# Mark scheme

## Enzyme experiments (temperature and pH)

Biology 0610 · Questions from Paper 1, Paper 2, Paper 4 and Paper 6

Total marks

**34**

MARKS FOR EACH QUESTION

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 10 | 11 | **34** |

### Question 1 [1]

**Answer B**

### Question 2 [1]

**Answer A**

### Question 3 [1]

**Answer C**

### Question 4 [1]

**Answer D**

### Question 5 [1]

**Answer C**

### Question 6 [1]

**Answer D**

### Question 7 [1]

**Answer A**

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## Question 8 [6]

| | | | |
|---|---|---|---|
| 8 | *total of six from:*<br><br>**1** *independent variable*<br>at least two pH values **,** tested / stated **;**<br><br>**2** *dependent variable*<br>time for iodine solution to stay yellow-brown / time for disappearance of starch/colour of iodine (solution) after a set period of time **;**<br><br>**3, 4 + 5** *variables kept constant* **;;;**<br>• concentration of amylase / enzyme (solution)<br>• volume of amylase / enzyme (solution)<br>• temperature<br>• volume of starch (suspension)<br>• concentration of starch (suspension)<br>• sampling interval time, stated / described<br>• buffer / pH (solution) volume<br>• iodine concentration / volume / number of drops<br><br>**6 & 7** *method* **;;**<br>• equilibration (both solutions in the water bath before mixing)<br>• take samples<br>• use of, spotting / white, tile<br>• use of buffer<br><br>**8** repeat investigation twice more / at least two replicates **;**<br><br>**9** relevant safety precaution **;** | **6** | |

## Question 9 [10]

| | | | |
|---|---|---|---|
| 9(a) | *any five from:*<br>1 enzyme activity reaches, peaks / increases and decreases (for **L** / **M**) **;**<br>2 maximum (area digested) / peaks, is pH 2 for **L** and pH 10 for **M** **;**<br>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 **;**<br>4 **L** has higher activity than **M** at their optimum pHs / AW **;** ora<br>5 **L** and **M** are active, between pH 3 and pH 5 **;**<br>6 **L** has no activity, from / at pH 5 (and onwards) OR **M** has no activity, before / at, pH 3 **;**<br>7 **M** is active for a wider pH range (in this investigation than **L**) **;** ora<br>8 no change in activity between pH 7 and 8 for **M** **;**<br>9 data quote with correct units that includes ref to pH and area where the enzyme is active **;** | **5** | MP6 **A** denatured for no enzyme activity<br><br>MP9 examples:<br>• at pH 2 **L** digests 160 $mm^2$ of jelly<br>• at pH 10 **M** digests 140 $mm^2$ of jelly<br>• at pH, 7 / 8 **M** digests 80 $mm^2$ of jelly |
| 9(b) | *any three from:*<br>no jelly is broken down / enzyme has no activity **;**<br>enzyme / **M** / active site, is denatured **;**<br>enzyme / **M** / active site, has changed shape **;**<br>active site, does not fit / does not bind / is not complementary to, the substrate / protein in jelly **;** | **3** | |
| 9(c) | *enzyme **L***: pepsin **;**<br>*location:* stomach **;** | **2** | |

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## Question 10 [11]

| | | | |
|---|---|---|---|
| **10**(a) | increases the rate of a (chemical) reaction ;<br>(and is) not changed (during the reaction) / AW ; | **2** | |
| **10**(b)(i) | *any six from:*<br>**1** amylase breaks down starch ;<br>**2** iodine (solution) turns blue-black in the presence of starch ;<br><br>*idea that at 0 °C / at the start*<br><br>**3** least, starch break down / enzyme activity / amylase activity ;<br>**4** fewest, successful collisions / enzyme substrate-complexes formed ;<br>**5** *idea that* particles do not have sufficient (kinetic) energy ;<br><br>*idea as temperature increases*<br><br>**6** the kinetic energy (of particles) increases ;<br>**7** (starch and amylase) collide more, frequently / successfully or more enzyme-substrate complexes form ;<br>**8** faster break down of starch ;<br><br>**9** 40 °C is the optimum temperature ; | **6** | |
| **10**(b)(ii) | *any two from:*<br>*ref to* specificity ;<br>*idea that* protease has a different shaped active site (to amylase) / starch and the active site (of protease) are not complementary ;<br>unable to bind / unable to form an enzyme-substrate complex ; | **2** | |
| **10**(c) | pH / **AVP** ; | **1** | |

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