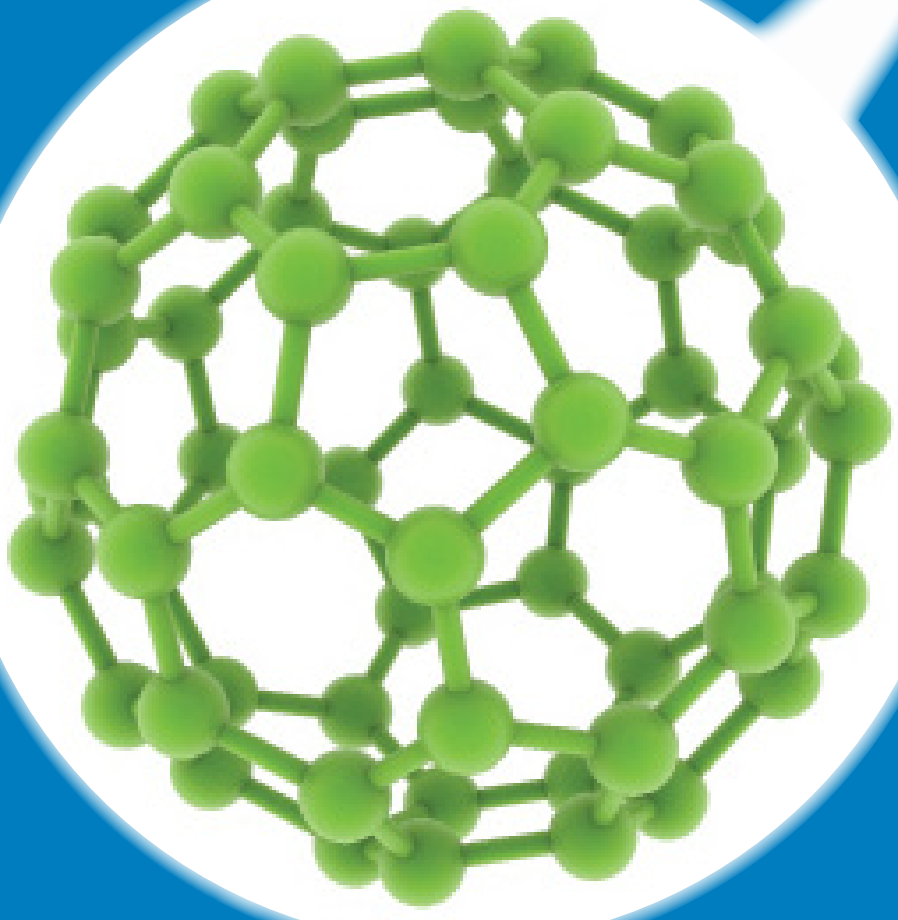
OCR
RECOGNISING ACHIEVEMENT



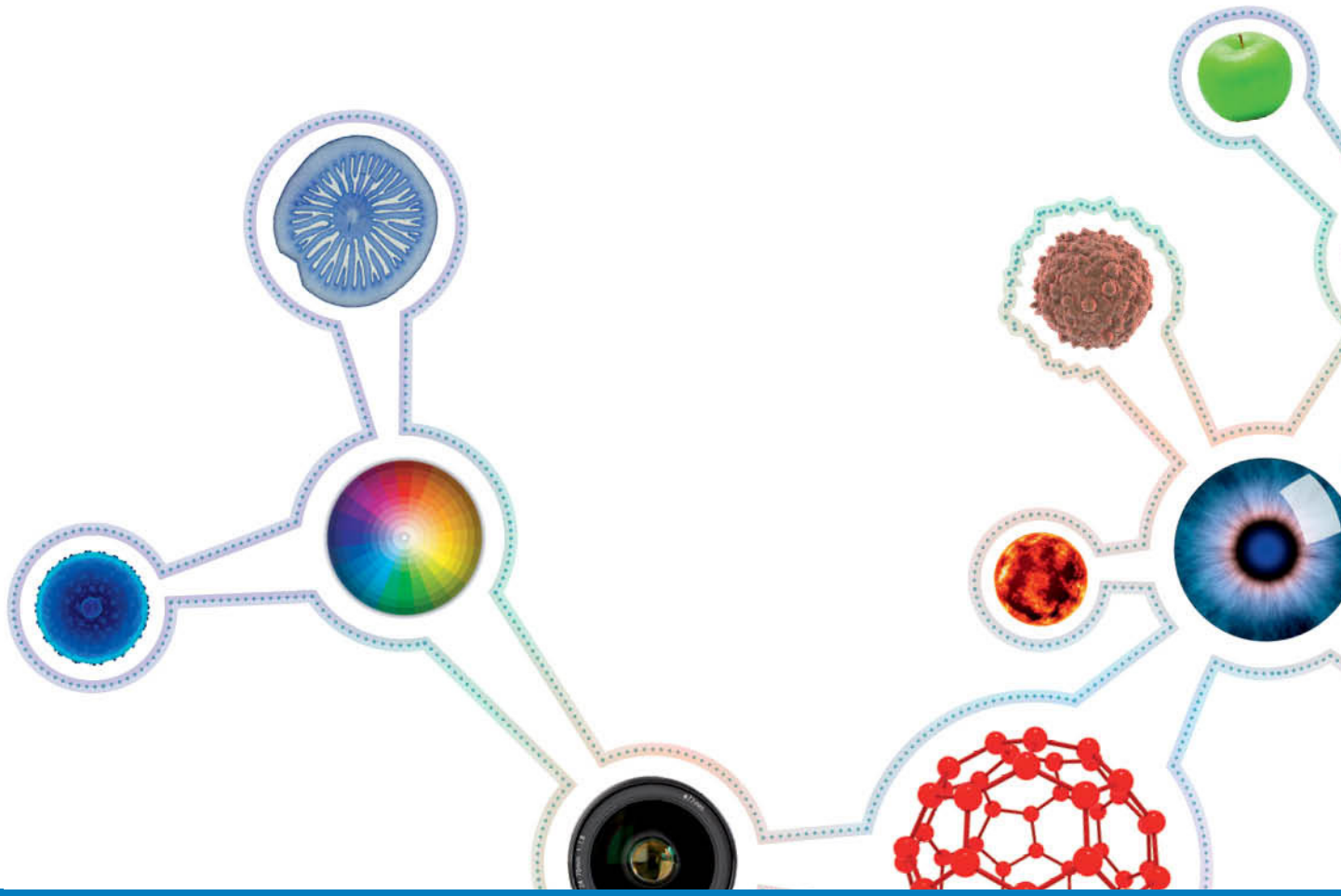
GATEWAY SCIENCE SUITE

EXEMPLAR CANDIDATE WORK

VERSION 1 JUNE 2012

www.ocr.org.uk/science

INDEX



INTRODUCTION

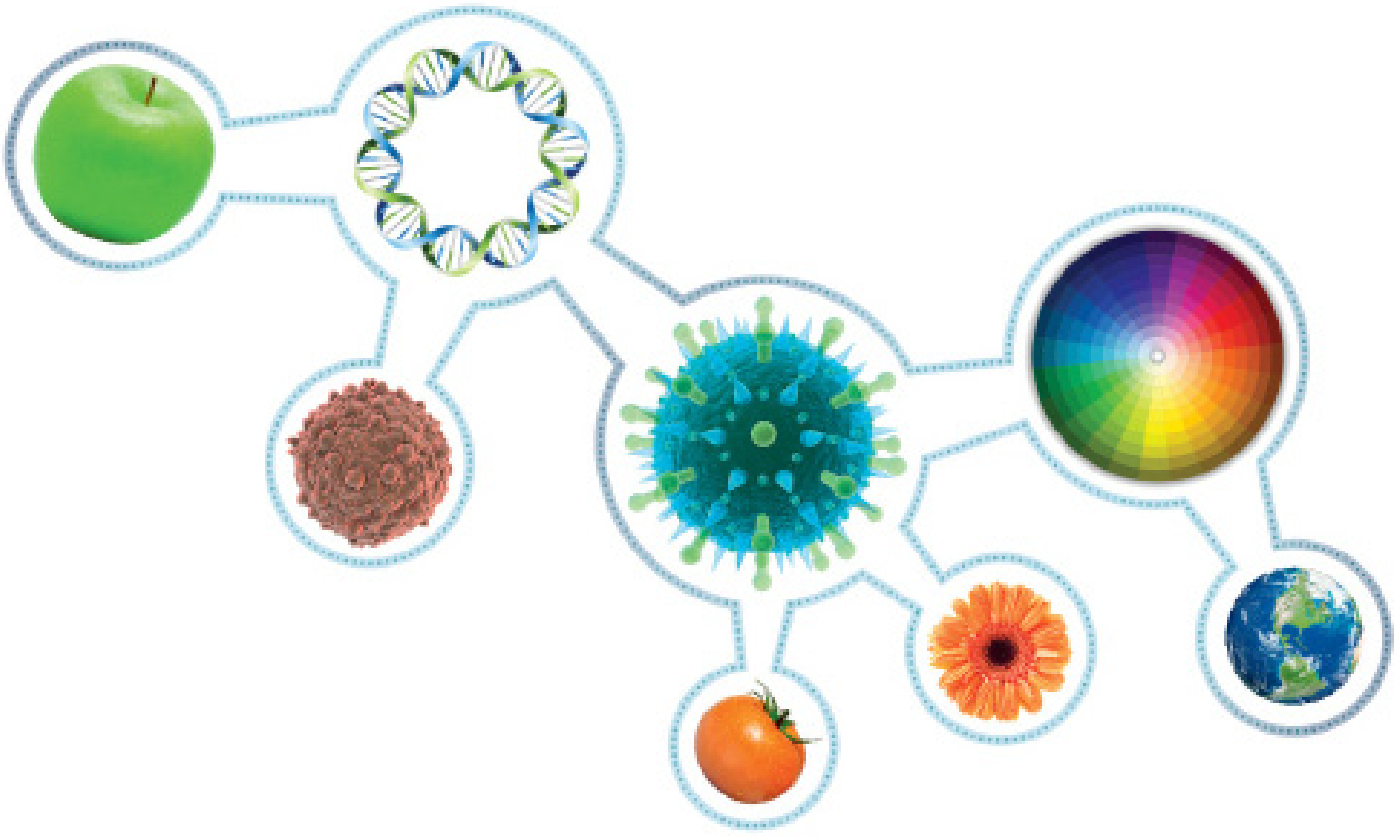
These support materials are intended to support teachers in understanding how examiners apply the marking criteria and what they are looking for in candidate responses . There is exemplar candidate work for a selection of questions from the January 2012 series, with accompanying commentary.

The exemplars and commentaries should be read alongside the Specification for GCSE Gateway Science, which is available from the website.

OCR will update these materials as appropriate.

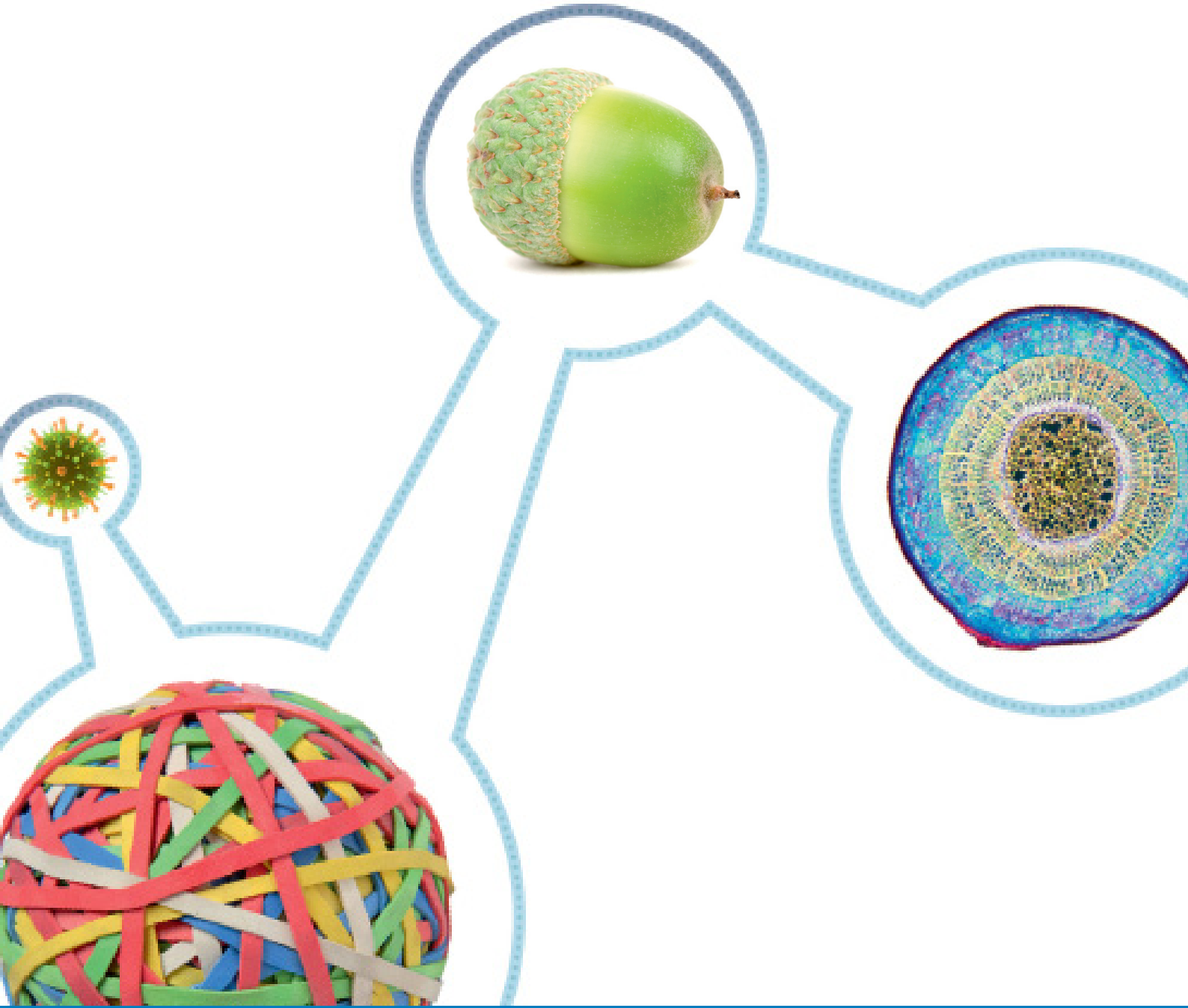
Centres may wish to use these support materials in a number of ways:

- teacher training in interpretation of the marking criteria
- departmental standardisation meetings
- exemplars for candidates to review.



BIOLOGY

GCSE GATEWAY SCIENCE
BIOLOGY B B731/01
JANUARY 2012



QUESTION 2 (b)

This question was targeted at grades up to and including E and covered low demand statements. It was designed to cover Assessment Objective 1 (recall) and Assessment Objective 2 (application).

(b) Emma takes her sick cat to the vet.

The vet says it has cat flu and that the virus infected the cells of the cat's **lungs.**

The virus must have got past the cat's defence mechanisms.

The vet says that cats have similar defence mechanisms to humans.

Emma thought the cat's body should have stopped the virus infecting its cells.

Suggest how the flu virus got into the cat and describe the cat's defence mechanisms against the virus.

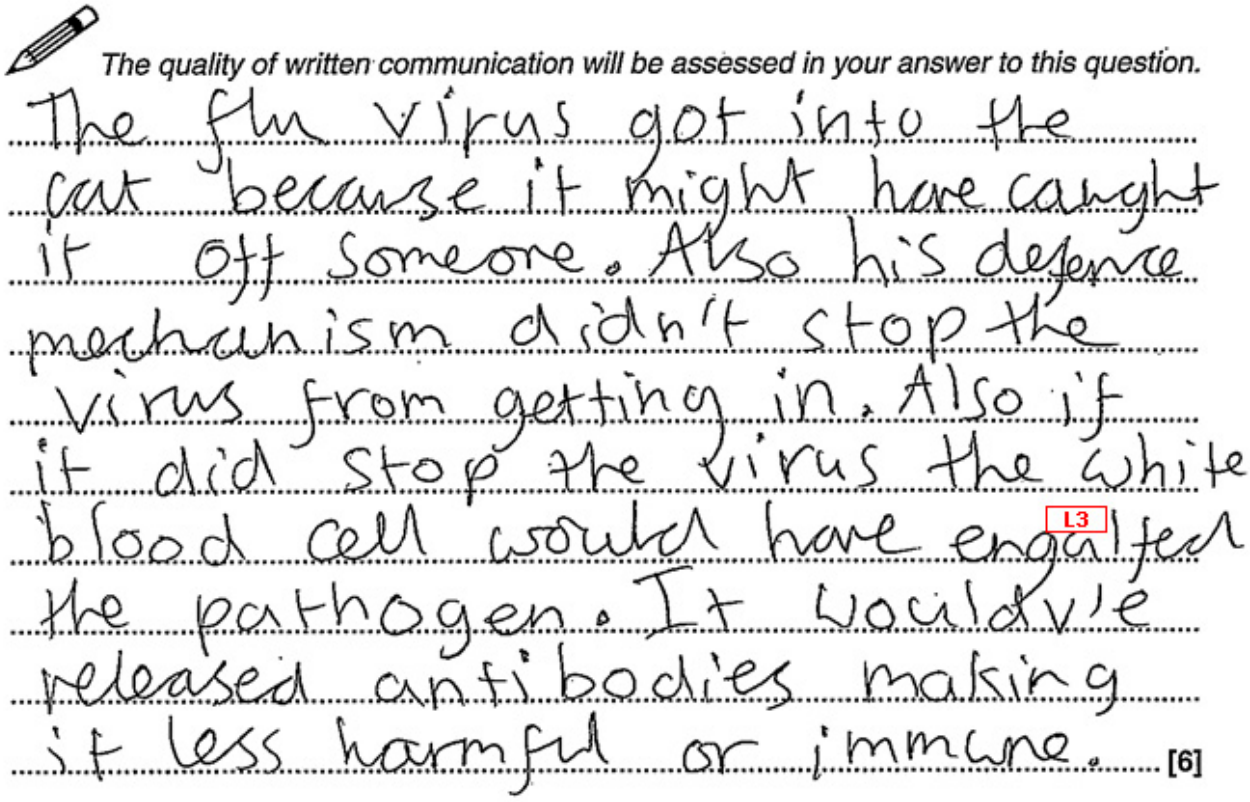
The quality of written communication will be assessed in your answer to this question.

MARKING CRITERIA

Question			Answer	Marks	Guidance
2	(b)		**[Level 3]** Answer applies understanding of pathogens to describe at least one defence mechanism and how it works that may have stopped this virus. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer applies understanding of pathogens to state one defence mechanism that may have stopped this virus. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** An incomplete answer, applies understanding of pathogens to describe how the virus gets into the cat. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to E** **Indicative scientific points at level 3 may include:** **at least one from:** **parts of the body and mechanism involved** • blood - white blood cells engulf pathogen • white blood cells make antibodies • airways have mucus to trap pathogen **Indicative scientific points at level 2 may include:** **parts of the body involved** • white blood cells • antibodies • airways have mucus **Indicative scientific points at level 1 may include:** **how virus enters** • virus came from other cats • virus in air • cat breathed virus in • through the airways • enters cells of the lung **ignore** • skin acts as a barrier • blood clots to stop pathogen • stomach makes acid to kill pathogen • reference to antibiotics **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

EXEMPLARS AND COMMENTARIES

SAMPLE 1



The quality of written communication will be assessed in your answer to this question.

The flu virus got into the cat because it might have caught it off someone. Also his defence mechanism didn't stop the virus from getting in. Also if it did stop the virus the white blood cell would have engulfed the pathogen. It would've released antibodies making it less harmful or immune. [6]

L3

COMMENTARY

Candidate scores 6 marks at Level 3.

The method of infection is not clearly described as the statement of the 'virus got into the cat because it might have caught it off someone' is rather vague but does suggest another organism is involved, although not specifically a cat. However, this candidate has clearly demonstrated an understanding of the role of the white blood cell in engulfing pathogens and also in the production of antibodies and meets more than one of the indicative points of a Level 3 response. There is no evidence to suggest that the quality of written communication impedes the communication of the science involved and in fact many of the keywords involved have the correct spelling so 6 marks were awarded.

SAMPLE 2

The quality of written communication will be assessed in your answer to this question.

L2

The flu would have gotten into the cat by it being near another infected creature. Defence mechanisms (such as white blood cells) should have worked on trying to prevent the pathogen from causing any damage as soon as it entered the body.

[6]

COMMENTARY

Candidate scores 4 marks at Level 2.

The method of infection does suggest another animal is involved and the candidate has recognised that it is from an infected 'creature' but does not identify it as another cat. This candidate has recognised that white blood cells are involved in defence and this is an indicative point of a Level 2 response. The use of the word 'creature' is some evidence of impeding the communication of the science but this was felt insufficient to restrict the mark to 3, so overall 4 marks were awarded.

SAMPLE 3

The quality of written communication will be assessed in your answer to this question.

The Cat could of gained the virus from a different species of animal which have a different defence Mechanism which made it harder for the Cat to fight off which has now moves to her lungs.

L1

[6]

COMMENTARY

Candidate scores 2 marks at Level 1.

The method of infection does suggest another animal is involved but the candidate has incorrectly stated that it would be from a different species. This candidate has, however, recognised that the virus would enter the cat through the lungs and this is an indicative point of a Level 1 response. The lack of scientific terminology in the response is evidence of impeding the communication of the science but the use of species and lungs meant it was suitable to award 2 marks overall.

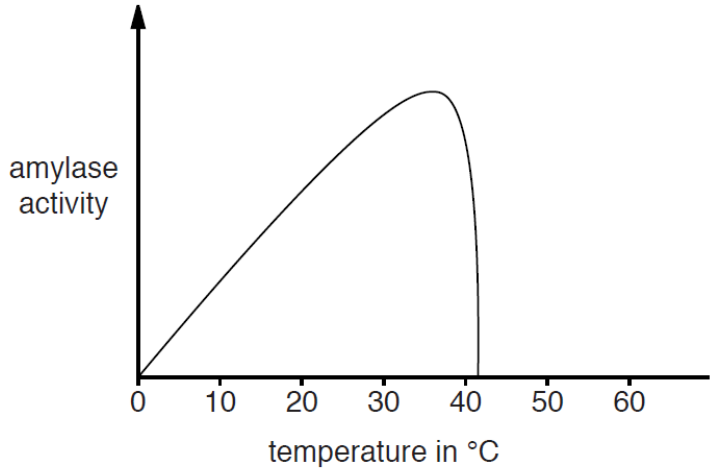
QUESTION 9 (b)

This question was targeted at grades up to and including C and covered low demand and standard demand statements. It was designed to cover Assessment Objective 1 (recall) and Assessment Objective 2 (application).

(b) Amylase is an enzyme which is found in saliva. It only digests starchy foods.

Look at the graph.

It shows the effect of temperature on amylase.



(i) Describe the shape of the graph for amylase and explain why amylase **only** breaks down starch.

The quality of written communication will be assessed in your answer to this question.

MARKING CRITERIA

Question			Answer	Marks	Guidance
9	(b)	(i)	**[Level 3]** Describes rise in enzyme activity linked to temperature increase and identifies the optimum temperature. Also describes the rapid decrease after the optimum temperature and applies understanding to reference that amylase active site being correct shape to recognise starch. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Describes the increase to best / peak activity then a rapid decrease of activity and applies understanding of enzyme lock and key mechanism to explain why only starch is broken down. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Describes general shape as increasing enzyme activity with increased temperature and that there is a best temperature. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to C** **Indicative scientific points at level 3 may include:** • enzyme activity rapid decreases after the optimum temperature due to change in shape of active site • reference to amylase active site being correct shape to recognise starch **Indicative scientific points at level 2 may include:** • enzyme activity increases at beginning then decreases • optimum temperature at peak of graph • optimum temperature is at 37°C +/- 1°C • describes lock and key mechanism **allow** best /peak temperature instead of optimum **allow** references to higher level denaturing to explain lack of activity after 42°C **ignore** enzyme is no good after 42°C **no credit** for enzyme dies **Indicative scientific points at level 1 may include:** • as temperature rises the rate of enzyme activity increases • best temperature identified

EXEMPLARS AND COMMENTARIES

SAMPLE 1

(i) Describe the shape of the graph for amylase and explain why amylase **only** breaks down starch.

The quality of written communication will be assessed in your answer to this question.

Amylase is a enzyme. ~~& ETC~~ most enzyme's have a optimumum temperature of 37°c. Thats why after 37°c on the graph the amylase activity decreased. Amylase of breaks down starch because it only ~~have~~ has a substate that matches starch. and when it fits in the active site the enzyme get to work.

L3

[6]

COMMENTARY

Candidate scores 6 marks at Level 3.

The candidate has correctly identified the optimum temperature at 370C and recognised the fall in activity after 370C and although hasn't specifically identified 420C as the point at which denaturing occurs, the candidate has referred to the specificity of the amylase and that it only breaks down starch when the starch fits the active site. This is an indicative point of a Level 3 response. The idea that the amylase works on a substrate that only starch matches demonstrates a clear understanding of the lock and key hypothesis. It was felt that this response best matched with Level 3. Although optimum is incorrectly spelt there is little other evidence of impeding the communication of the science involved so overall 6 marks were awarded.

SAMPLE 2

The quality of written communication will be assessed in your answer to this question.

L2 The activity of the amylase drops when it is just over 40° - this is because the enzyme denatures (because the temperature is to high) so that it can no-longer work. Amylase can only digest starchy foods because it's an enzyme and enzymes are differentiated (which means that they are made for one job / purpose each.

..... [6]

COMMENTARY

Candidate scores 4 marks at Level 2.

The candidate has recognised the fall in activity after 400C and, although hasn't specifically identified 420C as the point at which denaturing occurs, the candidate has referred specifically to denaturing and commented about the temperature being too high for the enzyme to work and this is an indicative point of a Level 2 response. The use of the word 'differentiated' and 'made for one job' is going someway to identifying the specificity but there is not a clear understanding of the lock and key hypothesis demonstrated. It was felt that this response best matched with Level 2. There is little evidence of impeding the communication of the science so overall 4 marks were awarded.

SAMPLE 3

The quality of written communication will be assessed in your answer to this question.

L1

The shape has its highest peak at 35°C and stops at 42°C this means that at a certain temperature, the amylase stops digesting the starchy foods.
The amylase only breaks down starchy foods are this is what the cell is there for. It will not do any other job except for breaking the starchy foods down. [6]

COMMENTARY

Candidate scores 2 marks at Level 1.

The candidate has recognised the peak in activity but has inaccurately identified this at 350C but accurately identified 420C as the point at which the enzyme stops functioning. The candidate has not referred to denaturing and there is no understanding of the lock and key hypothesis or that the temperature is too high for the enzyme to work and this is indicative of a Level 1 response. There is some attempt to identify the specificity but this is a weak reference to it not doing any other job than breaking down starch. It was felt that this response best matched with Level 1. There is little evidence of scientific terminology to support the communication of the science so overall 2 marks this were awarded.

BIOLOGY

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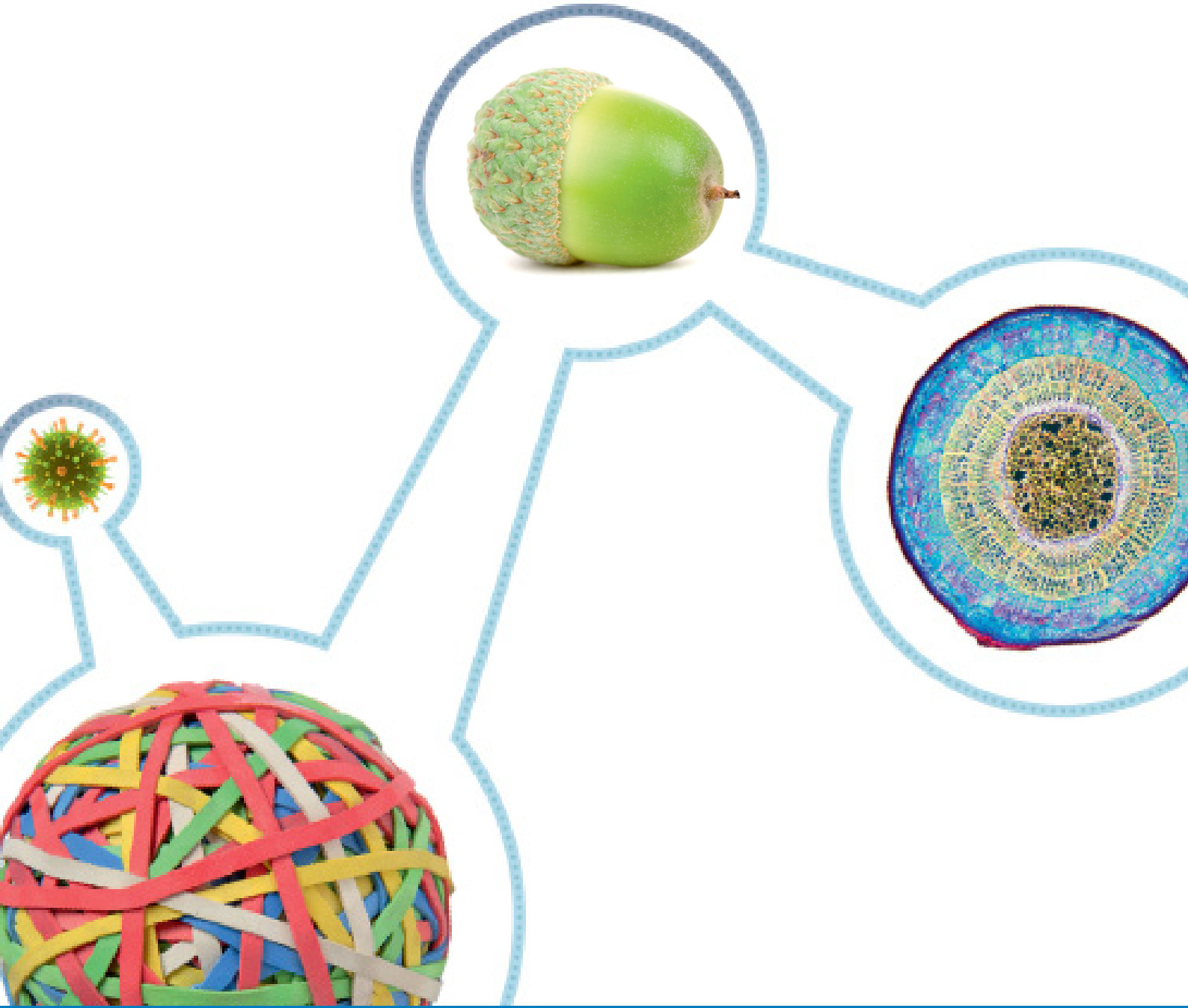
BIOLOGY B B731/02
JANUARY 2012



A few points:

- LOR (level of response) descriptors are NOT hierarchical – you are looking for best fit.
- You are not looking for a perfect match to the descriptors.
- Indicative content is just that – it is not a list in which everything has to be matched in the answer.
- If you have assigned an answer to Level 1, 2 or 3, then first look to see if you can award 2, 4 or 6 marks, however if a candidate's answer is worded in such a way that it has impeded communication of the science to the extent that you are not confident in assigning 2, 4, or 6 marks, or the science has weaknesses for that level, then assign 1, 3 or 5.
- Look for the 'diamonds in the rough' – if part of an answer allows you to award a level, then do not penalise them because they have also written things elsewhere that may be irrelevant or even incorrect, unless the incorrect statements contradict the points you are giving credit for.

QUESTION 2(a)

This question was targeted at grades up to and including A* and covered high demand statements. It was designed to cover Assessment Objective 1 (recall) and Assessment Objective 2 (application).

2 Look at the picture of a prescription drug with the brand name Deflex.

(a) Emma has difficulty sleeping.

Her doctor prescribes Deflex.

Deflex is a drug which affects the nervous system.

Suggest and explain how Deflex affects the nervous system to help Emma sleep.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

MARKING CRITERIA

Question			Answer	Marks	Guidance
2	(a)		**[Level 3]** Answer gives a correct explanation of how Deflex may reduce transmission across synapses in terms of its effect on (neuro) transmitters or receptors. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Answer indicates reduction of transmission across synapses OR reduced activity of (neuro)transmitters. Mechanism unclear. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Suggests that Deflex is a depressant or reduces transmission of impulses. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to A/A*** **Indicative scientific points at level 3 may include:** • Deflex binds with receptors in synapses • transmitter can no longer bind to receptors • binds with the neurotransmitter once released • breaks down the released neurotransmitter **Indicative scientific points at level 2 may include:** • Deflex works on synapses • Deflex reduces amount of transmitter substance **Indicative scientific points at level 1 may include:** • Deflex is a depressant • no impulse sent along second neurone **ignore** Deflex is a sedative / sleeping tablet **ignore** Deflex affects / slows the nervous system **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

EXEMPLARS AND COMMENTARIES

SAMPLE 1

The quality of written communication will be assessed in your answer to this question.

Because you can react to something by It will help by not being able to react to something and make it easyer for her to sleep much better

[6]

COMMENTARY

Candidate scores 0 marks at Level 0.

There is no match to any descriptors.

SAMPLE 2

The quality of written communication will be assessed in your answer to this question.

L1 The drug is a depressant as it reduces the activity of the brain making it less active this slows down your nervous system and makes you body relaxed, it consumers your energy making you more tired so you will sleep. But due to you brain being less active your ~~nerves~~ nerve systems will slow down and senses so it may be hard to wake up in an emergency.

[6]

COMMENTARY

Candidate scores 2 marks at Level 1.

The correct reference to Deflex being a depressant gains Level 1. If the correct term had not been used and instead the candidate had simply referred to nerve signals being slowed down, then 1 mark would have been awarded.

SAMPLE 3

The quality of written communication will be assessed in your answer to this question.

Deflex will help Emma to relax so that she can sleep. It will slow her nervous system down so that she feels sleepy istead of feeling alert and awake. This is because the drug is a depressant and slows her body down. It will affect the synapses by sending slowing the slower impulses through.

[6]

COMMENTARY

Candidate scores 3 marks at Level 2.

The reference to synapses puts this at Level 2 but the wording that impulses cross the synapses is not correct, so 3 marks are awarded rather than 4.

SAMPLE 4

The quality of written communication will be assessed in your answer to this question.

Drugs block the transmission of nerve impulse through the synapse by binding with the receptor molecules in the membrane of the receiving neurone. This means that reaction are much slower, helping Emma to fall asleep. The drugs slow ~~down~~ down the nervous system, so she feels tired.

[6]

COMMENTARY

Candidate scores 6 marks at Level 3.

The answer gives a valid mechanism of how the drug can reduce transmission across synapses, and so matches Level 3. Correct terminology and a clear explanation gains 6 marks.

QUESTION 6(a)

This question was targeted at grades up to and including A* and covered high demand statements. It was designed to cover Assessment Objective 1 (recall) and Assessment Objective 2 (application).

6 Scientists discover a new animal living in an area of remote forest.

Two of the scientists are discussing the animal.

Explain why Anna is more likely to be correct and how she could investigate her ideas.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

MARKING CRITERIA

Question			Answer	Marks	Guidance
6	(a)		**[Level 3]** Answer gives a complete explanation using all three ideas. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer gives a clear explanation using at least two of the three ideas. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer includes a simple explanation using one of the three ideas. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to A/A*** **Indicative scientific points may include:** • Idea 1: Evolutionary relationships between organisms can be tested by using DNA analysis or by looking at similarities between multiple characteristics. • Idea 2: Organisms can share similar characteristics due to evolutionary but also ecological reasons • Idea 3: Members of a species can reproduce / produce fertile offspring. **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

EXEMPLARS AND COMMENTARIES

SAMPLE 1

The quality of written communication will be assessed in your answer to this question.

Anna is more likely to be correct as new species can be made from a different species, for example an animal produce alot of offspring, the best adapted survive, the best adapted animals then pass on ideal genes to the next generation, this could have been happening for years, which could create a new species over time if the same animal mate. Anna can investigate her ideas by observing the animals behaviours in their habitat. [6]

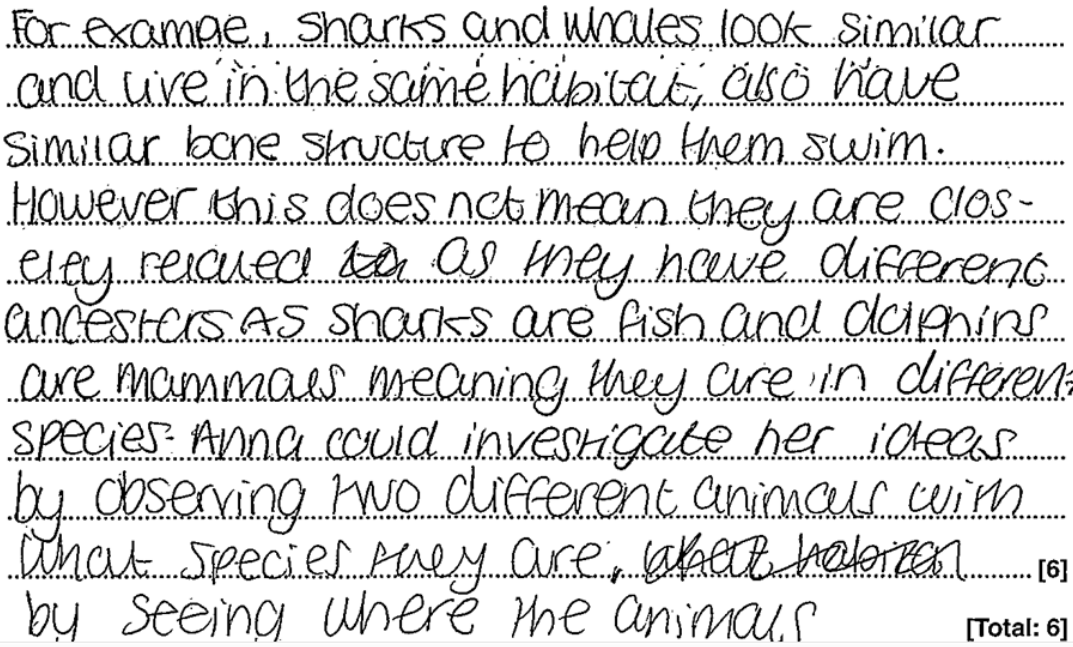
[Total: 6]

COMMENTARY

Candidate scores 0 marks at Level 0.

The answer has not addressed any descriptors.

SAMPLE 2


For example, sharks and whales look similar and live in the same habitat, also have similar bone structure to help them swim. However this does not mean they are closely related as they have different ancestors as sharks are fish and dolphins are mammals meaning they are in different species. Anna could investigate her ideas by observing two different animals with what species they are, where they are [6] by seeing where the animals [Total: 6]

COMMENTARY

Candidate scores 1 mark at Level 1.

The answer matches Idea 2 in the guidance but is not clearly explained so only 1 mark is awarded. 2 marks would have been awarded if the candidate had explained that the shark and dolphin share similar features because they are adapted to the same habitat.

SAMPLE 3

The quality of written communication will be assessed in your answer to this question.

Anna is more likely to be correct than Mark because the organisms may look similar for the reason that they have both adapted to their environment. To investigate her ideas Anna could look at the animal's genes and compare it to those of other species. The animal could have changed through evolution and may have the same common ancestor as another species. It's genes should be looked at to see from it's Kingdom, to it's genes and species to discover whether it is a new species or not. [6]

[Total: 6]

COMMENTARY

Candidate scores 4 marks at Level 2.

The candidate has clearly explained Idea 2 and then has said enough to match Idea 1 from the guidance. The last part of the answer is irrelevant but doesn't contradict previous statements, so is ignored.

SAMPLE 4

The quality of written communication will be assessed in your answer to this question.

A specieces is a group of organisms that can breed together to produce fertile off-spring. Sometimes it is difficult to classify organisms, for example the dolphin and the shark share many characteristics and look similar but actually are two different species, proving Anna's point. She could investigate by seeing if the animal is fertile because it could be a hybrid, the product of two organisms breeding together from an infertile offspring, then it is a different species. Also some animals that share similar DNA, meaning they shared a common ancestor are closely related in the same species but could occupy very different ecological niches and therefore look and behave not alike. She could find out if the animal is a species by looking at how similar the DNA is. [6]

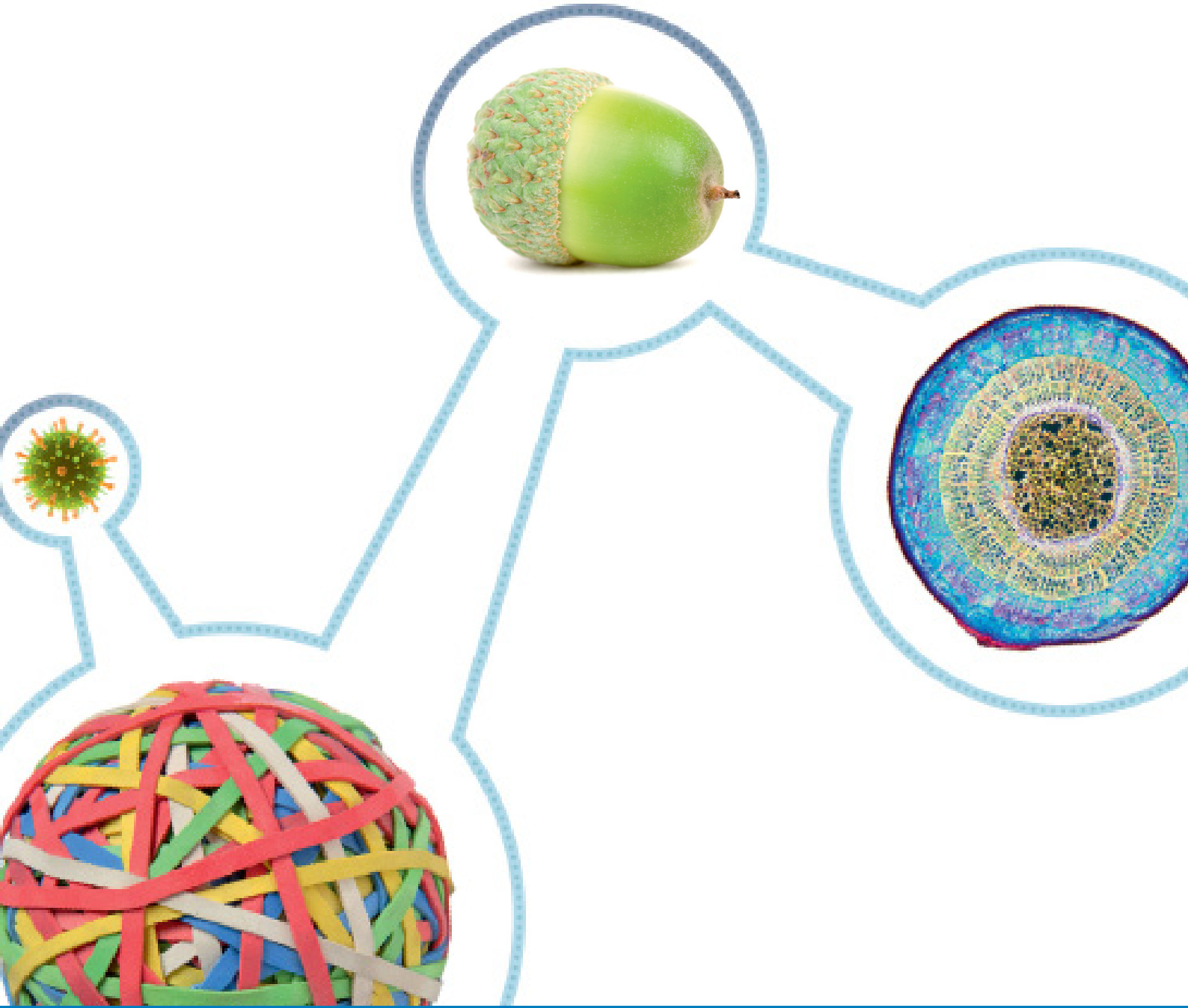
COMMENTARY

Candidate scores 5 marks at Level 3.

The candidate has used all three ideas from the mark scheme and so is at Level 3. However the ideas are not fully and clearly explained so 5 marks are awarded rather than 6. Idea 2 is only partly matched because the candidate has not fully explained that dolphins and sharks have similar adaptations because they live in the same habitat. Idea 3 is not explained clearly either. Idea 1 is fully matched.

CHEMISTRY

GCSE GATEWAY SCIENCE
CHEMISTRY B B741/02
JANUARY 2012



QUESTION 7

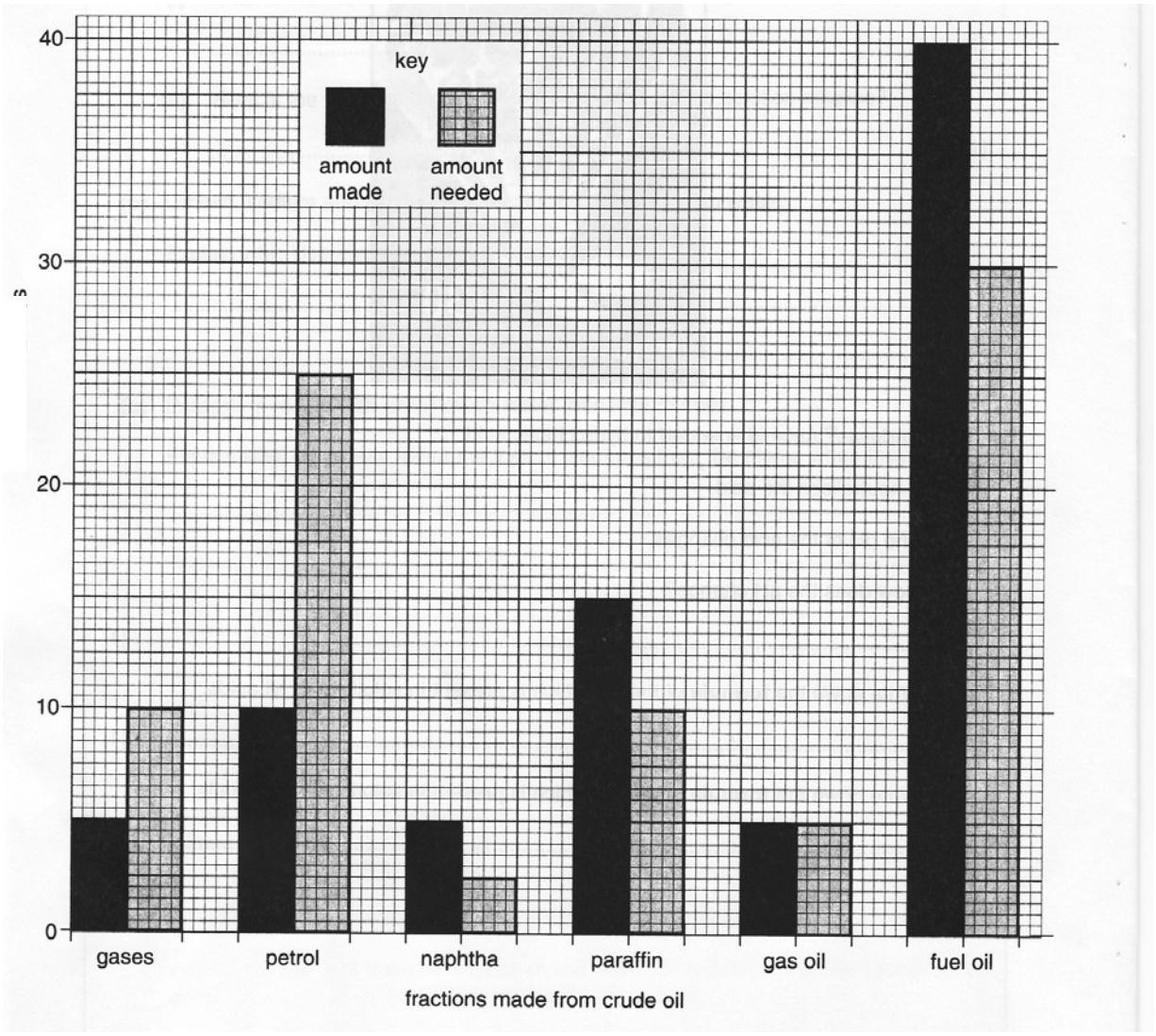
This question was targeted at grades up to and including A* and covered both standard demand and high demand statements. It was designed to cover Assessment Objective 1 (recall) and Assessment Objective 2 (application)

7 Oil refineries separate crude oil into useful fractions.

They do this by fractional distillation.

The bar chart shows the amount of some fractions **made** from 100 tonnes of crude oil.

It also shows the amount of these fractions **needed** for everyday uses.



(a) Look at the amount made and the amount needed for each fraction in the bar chart.

What problems does this give the manager of an oil refinery?

Explain how cracking overcomes these problems. Include an equation for cracking.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

MARKING CRITERIA

The mark scheme included the following guidance for marking level of response questions.

For answers marked by levels of response:

a. **Read through the answer from start to finish**

b. **Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor

c. **To determine the mark within the level,** consider the following:

Descriptor	**Award mark**
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

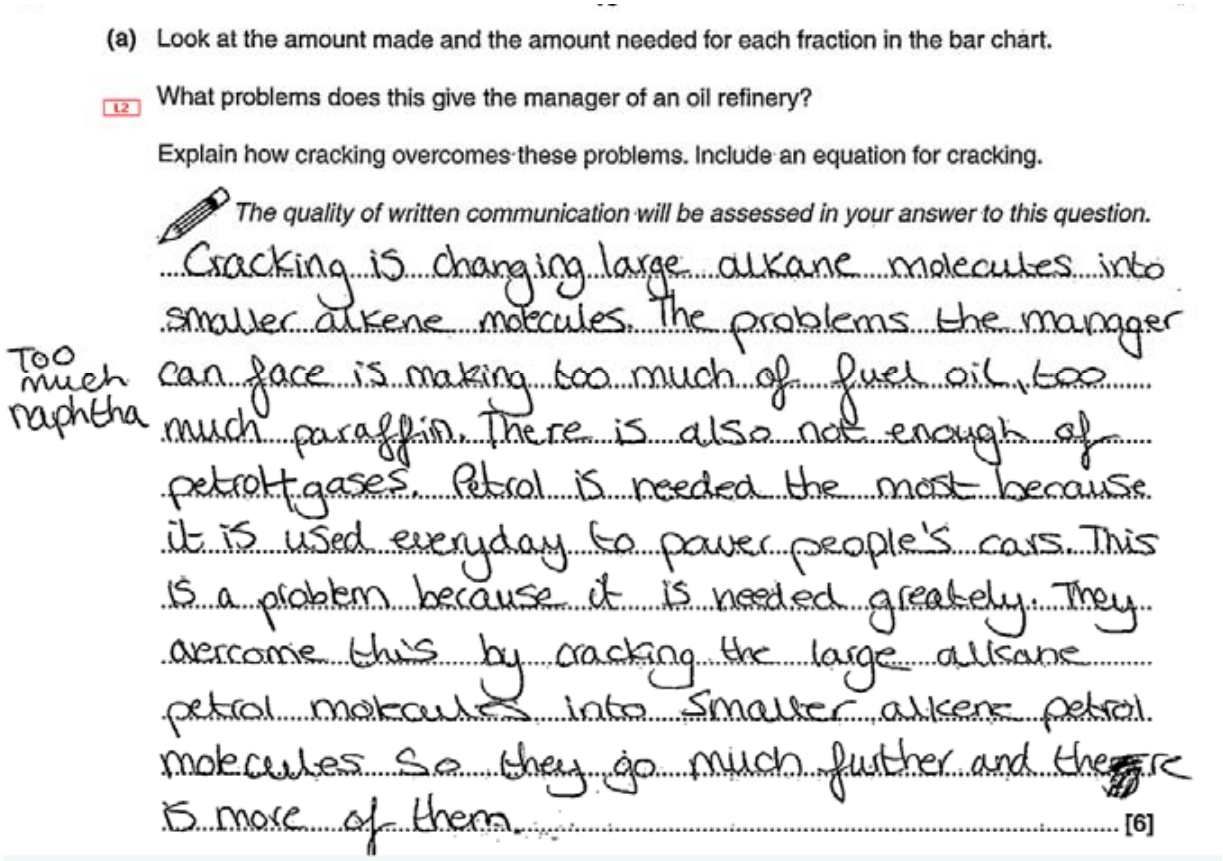
d. Quality of Written Communication skills assessed in 6-mark extended writing questions may include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer	Marks	Guidance
2	(a)		**[Level 3]** Comprehensive analysis of shortfalls and excesses of fractions. Comprehensive description of cracking. Relevant word or symbol equation included. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Some analysis of shortfalls and excesses of fractions. Limited description of cracking. May attempt to write a word or symbol equation. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Simple analysis of shortfall and excess of fractions, and/or rudimentary description of cracking. Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to A/A*.** **ignore** references to fractional distillation at all levels. **allow** chains as idea of molecules for levels 1 and 2. **Indicative scientific points at level 3 may include:** • some of the points from level 2 plus • fuel oil, paraffin and naphtha exceed demand • insufficient petrol and gases to meet demand • cracking helps the oil refinery match supply of useful products (petrol) with the demand for them. • Correctly balanced equation e.g. C12H26 C8H18 + C4H8 **Indicative scientific points at level 2 may include:** • fuel oil /paraffin /naphtha exceed demand • petrol / gases not sufficient to meet demand • cracking converts large alkane molecules into smaller (alkane and alkene) molecules – this may be illustrated with an equation • cracking makes useful (smaller) alkene molecules (which can be used to make polymers) • If no cracking then fuel oil would need to be stored. **Indicative scientific points at level 1 may include:** • idea that there is too much of some fractions • idea that there is not enough of other fractions • cracking makes more petrol • idea that cracking breaks large molecules to small molecules • cracking needs a high temperature / catalyst Use the L1, L2, L3 annotations in Scoris; do not use ticks.

EXEMPLARS AND COMMENTARIES

SAMPLE 1



(a) Look at the amount made and the amount needed for each fraction in the bar chart.

L2 What problems does this give the manager of an oil refinery?

Explain how cracking overcomes these problems. Include an equation for cracking.

The quality of written communication will be assessed in your answer to this question.

Too much naphtha

Cracking is changing large alkane molecules into smaller alkene molecules. The problems the manager can face is making too much of fuel oil, too much paraffin. There is also not enough of petrol gases. Petrol is needed the most because it is used everyday to power people's cars. This is a problem because it is needed greately. They overcome this by cracking the large alkane petrol molecules into smaller alkene petrol molecules so they go much further and there is more of them. [6]

COMMENTARY

Candidate scores 4 marks at Level 2.

The answer includes a good analysis of both excesses (too much fuel oil and paraffin) and shortfalls (not enough petrol and gases). The description of cracking includes changing large alkane molecules to smaller alkene molecules. Small alkane molecules are not mentioned, however this is in brackets in the mark scheme and so not essential. There is no attempt at an equation ruling out Level 3. This is a Level 2 response. 4 marks were awarded.

It is important to note that not all the indicative scientific points need to be included for the award of a level.

SAMPLE 2

(a) Look at the amount made and the amount needed for each fraction in the bar chart.

L3 What problems does this give the manager of an oil refinery?

Explain how cracking overcomes these problems. Include an equation for cracking.

The quality of written communication will be assessed in your answer to this question.

$C_{10}H_{22} \xrightarrow{\text{Heat}} C_5H_{10} + C_5H_{12}$ (Cracking)

The ~~oil~~ oil refinery needs to meet supply with demand. They do not make enough of things like petrol which are on high demand, and too much of fuel oil is made.

Cracking uses heat and a catalyst to split bonds between atoms, converting long chain alkanes into shorter more useful hydrocarbons like petrol which they need more of.

[6]

COMMENTARY

Candidate scores 6 marks at Level 3.

This candidate has included a correctly balanced equation (which was a rarity). The equation shows a large alkane molecule being broken down into smaller alkane and alkene molecules. The analysis of excesses and shortfalls is not complete but there is a clear reference to the need for the refinery to match supply with demand. This is a Level 3 answer which was awarded 6 marks. It is important to note that the award of 6 marks does not require perfection.

SAMPLE 3

(a) Look at the amount made and the amount needed for each fraction in the bar chart.

(What problems does this give the manager of an oil refinery?)

(Explain how cracking overcomes these problems.) Include an equation for cracking.

The quality of written communication will be assessed in your answer to this question.

L1

Because the manager doesn't meet the amounts needed on some fractions and on some, he has too much of the fraction. He then needs to use cracking to break bigger fractions into smaller fractions. Cracking breaks up bigger fractions which have more than is needed. So then it can be used for smaller fractions which haven't met their demand for.

[6]

COMMENTARY

Candidate scores 2 marks at Level 1.

This candidate does not identify the fractions in excess or where there is a shortfall, but does refer to excesses and shortfalls. There is a rudimentary description of cracking (idea that large molecules are broken into smaller molecules).

QUESTION 14(b)(ii)

This question appeared on both the higher and foundation papers (i.e. an overlap question). It examined only standard demand statements so was aimed at grades C and D. It assessed Assessment Objective 1 (recall of collision theory) and Assessment Objective 2 (application of collision theory to this particular reaction.

Question 14(a) and 14(b)(i) have been included for completeness.

14 Magnesium reacts with dilute hydrochloric acid.

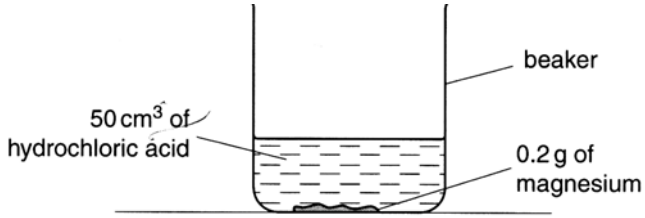
Magnesium chloride and hydrogen are made.

(a) Write down the **word** equation for this reaction.

..... **[1]**

(b) Peter and Rachel investigate the reaction between magnesium and hydrochloric acid.

Look at the apparatus they use.



They time how long it takes for all of the magnesium to react (the reaction time).

Look at their results.

experiment	temperature of acid	concentration of acid	magnesium ribbon or powder	reaction time in seconds
A	cold	dilute	ribbon	240
B	warm	dilute	ribbon	100
C	cold	concentrated	ribbon	120
D	cold	dilute	powder	50

(i) Peter and Rachel conclude that the reaction time gets shorter as the temperature and concentration of acid increase.

Explain how their results show this.

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[2]

(ii) Peter and Rachel can use a model called **collision theory** to explain how factors affect the rate of a reaction.

They know the rate of reaction increases when

- the temperature of the acid increases
- magnesium powder is used instead of magnesium ribbon.

Explain why, using collision theory.

The quality of written communication will be assessed in your answer to this question.

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.....**[6]**

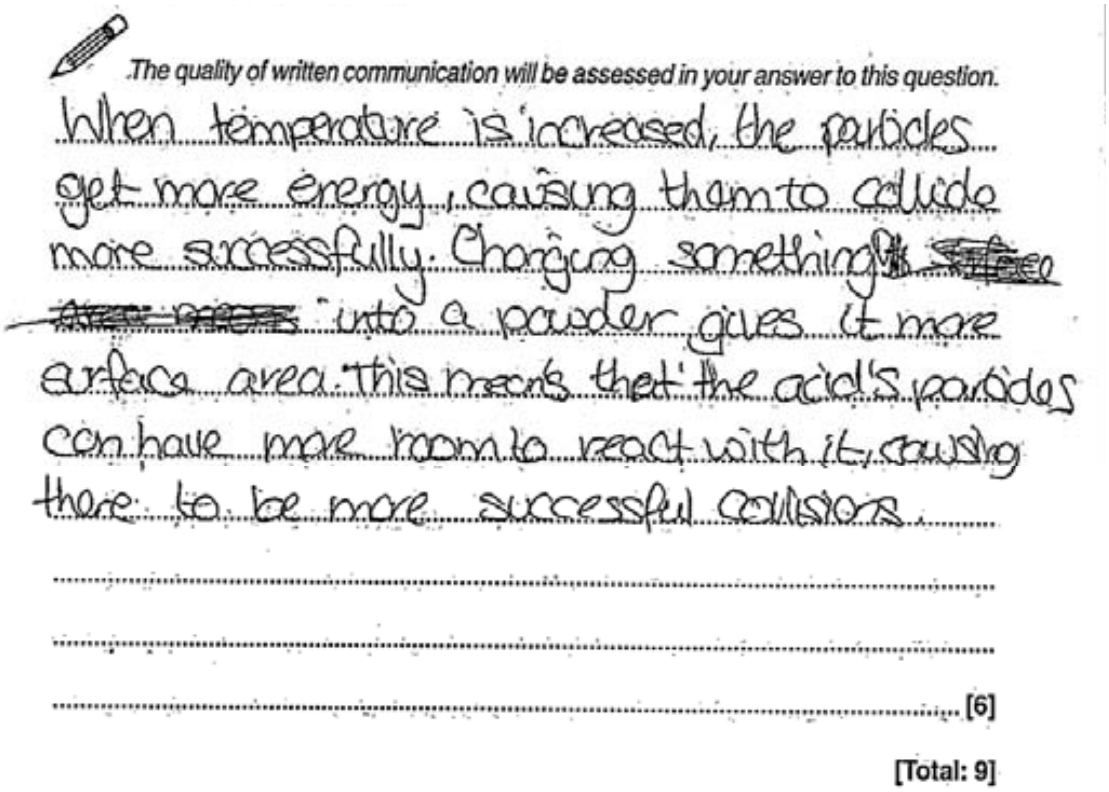
[Total: 9]

MARKING CRITERIA

Question			Answer	Marks	Guidance
14	(b)	(ii)	**[Level 3]** Applies knowledge and understanding of collision theory to explain both factors in detail although the reference to more collisions may only be made for one of the factors. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Applies knowledge and understanding of collision theory to explain one of the factors in detail or partially explain both factors Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Appreciation that the rate of any reaction depends on the number of collisions in whatever context it is used Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to C** At all levels **ignore** reference to faster collisions and to more particles and **ignore** particles vibrate more **allow** answers that give ora but it must be very clear that this is what they have done **Indicative scientific points at levels 2 and 3 may include:** rate increases with **temperature** because • acid particles move faster / acid particles have more energy • more collisions between particles of acid and magnesium – this does not have to be qualified eg more (successful) collisions or more collisions (per second) **allow** – higher level answers for temperature that refer to more acid particles having sufficient energy to react or more acid particles having energy above that of the activation energy rate increases with **powder** because • magnesium has greater surface area / powder has more magnesium particles exposed • more collisions between particles of acid and magnesium – this does not have to be qualified eg more (successful) collisions or more collisions (per second) **Indicative scientific points at level 1 may include:** • more collisions gives a faster reaction even if referring to concentration or pressure • link between number of collisions and rate of reaction **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

EXEMPLARS AND COMMENTARIES

SAMPLE 1



The quality of written communication will be assessed in your answer to this question.

When temperature is increased, the particles get more energy, causing them to collide more successfully. Changing something ~~from pieces~~ into a powder gives it more surface area. This means that the acid's particles can have more room to react with it, causing there to be more successful collisions.

[6]

[Total: 9]

COMMENTARY

Candidate scores 6 marks at Level 3.

The candidates has fully explained, using collision theory, how both increasing the temperature and using powdered magnesium increase the rate of this reaction. The detail of the answer exceeds that required by the mark scheme (e.g. more successful collisions rather than more collisions).

SAMPLE 2

The quality of written communication will be assessed in your answer to this question.

When the temperature of the acid ~~increases~~ increases and the concentration of the acid ~~the reaction~~ increase the rate of reaction gets faster because higher temperature gives particles more energy causing more collisions. The powder is more of a solid ~~than~~ than ribbon which means ~~more~~ that there ~~isn't~~ isn't much room for particles therefore more collisions.

[6]

[Total: 9]

COMMENTARY

Candidate scores 4 marks at Level 2.

The candidate has explained how increasing the temperature increases the rate of reaction using collision theory. The explanation of this factor is complete and has sufficient detail. The reference to concentration is ignored. The references to using powdered magnesium do not mention increased surface area and are confused.

SAMPLE 3

The quality of written communication will be assessed in your answer to this question.

Because magnesium powder doesn't take as long to get concentration of acid and it's better than magnesium ribbon for reacting

[6]

[Total: 9]

COMMENTARY

Candidate scores 0 marks.

This candidate makes no reference to collisions and does not answer the question. This is a Level 0 response and does not score.

SAMPLE 4

The quality of written communication will be assessed in your answer to this question.

Peter and Rachel find out in there experiment that the higher the temperature the quicker the reaction time. So the warm water works as a catalyst. They also found out powder reacts quicker than ribbon. The collision theory is when particles collide creating a reaction. This method shows powder and warm water create a quicker reaction time.

[6]

[Total: 9]

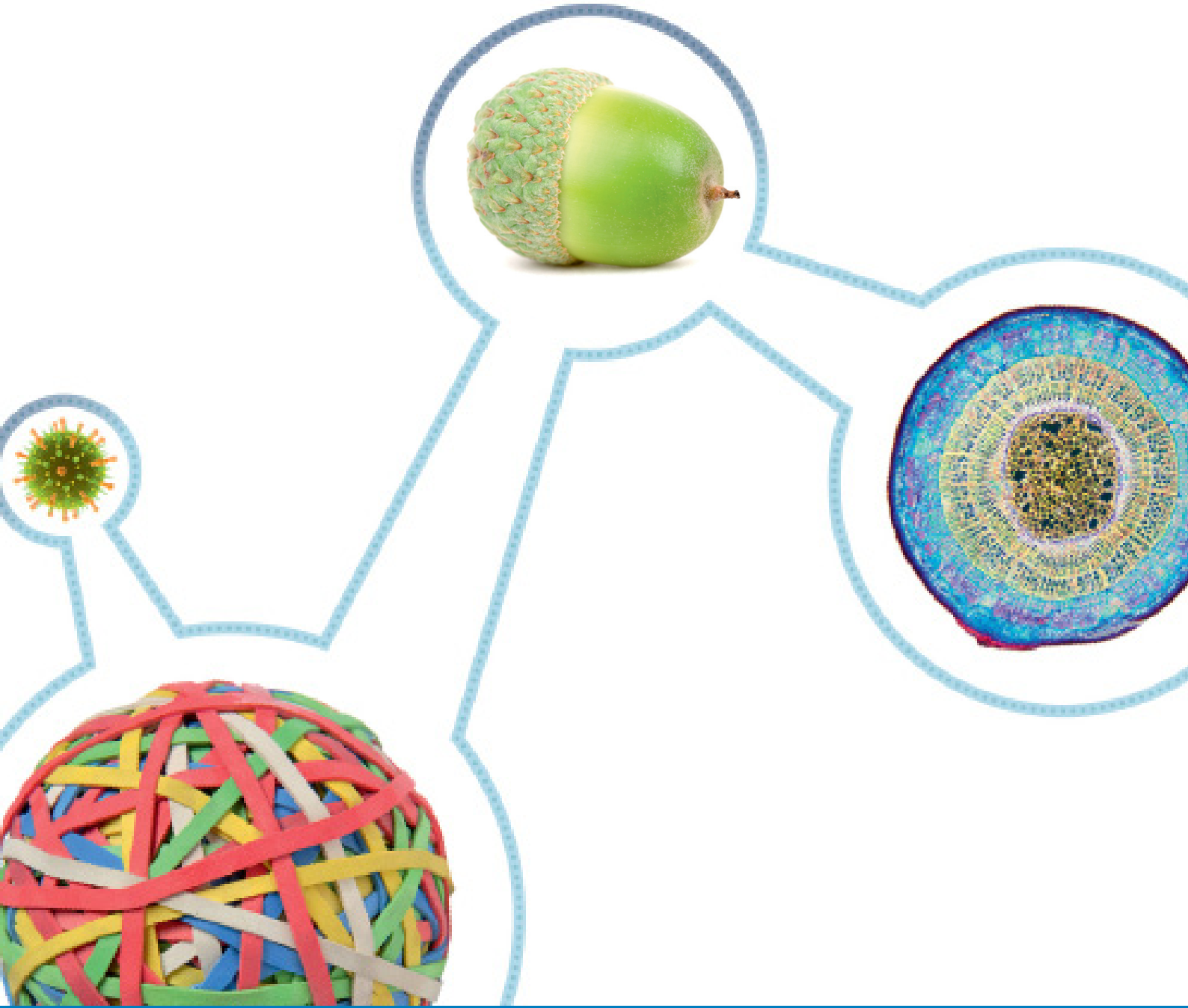
COMMENTARY

Candidate scores 1 mark at Level 1.

The candidate has made a vague reference to collisions but has not linked more collisions to increased rate. There is no explanation of the effect of increased temperature or powdering the magnesium. This is a Level 1 response and the chemistry is only a partial match at Level 1. 1 mark is awarded

PHYSICS

GCSE GATEWAY SCIENCE
PHYSICS B B751/02
JANUARY 2012

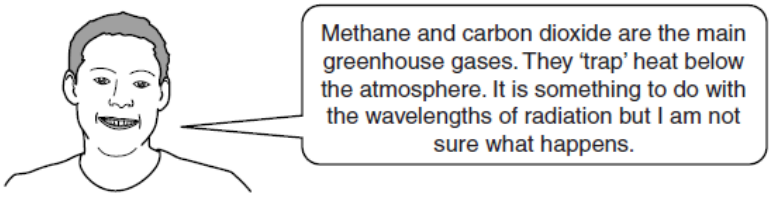


QUESTION 6 (b)

High demand question.

Question 6 was about the greenhouse effect. It was aimed at grades B-A* and covered mainly high demand statements although some credit could be gained from an explanation using standard demand ideas. The question was designed to be answered in terms of assessment objective AO1 (recall, knowledge and understanding).

6 (b) Josh tries to explain what the greenhouse effect is.



Explain in more detail the role of radiation in the greenhouse effect.

The quality of written communication will be assessed in your answer to this question.

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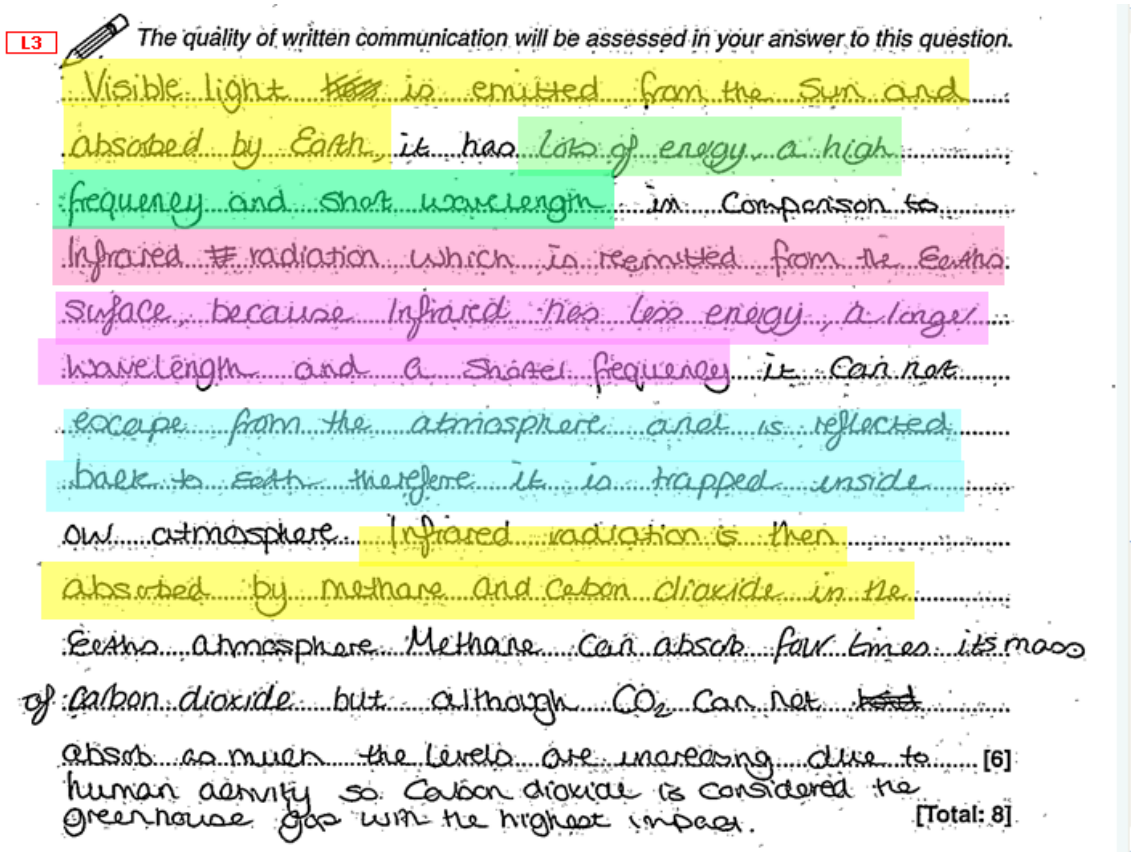
..... **[6]**

MARKING CRITERIA

Question			Answer	Marks	Guidance
6	(b)		**[Level 3]** Explanation should include detail of at least two of the mechanisms involved in terms of different wavelengths. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Explanation should include at least on of the general mechanisms involved in terms of different wavelength of radiation. Correct order of wavelength not essential. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Simple description of the mechanisms or processes involved. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted at grades up to A/A*** **Indicative scientific points at Level 3 may include:** • Sun is very hot so wavelength of radiation emitted is very small • short wavelength radiation comes from the Sun • short wave radiation from Sun is absorbed by and heats the Earth • the Earth radiates or emits heat as longer wavelength • the longer wavelength radiation that heats the Earth is infrared radiation • greenhouse gases or atmosphere absorb some of the longer waves **Indicative scientific points at Level 2 may include:** • absorption of infrared radiation warms the greenhouse gases • radiation at most wavelengths can pass through the Earth's atmosphere • Earth radiates or emits heat out / back • certain wavelengths are absorbed or some reflected **Indicative scientific points at Level 1 may include:** • (greenhouse) gases produced trapped (in atmosphere) • Sun's radiation reaches or is absorbed by Earth • Earth gives out heat / radiation / energy • radiated heat cannot penetrate the atmosphere / is trapped / reflected • radiated heat cannot be absorbed by the atmosphere • atmosphere warms the Earth **ignore** ultraviolet reference to ozone layer limits mark to max 2 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

EXEMPLARS AND COMMENTARIES

SAMPLE 1



L3 The quality of written communication will be assessed in your answer to this question.

Visible light ~~from~~ is emitted from the Sun and absorbed by Earth, it has lots of energy a high frequency and short wavelength in comparison to Infrared ~~#~~ radiation which is reemitted from the Earths Suface, because Infrared has less energy, a longer wavelength and a shorter frequency it can not escape from the atmosphere and is reflected back to Earth therefore it is trapped inside our atmosphere. Infrared radiation is then absorbed by methane and Carbon dioxide in the Earths atmosphere. Methane can absob four times its mass of carbon dioxide but although CO_2 can not ~~bsob~~ absob as much the levels are increasing due to human activity so Carbon dioxide is considered the greenhouse gas with the highest impact. [6]

[Total: 8]

COMMENTARY

Candidate scores 6 marks at Level 3.

This response is a very clear and well ordered description of the processes of radiation involved in the greenhouse effect. The ideas of emission from the Sun, absorption by the Earth, re-emission and absorption by greenhouse gases are correctly linked to wavelength. A good Level 3 answer – 6 marks awarded.

SAMPLE 2

Explain in more detail the role of radiation in the greenhouse effect.

L2 *The quality of written communication will be assessed in your answer to this question.*

As radiation from the sun enters the atmosphere, it heats the earth's surface. The radiation is then emmited back into space, once absorbed. CO_2 absorbs the radiation and reflect the radiation back to earth. As the wavelengths of the radiation are too small to get past and not be reflected by the CO_2 and methane in the atmosphere.

[6]

COMMENTARY

Candidate scores 4 marks at Level 2.

This response contains correct references to absorption and re-emission of radiation.
Although there is some recognition that wavelength is important the answer falls short of a clear explanation and is Level 2. 4 marks were awarded.

SAMPLE 3

Explain in more detail the role of radiation in the greenhouse effect.

The quality of written communication will be assessed in your answer to this question.

L1

Radiation from the sun gets trapped in the by greenhouse gases as they the Earth's atmosphere by greenhouse gases such as methane and carbon dioxide. This shortens the wavelength so is trapped heat gets trapped. This increases world's temperature and can cause rising sea levels.

[6]

COMMENTARY

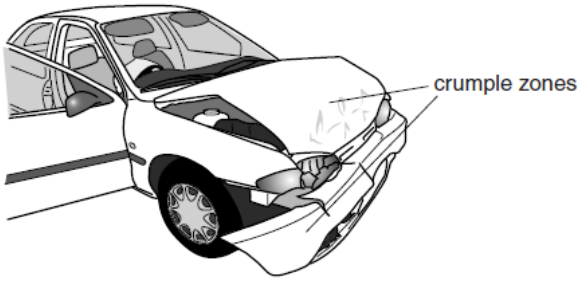
Candidate scores 2 marks at Level 1.

This response contains the idea of trapping heat in the Earth's atmosphere together with a mention of wavelength but it is a limited explanation and scores at Level 1. 2 marks awarded.

OVERLAP QUESTION

Question 11 was about crumple zones. It was aimed at grades C/D and covered standard demand statements although full credit could be gained from an explanation using higher demand ideas. The question was designed to be answered in terms of assessment objective AO1 (recall, knowledge and understanding) and assessment objective AO2 (application of knowledge and understanding).

11 Cars have many safety features such as crumple zones.



Crumple zones help to protect the occupants if a car is involved in a crash.

Car manufacturers continually try to improve safety features for drivers and passengers.

Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

MARKING CRITERIA

Question			Answer	Marks	Guidance
11			**[Level 3]** Explanation of the reasons for having crumple zones in a car including the idea of force reduced or lower rate of change of momentum. A more detailed description of the method(s) of testing or the use of the data or retesting should be included. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Ideas of longer time of collision or lower acceleration or transfer of energy resulting in reduction of injury. Some reference to testing should be included. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Idea of changing shape and protecting occupants or reduce injuries in a crash may be included or mentions simple points in the testing process. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**6**	**This question is targeted up grade C** **Indicative scientific points at Level 3 may include:** • idea of spreading the momentum change on passenger • longer time collision time to transfer momentum • retest with new design feature • measure forces on test dummies • how crumple zones protect dummies • crumple zone design or placement improved • collection and analysis of data from actual crashes • video crash tests **allow higher level answers at level 3** • forces reduced due to increased stopping / collision distance or time • lower acceleration (of driver or passenger) • spreading change in momentum over longer time reduces forces on driver or passenger and reduces potential injury **Indicative scientific points at Level 2 may include :** • longer time collision time or distance produced • idea of transfer of car or driver's energy • injuries in a crash are due to rapid deceleration of parts of the body • features are to reduce injuries to driver or passenger • measurements made on test dummies • assessment of effectiveness of crumple zones • new improved design fitted to car **Indicative scientific points at Level 1 may include:** • features change shape in a crash • features absorb energy in a crash • crash simulation • 'dummy' driver / passengers used • crumple zones examined **throughout** answer **ignore** slows down impact or force **ignore** absorbs force or impact **Use the L1, L2, L3 annotations in Scoris; do not use ticks**.

EXEMPLARS AND COMMENTARIES

SAMPLE 1

Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.

The quality of written communication will be assessed in your answer to this question.

L3 When a vehicle is involved in an accident the crumple zones crumple. This makes the car slow down over a longer time, therefore reducing the force acting on the occupants. This is because force=mass x acceleration. If the acceleration is less then the force will also be less. Manufactures test crumple zones by crashing the cars with crash test dummies in them and measuring the force acting on the dummies. This helps them to see how effective the crumple zones are and where the force is mainly acting on them. This will improve future car design as it will help designers to choose where to locate crumple zones and how much they should crumple. [6]

[Total: 6]

COMMENTARY

Candidate scores 6 marks at Level 3.

This response is a strong Level 3 answer. There is good use of the physics ideas based around F=ma resulting in reduced force on the car's occupants. A sound description of a testing regime is also included. 6 marks awarded.

SAMPLE 2

Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.

L2 *The quality of written communication will be assessed in your answer to this question.*

Crumple Zones increase the impact area and absorb some of the energy from the crash by increasing the impact time. An airbag for example will absorb the energy from the crash by ~~absorb~~ increasing the time the drivers head hits the dashboard, reducing the energy and harm felt by the driver. Crash test dummies are used to simulate crashes in cars and test ~~their~~ new crumple zones. If the amount of force recieved by the test dummy ~~was~~ converted to data is too harmful for a human to survive without great injury, the car manufacturers know, that the crumple zone ~~is~~ used isn't effective. [6]

COMMENTARY

Candidate scores 4 marks at Level 2.

This response is a secure Level 2 with good description of testing related to the increased collision (impact) time and absorption of energy. 4 marks awarded.

SAMPLE 3

L1 Explain in detail how crumple zones work and describe how manufacturers test crumple zones and use the results to improve future car design.

The quality of written communication will be assessed in your answer to this question.

Crumple zones are areas at the front and back of the car which crumple when are collided with. This decreases its speed, which then increases the distance in which the car is stopped over. This means that the cars kenetic energy is reduced less rapidly, meaning that the people inside the car don't get thrown foward as suddenly than if there was no crumple zone the crumple zone increases the time and distance of a crash. [6]

[Total: 6]

COMMENTARY

Candidate scores 2 marks at Level 1.

This response actually includes some points that would push the answer to Level 2 but there is no inclusion of testing so the best fit match is limited to a strong Level 1. 2 marks awarded.

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