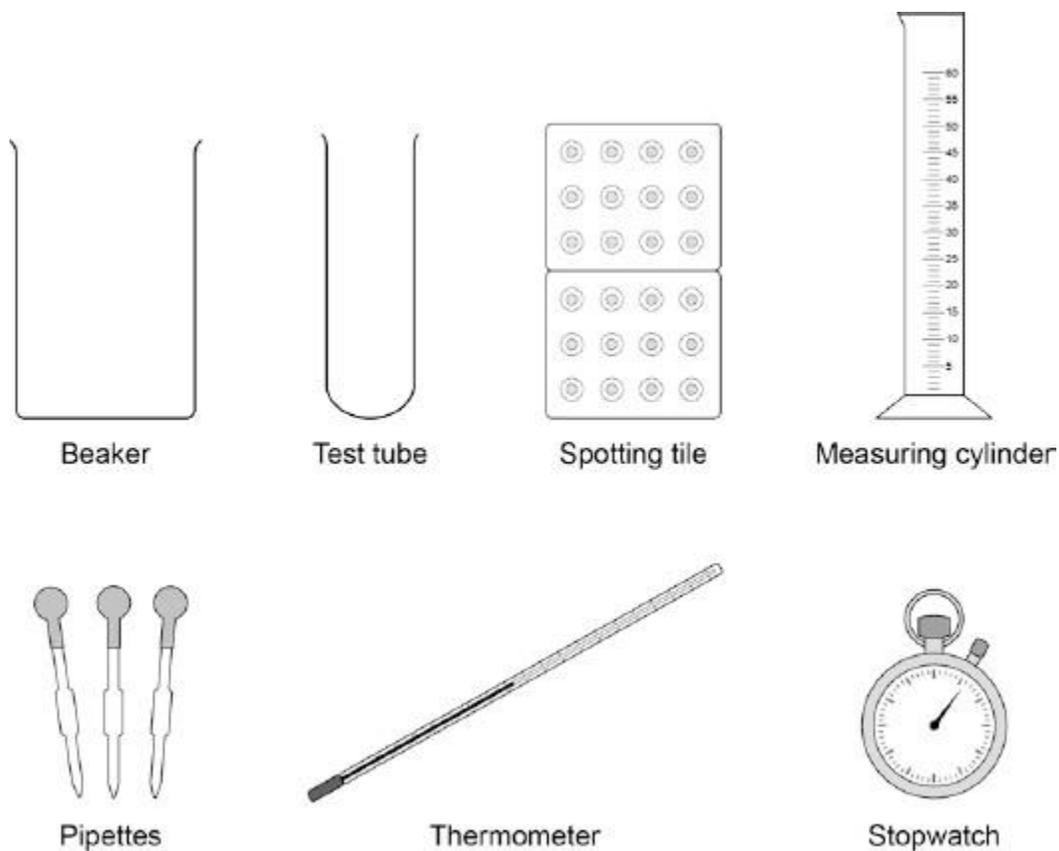


1 Amylase catalyses the breakdown of starch into sugars.

A student investigated the effect of amylase on the reaction at different temperatures.

Figure 1 shows the apparatus the student used.

Figure 1



This is the method used.

1. Put starch suspension into a test tube.
2. Add amylase solution.
3. Put the test tube in a beaker of water at 15 °C.
4. Remove a small sample of the mixture every 30 seconds and put in a spotting tile.
5. Test the sample for starch.
6. Time how long it takes to break down all of the starch in the mixture.
7. Repeat steps 1–5 at 20 °C, 25 °C and 30 °C.
8. Repeat for each temperature twice more.

The table below shows the student's results.

	Time taken until there was no starch in the sample in minutes			
Temperature in °C	Test 1	Test 2	Test 3	Mean
15	6.1	9.4	10.0	8.5
20	4.8	5.0	4.6	4.8
25	3.0	2.5	3.0	3.2
30	1.5	2.0	2.0	

(a) One of the results in the table above is anomalous.

Draw a ring around the anomalous result.

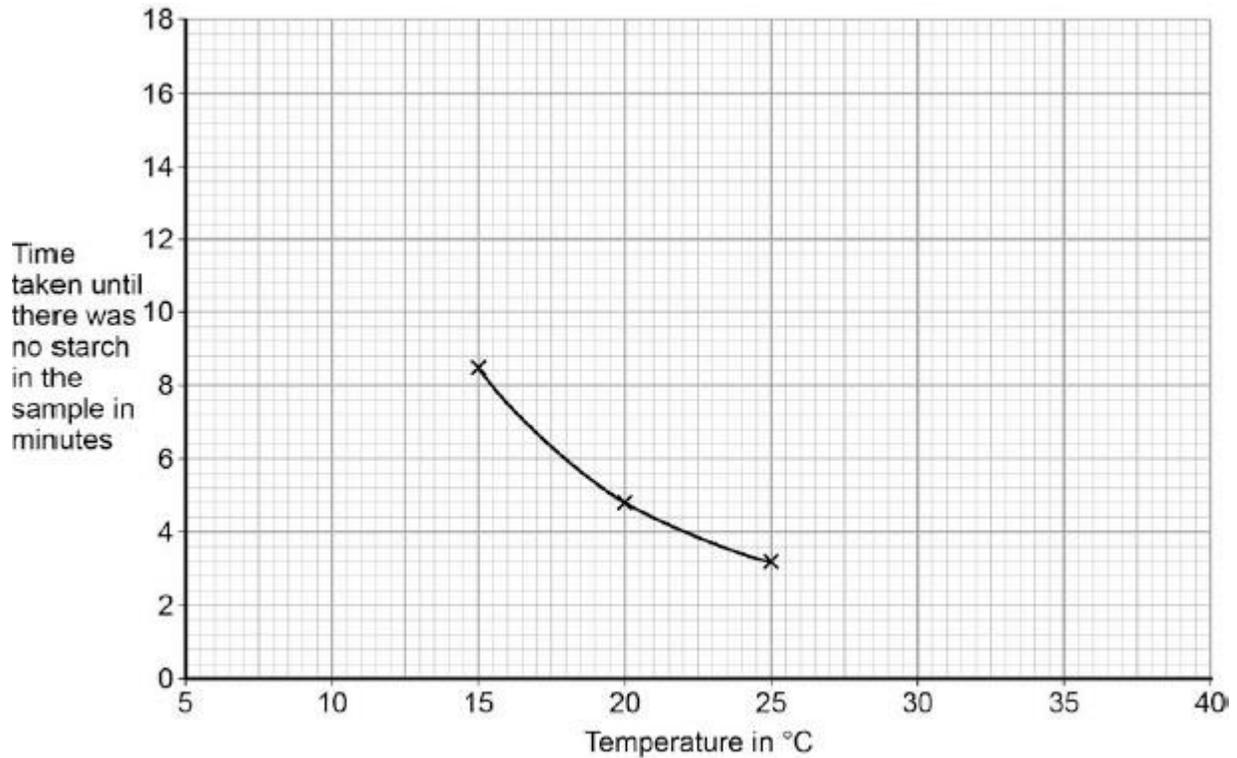
(1)

(b) Calculate the mean for 30 °C.

(1)

(c) **Figure 2** shows a graph of the student's results.

Figure 2



Use the graph to predict how long it would take to break down all of the starch at 10 °C.

Time = _____ minutes

(1)

(d) The student tested samples of the mixture for starch every 30 seconds.

In each test she added one drop of iodine to the sample in the spotting tile.

Predict the colour of the samples from the 20 °C test at 4.0 minutes and 7.0 minutes.

Colour at 4.0 minutes _____

Colour at 7.0 minutes _____

(2)

(e) The student did a fourth test at 30 °C.

In this test the starch did not break down, even after 45 minutes.

Why did the amylase not break down the starch in this test?

Tick **one** box.

The amylase solution and the starch suspension were mixed before the start of the experiment.

The amylase solution had been prepared with water at 95 °C.

The amylase solution had been prepared with water at 20 °C.

The amylase solution had been stored in the fridge.

(1)

(f) The student made the following conclusion about the optimum temperature for amylase to work at.

'Amylase works fastest at 40 °C'

Her teacher said that this is **not** a valid conclusion from her results.

Describe how the student could change her method to give results that would improve the validity of her conclusion.

(6)

(Total 12 marks)

2

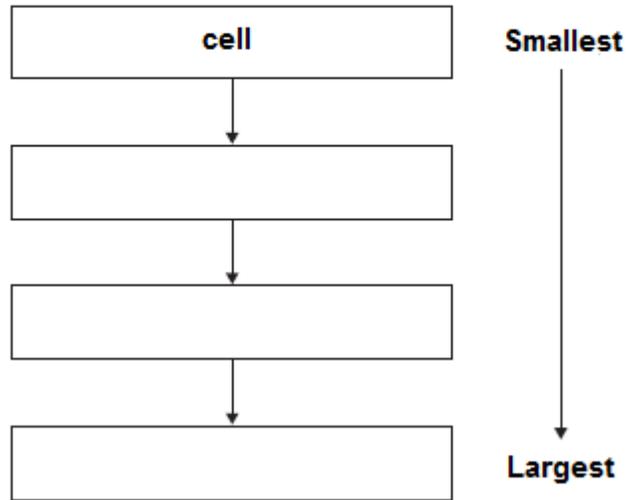
The human body is organised to carry out many different functions.

- (a) Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.



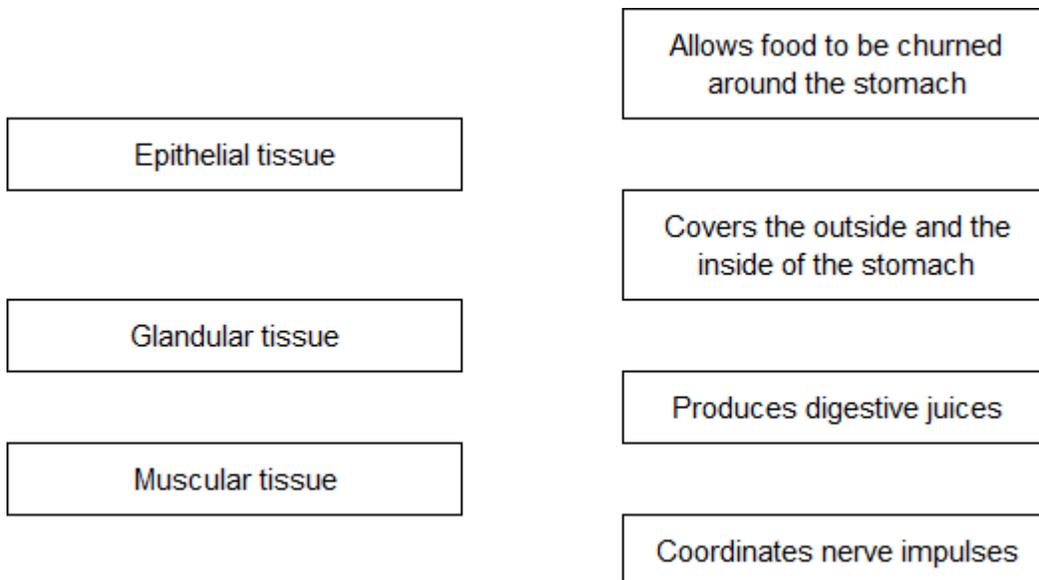
Figure 1



(2)

- (b) The stomach is made of different types of tissue.

Draw **one** line from each type of stomach tissue to the correct description.



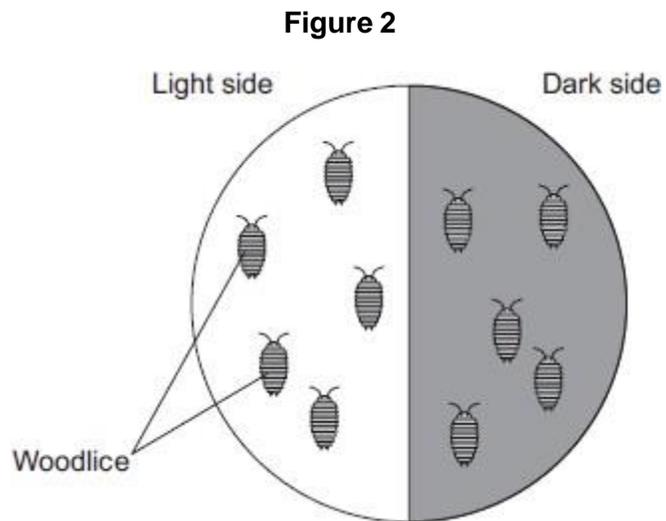
(3)

(c) Animals can react to their surroundings because they have nervous systems.

A student investigated the behaviour of small animals called woodlice.

The student set up the investigation as shown in **Figure 2**.

- The student covered one half of a Petri dish with black paper to make that side of the Petri dish dark.
- The other side had no cover.
- The student put five woodlice into each side of the dish and then put the clear Petri dish lid back on the dish.



After 30 minutes, all the woodlice had moved to the dark side of the Petri dish.

(i) In this investigation, what is the **stimulus** that the woodlice responded to?

(1)

(ii) In this investigation, what is the **response** that the woodlice made?

(1)

(iii) The student concluded that woodlice prefer dark conditions.

Give **two** ways in which the student could improve the investigation to be sure that his conclusion was correct.

1. _____

2. _____

(2)

(Total 9 marks)

3

This question is about hormones.

(a) (i) Hormones carry messages.

What type of messenger is a hormone?

Draw a ring around the correct answer.

chemical

electrical

environmental

(1)

(ii) Which part of the brain secretes hormones?

Draw a ring around the correct answer.

cerebellum

medulla

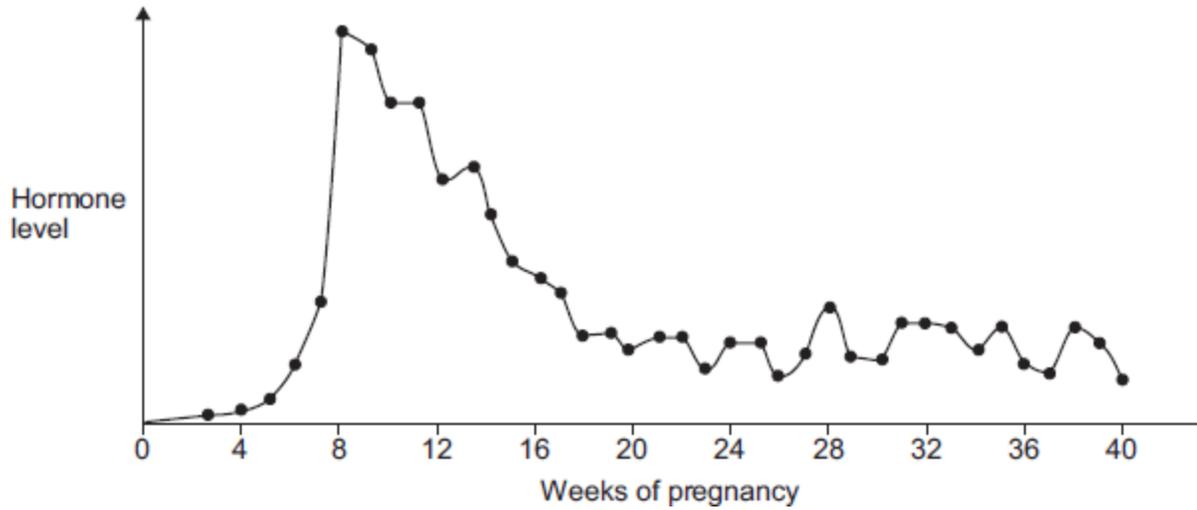
pituitary gland

(1)

(b) **Figure 1** shows the level of a pregnancy hormone over a 40-week pregnancy.

This hormone can be detected in a pregnancy test.

Figure 1



A woman takes a pregnancy test.

In which week of pregnancy is the test most likely to give a positive result?

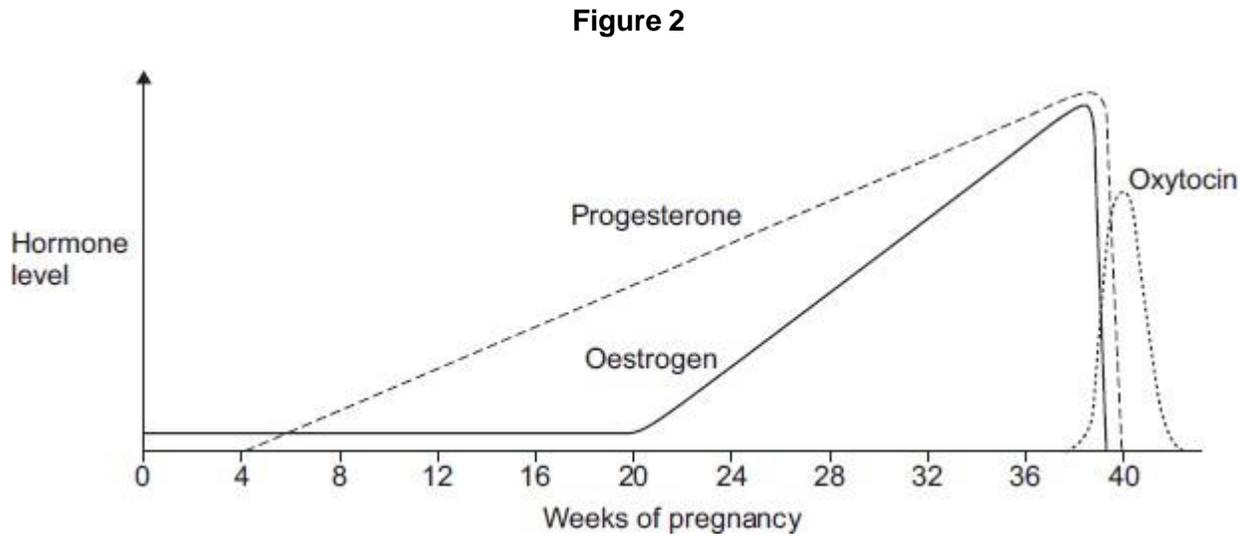
Use information from **Figure 1**.

Write the correct answer in the box.

(1)

(c) **Figure 2** shows the levels of three other hormones during pregnancy.

The baby is usually born at about 40 weeks.



(i) Describe the patterns in the levels of oestrogen and progesterone from 0 to 36 weeks.

(4)

(ii) Which hormone is likely to stimulate contractions of the uterus (womb) when the baby is born?

Use information from **Figure 2** to give a reason for your answer.

(2)

(Total 9 marks)

4 The rate of chemical reactions can be changed by changing the conditions.

(a) Methane burns in oxygen to produce carbon dioxide and water.

The activation energy for the reaction is 2648 kJ / mol.

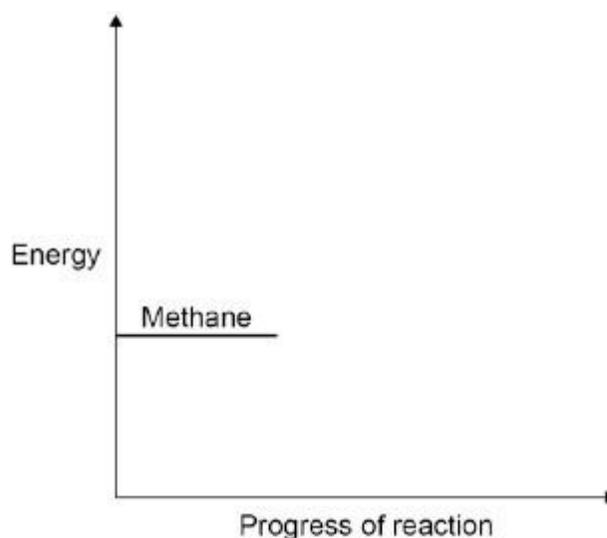
The reaction gives out 818 kJ / mol of energy.

The figure below shows the reaction profile for this reaction.

Complete the reaction profile.

Draw arrows to represent:

- the activation energy
- the energy given out.



(4)

(b) What percentage of the activation energy is the energy given out?

(1)

(c) Calcium carbonate decomposes when it is heated:

The decomposition of calcium carbonate is an endothermic reaction.

How would the reaction profile for decomposition of calcium carbonate be different from the reaction profile of methane burning in oxygen?

(1)

(d) Catalysts are used in chemical reactions in industry.

Give **two** properties of catalysts.

For each property, explain why it makes the catalyst useful in industry.

(4)

(e) Enzymes are biological catalysts.

What type of molecule is an enzyme?

Tick **one** box.

Carbohydrate

Hydrocarbon

Lipid

Protein

(1)

(f) If enzymes are denatured they stop working.

Give **two** ways an enzyme can be denatured.

1. _____

2. _____

(2)

- (g) An enzyme called lactase catalyses the reaction that breaks down lactose to smaller molecules.

One model used to explain how enzymes affect reactions is called the lock and key model.

Use the lock and key model to explain why lactase cannot be used to speed up **all** chemical reactions.

(3)

(Total 16 marks)

5

This question is about the nervous system.

- (a) Describe the difference between the function of a receptor and the function of an effector.

In your answer you should give **one** example of a receptor and **one** example of an effector.

(4)

(b) Synapses are important in the nervous system.

(i) What is a synapse?

(2)

(ii) Describe how information passes across a synapse.

(2)

(c) Reflexes may be co-ordinated by the brain or by the spinal cord.

(i) The reflexes from sense organs in the head are co-ordinated by the brain.

Name a sense organ involved in a reflex co-ordinated by the spinal cord.

(1)

(ii) The table shows information about reflexes co-ordinated by the brain and reflexes co-ordinated by the spinal cord.

Organ co-ordinating the reflex	Mean length of neurones involved in cm	Mean time taken for reflex in milliseconds	Mean speed of impulse in cm per millisecond
Brain	12	4	3
Spinal cord	80	50	

Calculate the mean speed of the impulse for the reflex co-ordinated by the spinal cord.

Mean speed = _____ cm per millisecond

(1)

(iii) In reflexes co-ordinated by the brain there are **no** relay neurones.

Suggest why there is a difference in the mean speed of the impulse for the two reflexes.

(2)
(Total 12 marks)

Mark schemes

- 1**
- (a) 6.1 circled on table (15 °C, test 1) 1
- (b) 1.8 1
do not allow 1.83
- (c) 16 (minutes) 1
correct number extrapolated from curve
- (d) 4.0 min – blue / black / purple 1
7.0 min – yellow / orange / brown 1
- (e) The amylase solution had been prepared with water at 95 °C 1

(f) **Level 3 (5–6 marks):**

A clear and coherent method is described using logical steps and demonstrating a good understanding of how to improve the validity of the method. The method would lead to the production of valid results that would give rise to a more valid conclusion.

Level 2 (3–4 marks):

The substantive content of a method is present and demonstrates reasonable understanding of how to improve the validity but may be missing some detail. The plan may not be in a completely logical sequence but leads towards the measurement of rate of the reaction.

Level 1 (1–2 marks):

Simple relevant statements made, which demonstrate limited understanding of how to improve the experimental method. The response lacks logical structure and would not lead to the production of valid results or a more precise optimum temperature.

0 marks:

No relevant content

Indicative content

- conduct at a greater range of temperatures
- use temperatures both above and below 40 °C
- use smaller temperature intervals to get a more accurate optimum (eg go up in 2 °C increments)
- take samples at smaller time intervals to get a more accurate result for 'time taken'
- control the volume of starch used (eg 5 cm³)
- control the volume of the amylase solution (eg 1 cm³)
- control the temperature (eg using a water bath)
- heat the two solutions separately before mixing
- control the concentration of the starch solution
- control the concentration of the amylase solution

6

[13]

2

(a) tissue → organ → organ system

one right for 1 mark

three right for 2 marks

2

(b) **Epithelial tissue** → covers the outside and the inside of the stomach

more than one line from a tissue = no mark

1

Glandular tissue → produces digestive juices

1

Muscular tissue → allows food to be churned around the stomach

1

	(c) (i) light		
	<i>ignore dark</i>		1
	(ii) moving (to the dark)		1
	(iii) any two from:		
	• use more woodlice		
	• repeat the experiment		
	• run for a longer time		2
			[9]
3	(a) (i) chemical		1
	(ii) pituitary gland		1
	(b) 8		
	<i>allow 9 or 10</i>		1
	(c) (i) any four from:		
	• progesterone starts being produced at 4 weeks / no progesterone before 4 weeks		
	• and then / from 4 weeks increases		
	• oestrogen at constant / low level (from 0) to 20 weeks		
	• and then / from 20 weeks increases		
	• from 20 – 36 weeks level of O rises more steeply than that of P		
	or		
	• P is always higher than O from 6 to 36 weeks		
	<i>if no other marks awarded, allow progesterone and oestrogen both increase / rise for 1 mark.</i>		4
	(ii) oxytocin		1
	level of oxytocin increases just before birth		1
			[9]
4	(a) products below reactants		1
	correct energy profile		1
	activation energy correctly labelled		1
	energy given out correctly labelled		1

- (b) 31 (%) 1
- (c) the products would be above the reactants 1
- (d) catalysts increase rate of reaction
1 mark for each property
1 mark for each explanation
- so products formed in less time
- or**
- catalysts lower activation energy
explanation must be linked correctly to the property to gain the mark
- so lowers energy requirements
- or**
- catalysts not used up in the reaction
- so only an initial outlay needed
- or**
- only a small amount of catalyst needed
- so small initial cost max. 4
- (e) Protein 1
- (f) high temperatures 1
- extremes of pH 1
- (g) lactase acts as the lock, lactose is the key (substrate) 1
- lactase has an active site which will only fit lactose molecules 1
- so lactase will not work with other molecules 1

[16]

- 5 (a) receptors detect / sense stimuli / change in surroundings **or** convert stimulus into an impulse
ignore send impulses to brain / spinal cord 1
- example of a receptor
allow any appropriate organ or part of an organ, eg eye / retina or named type of receptor eg light receptor 1
- effectors allow / make response **or** convert an impulse to an action
ignore receive impulses from brain / spinal cord 1
- (effector) muscle / gland
allow an example
ignore eg arm / leg 1
- (b) (i) junction
allow idea of a (small) gap / space
*do **not** allow if implication is that the neurones move* 1
- between neuron(e)s
allow named types of neurones 1
- (ii) chemical
allow answers in terms of specific types of neurone
allow neurotransmitter / named neurotransmitter released 1
- any **one** from:
 - (chemical released) from one neurone
ignore produced
 - (chemical) passes (across synapse) to next neurone to stimulate / cause (electrical) impulse
allow diffuses for passes (across) 1
- (c) (i) skin
ignore hand / leg 1
- (ii) 1.6 (cm per millisecond)
allow 2 if evidence of rounding up of 1.6 1

(iii) any **two** from:

- ignore length of neurones*
- synapses slow down transmission / impulse
allow idea of movement of chemical being slower than electrical impulse
- fewer synapses (via brain)
*allow one synapse compared to two **or** only one synapse*
- (therefore) fewer delays
allow impulse travels more slowly in relay neurones

2

[12]