

Question 7 (Answer: **A**)

- Below the optimum, raising the temperature gives the molecules more kinetic energy, so the rate rises.
- At the optimum the rate is highest.
- Above it the enzyme denatures – its active site loses shape – so the rate falls sharply.

Question 6 (Answer: **C**)

- An enzyme is a protein that catalyses a reaction.
- Pepsin is the protease of the stomach.
- Fibrinogen is a clotting protein, mRNA is nucleic acid, and saliva is a mixture that *contains* an enzyme.

3(a)	increases the rate of a (chemical) reaction ; (and is) not changed (during the reaction) / AW ;
3(b)(i)	<i>any six from:</i> 1 <u>amylase</u> breaks down starch ; 2 iodine (solution) turns blue-black in the presence of starch ; <i>idea that at 0 °C / at the start</i> 3 least, starch break down / enzyme activity / amylase activity ; 4 fewest, successful collisions / enzyme substrate-complexes formed ; 5 <i>idea that</i> particles do not have sufficient (kinetic) energy ; <i>idea as temperature increases</i> 6 the kinetic energy (of particles) increases ; 7 (starch and amylase) collide more, frequently / successfully or more enzyme-substrate complexes form ; 8 faster break down of starch ; 9 40 °C is the <u>optimum</u> temperature ;
3(b)(ii)	<i>any two from:</i> <i>ref to specificity ;</i> <i>idea that</i> protease has a different shaped <u>active site</u> (to amylase) / starch and the <u>active site</u> (of protease) are not complementary ; unable to bind / unable to form an enzyme-substrate complex ;
3(c)	pH / AVP ;

Question 7 (Answer: **D**)

- Enzymes work fastest at their optimum temperature and slow down above it.
- Above the optimum the heat breaks the bonds holding the enzyme's shape.
- The active site changes shape – the enzyme is denatured – so the substrate no longer fits.

Question 8 (Answer: **C**)

- Enzymes are proteins, not carbohydrates.
- They speed up reactions without being used up, which makes them catalysts.
- They act *on* substrates – they are not substrates themselves.

Question 5 (Answer: **B**)

- The stomach enzyme is a protease, so its substrate is protein.
- It works best in the acid conditions the stomach provides.
- A process that destroys the enzyme's shape is denaturation, which is what a high temperature or the wrong pH causes.

6(a)	<i>any five from:</i> 1 enzyme activity reaches, peaks / increases and decreases (for L / M) ; 2 maximum (area digested) / peaks, is pH 2 for L and pH 10 for M ; 3 L has steepest increase in activity between pH 1 and 2 / M has most gradual increase from pH 3 to pH 10 / as pH increases / AW ; 4 L has higher activity than M at their optimum pHs / AW ; ora 5 L and M are active, between pH 3 and pH 5 ; 6 L has no activity, from / at pH 5 (and onwards) OR M has no activity, before / at, pH 3 ; 7 M is active for a wider pH range (in this investigation than L) ; ora 8 no change in activity between pH 7 and 8 for M ; 9 data quote with correct units that includes ref to pH and area where the enzyme is active ;
6(b)	<i>any three from:</i> no jelly is broken down / enzyme has no activity ; enzyme / M / active site, is <u>denatured</u> ; enzyme / M / active site, has changed shape ; <u>active site</u>, does not fit / does not bind / is not complementary to, the substrate / protein in jelly ;
6(c)	enzyme L: pepsin ; location: stomach ;

2(a)(i)	thermostatically controlled water-bath / AVP ;
2(a)(ii)	<i>any two from:</i> mass of apple ; volume of, pectinase / enzyme (solution) ; time / left for 30 minutes ;
2(b)(i)	axes labelled with units ; suitable linear scale and data occupies at least half the grid in both directions ; all points plotted accurately $\pm$ half a small square ; suitable line drawn ;
2(b)(ii)	any indication on graph at 0.5% pectinase concentration / indication of correct value on the volume axis ; correct value recorded from candidates graph ;
2(b)(iii)	increasing, concentration / pectinase , increases juice production and then stops increasing / AW ;
2(b)(iv)	more concentrations measured between 0.4% and 1.6% ;
2(b)(v)	<i>drawings of:</i> funnel with filter paper ; measuring cylinder ; <i>labelling:</i> at least one item correctly labelled ;

Question 9 (Answer: B)

- Enzymes are *proteins*, not carbohydrates.
- They speed reactions up, so they cannot decrease the rate.
- Each has an active site of its own specific shape, and they catalyse the reactions of metabolism.