid/toxic products;
Ethylene glycol excreted (without causing death); 4

[14]

29. (a) lowers activation energy;
relevant mechanism *e. g. brings molecules close together / reaction in smaller steps / change in charge distribution / proton donation or acceptance / induced fit ensuring substrates brought in correct sequence;*
including relevant reference to active site; 3

(b) (i) add iodine (solution);
blue / black colour; 2

(ii) heat with Benedict's (solution);
brick red / brown / orange / green / yellow colour;
(*max I mark if non-reducing sugar test described*) 2

(c) (i) 48 56-58 51-54 **(all** correct); 1

(ii) *description*
increase up to 48 / optimum *allow ECF from* (*i*)*;*
decrease above 48 / optimum *allow ECF from* (*i*)*;*
explanation of increase
increased KE / move faster;
therefore more collisions / more enzyme-substrate complexes formed;
with active site;

explanation of decrease
denaturation / 3D structure changed / tertiary structure changed;
detail e.g. breaking of hydrogen / sulphur bonds; (*reject peptide bonds*)
shape of active site changed;
substrate no longer fits; 6 max

[14]

30. (a) COOH / HOOC (either side); (*if bonds shown, must be correct*)
NH_2 / H_2N (either side); (*if bonds shown, must be correct*) 2

(b) (i) increases up to 20 - 29 units of urea / rate 20 – 21
since urea concentration limiting rate / more urea – enzyme collisions ONCE;
then (high) constant / levels off;
since active sites all (continually) occupied; (*saturated neutral*)
other named factor limiting e.g. enzyme concentration;
(*max 3 marks for part* (*i*))

(ii) increases up to 45 – 50 units / rate 17 – 19; 6 max
since urea concentration limiting rate / more urea – enzyme collisions ONCE;
NBPT reduces rate of reaction;
reduction greater at low concentration of urea than at high concentration;
NBPT competitive inhibitor / competes for active site;
since complementary shape / similar shape to substrate (NOT same shape);
at high concentrations urea competes more successfully for active site / more enzyme – urea collisions;

[8]

31. (a) (i) substances/molecules have more (kinetic) energy/moving faster;
(*reject vibrate*)
increased collisions / enzyme substrate complexes formed; 2

(ii) causes denaturation/tertiary structure/shape change;
H^+/ionic bonds break;
(shape) of <u>active site</u> changed;
substrate no longer binds/not complementary to (active site); 3 max

(b) all substrate changed into product / reaction is complete;
same amount of product formed;
same initial substrate concentration; 2 max

[7]

32. (a) C_{12} ; $H_{22}O_{11}$; 2

(b) (i) <u>heat</u> with Benedict's;
yellow/brown/orange/red; 2

(ii) (yes) (*may appear on second line*)
more precipitate in sample **B**;
both sugars are reducing sugars/ give a positive test; 2

[6]

33. (a) specific 3D tertiary structure/shape;
substrate complementary shape; (*reject same shape*)
substrate (can bind) to <u>active site</u>/ can fit into each <u>active site</u>; 3

(b) (bacterial) active site/enzymes/proteins denatured / tertiary 3D structure disrupted/changed;
(ionic) bonds broken; (*reject peptide bonds*) (*ignore other bonds*)
no enzyme substrate complex formed / substrate no longer fits; 3

[6]

34. (a) maximum rate at which enzyme can combine with substrate / form enzyme-substrate complexes / substrate no longer limiting / enzyme is a limiting factor;
(active site of) enzyme saturated with substrate
(*disqualify active sites/enzymes* '*used up*'); 2

(b) inhibitor attaches to enzyme away from the active site;
changes shape of active site;
prevents formation of enzyme-substrate complex; 2 max

(c) $\frac{7.6 - 5.6}{7.6}$ x 100;
= 26.32%; (*accept 26% or 26.3%*) 2
(correct answer = 2 marks)
(principle - $\frac{decrease\ in\ rate}{max rate}$ *x 100 = 1 mark)*

(d) curve below top curve (without inhibitor) joining to top curve / continues to increase to end of *x*-axis
(*must not exceed or level out below 'without inhibitor curve' and must start from origin*); 1

[7]

35. (i) absorbs/transports triglycerides/fats/lipids/chylomicrons; 1

(ii) enables villi to move;
increased contact with food; 2

[3]

36. (a) (i) absorbed by diffusion;
no energy/ATP available / active transport requires energy/ATP; 2 max

(disqualify energy made)

(allow energy reference in either (i) or (ii))

(ii) absorbed by active transport; 1

(b) (absorption by) diffusion no longer occurs / diffusion/movement of ions equal in both directions;
because no concentration/diffusion gradient / reached equilibrium; 2

(c) malonate fits into/blocks active site of enzyme / complementary to active site; (prevents fitting neutral)
competes with substrate / is a competitive inhibitor / prevents substrate forming enzyme-substrate complex; 2

[7]

37. (a) colour results from starch-iodine reaction;
decrease due to breakdown of starch by carbohydrase/enzyme; 2

(b) (i) curve drawn below curve on graph and starting at same point; 1

(ii) curve drawn above curve on graph and starting at same point but finishing above; 1

(allow curve or horizontal line)

(allow alternative curve for pH if explanation in (ii) is consistent)

(c) (i)
1 increase in temperature increases kinetic energy;
2 increases collisions (between enzyme/active site and substrate) / increases formation of enzyme/substrate complexes;
3 increases rate of breakdown of starch /rate of reaction/carbohydrase activity;

(ii)
4 (decrease in pH) increases H^+ ions/protons;
5 attach/attracted to amino acids;
6 hydrogen/ionic bonds disrupted/broken;
7 denatures enzyme / changes tertiary structure;
8 changes shape/charge of active site;
9 active site/enzyme unable to combine/fit with starch/enzyme-substrate complex no longer able to form;
decreases rate of breakdown of starch/rate of reaction /carbohydrase activity; 7 max

(allow alternative explanation for pH if consistent with line drawn in (ii))

[11]

38. (a) Measure diameter / radius / area of clear zone;
Detail of method e.g. determine mean diameter of each clear zone / use of graph paper to determine area; 2

(b) No measurements at intermediate pH values i.e. 5-7 / 7-9; 1

(c) Enzyme denatured / tertiary structure altered;
Ionic / hydrogen bonds broken;
Substrate cannot bind to active site; 2 max

Q *To gain first marking point, answer should use terminology specified in scheme*

(d) Use of denatured / boiled enzyme;
At all pH values; 2

[7]

39. (a) (i) Glucose;

Fructose; 2

Any order.

(ii) Lactose has a different shape/structure;

Does not fit/bind to active site of enzyme/sucrase;

Only allow a second mark if reference is made to the active site.
Max 1 mark if active site is described as being on the substrate.

OR

Active site of enzyme/sucrase has a specific shape/structure;
Does not fit/bind to lactose; 2

Do not accept same shape.

(b) (i) Rose and fell;

Peak at 45 (minutes) / concentration of 6.6 (mmol dm^{-3}); 2

(ii) Glucose (produced by digestion) is absorbed / enters blood;

Decrease as used up/stored; 2

(iii) Curve roughly parallel to the x-axis or falling, starting from approximately the same point; 1

[9]

40. (a) Enzyme/active site has a (specific) tertiary structure;

Only glucose has correct shape / is complementary / will bind/fit;

To active site;

(Forming) enzyme-substrate complex; 3 max

Q *Allow second mark if candidate refers to correct shape or complementary in terms of the enzyme. Do not allow 'same' shape*

Q *Do not allow third mark if active site is described as being on substrate.*

(b) (Only detects glucose whereas) Benedict's detects (all) reducing sugars/named examples;

Provides a reading / is quantitative / Benedict's only provides a colour / doesn't measure concentration / is qualitative/semiquantitative;

Is more sensitive / detects low concentration;

Red colour/colour of blood masks result;

Can monitor blood glucose concentration continuously; 2 max

Q *Do not credit quicker/more accurate unless qualified.*

Q *Allow Benedict's detects monosaccharides for first mark point.*

(c) (i) Broken down by enzymes / digested / denatured (by pH) too large to be absorbed; 1

(ii) Study not carried out on humans / only carried out on rats;
Long-term/side effects not known;
Scientists have vested interest;
Study should be repeated / further studies / sample size not known; 2 max

[8]