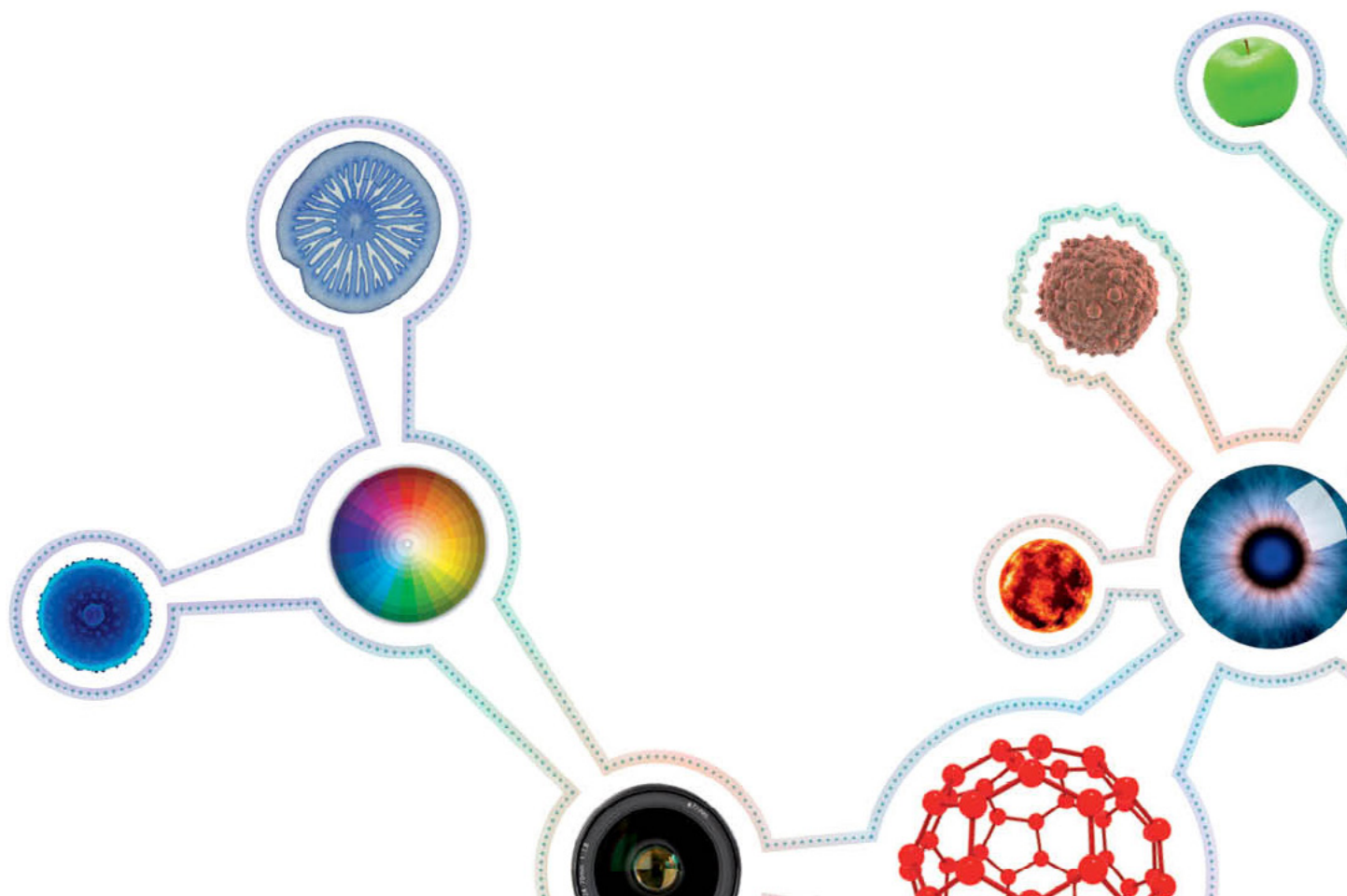


TWENTY FIRST CENTURY
SCIENCE SUITE
**EXEMPLAR
CANDIDATE WORK**

VERSION 1 JUNE 2012

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INTRODUCTION

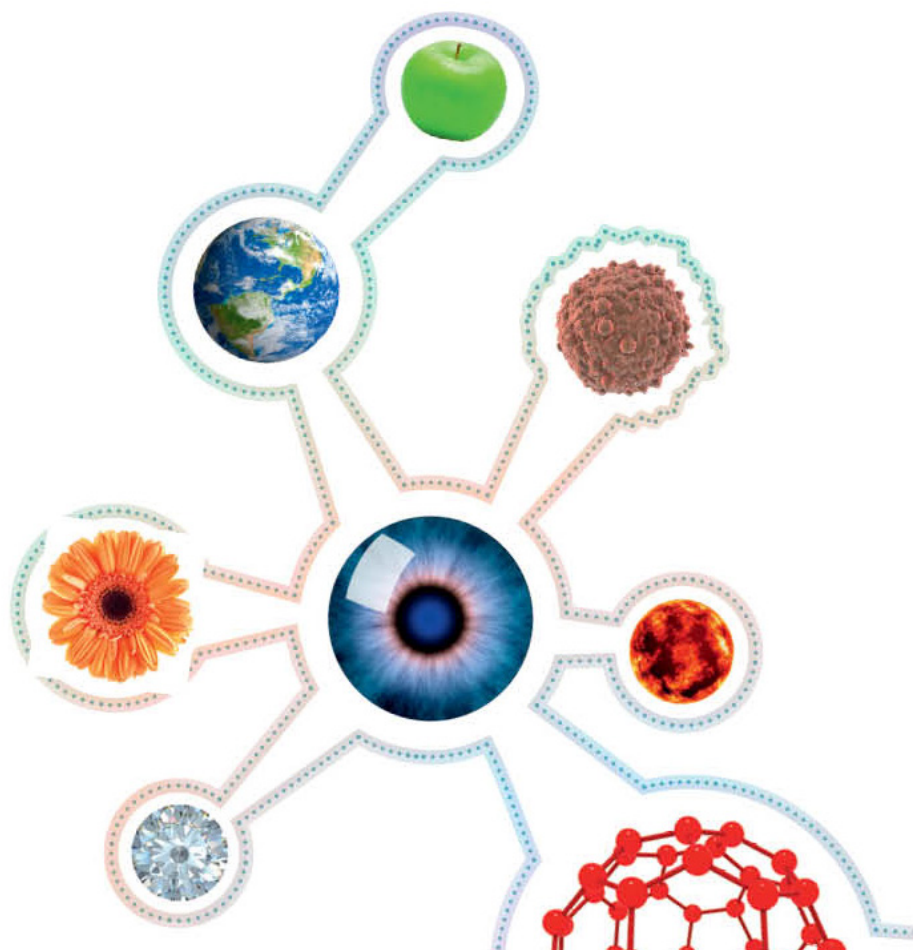
These support materials are intended to support teachers in understanding how examiners apply the marking criteria and what they are looking for in candidate responses . There is exemplar candidate work for a selection of questions from the January 2012 series, with accompanying commentary.

The exemplars and commentaries should be read alongside the Specification for GCSE Twenty First Century 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:

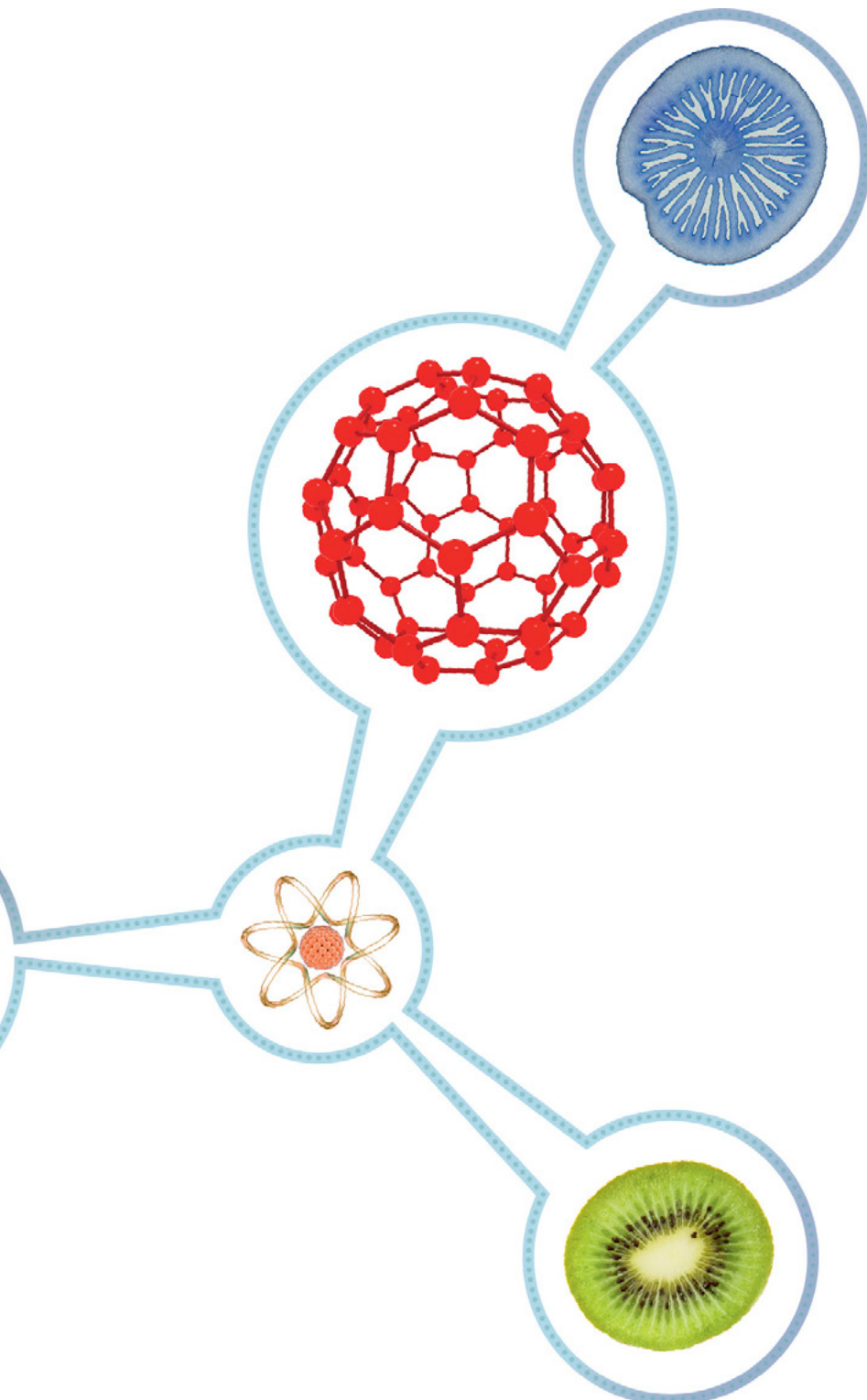
- teacher training in interpretation of the marking criteria
- departmental standardisation meetings
- exemplars for candidates to review.



BIOLOGY

**GCSE TWENTY FIRST CENTURY SCIENCE
BIOLOGY A J243
BIOLOGY A161-02 JANUARY 2012**

Overlap question with A181/02b Genetic testing can be used for screening adults, children and embryos.



QUESTION 2(b)



Describe uses of genetic testing and the implications of these tests for these people.
The quality of written communication will be assessed in your answer.

MARKING CRITERIA

Question		Answer	Marks	Guidance
2	(b)	<p>[Level 3] Have one use and two or more implications described in detail and linked. Answers specifically relate to embryos or adults or children. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Have just one implication not necessarily linked but described in less detail. Answers just relate to a person. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Have a description of one use OR implication. Not related to a person or assume it is a person. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Uses may include:</p> <ul style="list-style-type: none"> to find out if a (genetic) disorder / disease has been inherited / carrier to find out reaction to a drug paternity test. <p>If candidate only describes ‘implications’, limit to L1.</p> <p>If candidate only describes ‘uses’, limit to L1.</p> <p>Implications may include:</p> <ul style="list-style-type: none"> to decide whether to terminate a pregnancy decide whether to have children insurance implications employment implications unreliability of tests / false negs / false positives possible miscarriage stress / counselling tailor made treatments embryo selection / gene therapy who else you should tell in your family preparation for a newborn / rest of life religious / ethical implications. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

EXEMPLARS AND COMMENTARIES

SAMPLE 1



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

Genetic testing can be used for adults and children when they think they may either have a disease or inherited disorder or if for a certain medication which can't be used when you are a carrier or sufferer of a disorder. It is controversial because if you are told you are a carrier/sufferer you may be pressured into not having children and employers may not employ you if they have this info because you are likely to become ill. It can also be used on embryos during IVF. [6] This is called pre-implantation genetic diagnosis. This is where a healthy embryo is kept and the others are destroyed. This is controversial because some say embryos have the right to life even if they carry or have a genetic disorder.

COMMENTARY

Candidate scores 6 marks at Level 3.

The candidate describes two different reasons for testing and goes on to give three different implications. This means that Level 3 was awarded. The candidate then goes on to give additional details of the implications and also includes examples of testing and implications in adults, children and embryos. This level of detail meant that full marks were awarded.

SAMPLE 2

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

Genetic testing is used too see if the person has a disease or if they are a carrier of the disease.

Also genetic testing is used too see what the chances are of an offspring having the disease. Genetic testing is not always correct however and give false results. ~~the~~

COMMENTARY

Candidate scores 3 marks at Level 2.

The candidate has clearly given one use of genetic testing and went to describe one implication by stating the testing is not always accurate and may give false results. One test and one implication means that this is awarded Level 2. However the candidate does not go on to fully explain the implications of false results such as how it might affect the decision of whether to have the test or not. For this reason only 3 marks were awarded.

SAMPLE 3

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

Huntington's disease is caused by a recessive dominant cell because the one gene could just take place from their man or dad. This cell means that when Huntington was born he had a disorder from either one of there parents.

COMMENTARY

Candidate scores 1 mark at Level 1.

The candidate has engaged with the question and shows some limited understanding of one genetic disorder. However there are several errors such as referring to both recessive and dominant cells. The candidate's wording makes it unclear if reference is being made to any genetic testing and there are no implications arising from such tests. Benefit of the doubt was given in this case and Level 1 awarded, however the answer is certainly not worth any more than 1 mark.

QUESTION 4 (a) (i)

Using ideas about vaccines, explain how Jenner's treatment prevented James Phipps from getting smallpox.



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

MARKING CRITERIA

Question			Answer	Marks	Guidance
4	(a)	(i)	<p>[Level 3] Demonstrates clear understanding of the immune response. Quality of written communication does not impede communication of science at this level. (5 – 6 marks)</p> <p>[Level 2] Can recall but not fully explain the mechanism of the immune response. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Shows limited knowledge of the immune response. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*</p> <p>Indicative scientific points at Level 3 may include:</p> <ul style="list-style-type: none"> • good explanation of memory cells • idea of rapid response • scientific detail of complementary fit between antibody and antigen <p>Indicative scientific points at Level 2 may include:</p> <ul style="list-style-type: none"> • antigens of cowpox and small pox are similar • antibodies against cowpox are also effective against smallpox • some explanation of immunity • idea that white blood cells engulf / produce antibodies • mention of memory cells <p>Indicative scientific points at Level 1 may include:</p> <ul style="list-style-type: none"> • idea that cowpox and smallpox are similar • reference to immunity e.g. makes you immune • idea that white blood cells are involved. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

EXEMPLARS AND COMMENTARIES

SAMPLE 1



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

Cowpox is ~~quite~~ not fatal where as small pox can be. Cowpox ~~contains~~ microorganism's antigen (markers) are similar to those on small pox. ~~When~~ lymphocytes (white blood cells) produce antibodies which ~~and~~ eventually find the correct antibody to fit the antigen. The cowpox doesn't make you very ill. ~~When~~ The antibodies ^{make} clump the microbes clump together making it easy for phagocytes to engulf them. Memory cells in your blood remember the antigen. When you develop smallpox your memory cells remember the antigen and to produce the right antibody. The small pox is fought off before you develop symptoms. [6]

(ii) Use the example above to describe a correlation between a factor and an outcome

getting cowpox reduces the risk of developing becoming ill from small pox [1]

COMMENTARY

Candidate scores 6 marks at Level 3.

This is an excellent answer that best fits Level 3. It shows clear understanding of the immune response and describes in detail how the response works. The candidate shows understanding that cowpox antigens and smallpox antigens are similar and therefore the immune response to cowpox will also be triggered by smallpox antigens. All areas of the mark scheme are covered and fully explained so 6 marks were awarded.

SAMPLE 2



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

He stopped James from getting Smallpox because he injected a $\frac{1}{2}$ very similar disease (cowpox). ~~De~~ Because he injected him with cowpox the white blood cells memorised the cowpox when they sent ~~antibodies~~ antibodies out to destroy the disease, and so when he injected him with smallpox they had memorised the the similar disease and then sent out antibodies quicker to kill the smallpox off. So Jenner's treatment prevented James from get Smallpox because the white blood cells were able to react quicker. [6]

COMMENTARY

Candidate scores 4 marks at Level 2.

This response best fits Level 2 and almost fits Level 3. This is why 4 marks were awarded instead of 3. It includes all relevant facts but lacks some detailed explanations that would be needed for Level 3, such as describing memory cells and how antibodies and antigens have a complementary fit and the effect on white blood cells.

SAMPLE 3

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

James Phipps did not catch smallpox because
the bacteria in cowpox prevented him from
getting smallpox and he was recovered again

COMMENTARY

Candidate scores 1 mark at Level 1.

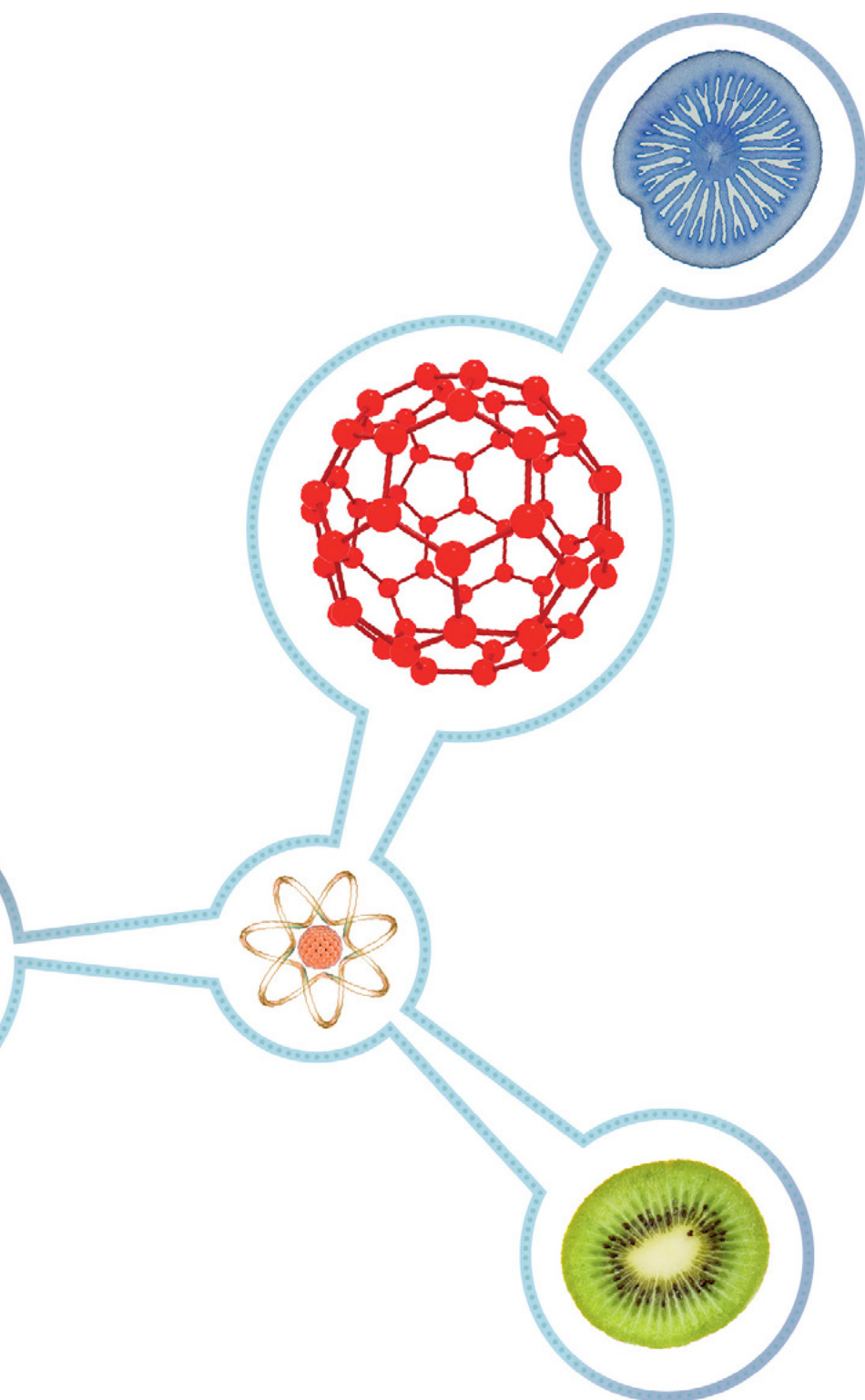
The candidate shows some limited knowledge that cowpox prevents smallpox but fails to provide any detail or explain of the mechanism involved. This limits the response to Level 1.

As there was no reference to the fact that cowpox and smallpox must be caused by similar organisms or any other limited explanation provided, only 1 mark was awarded.

CHEMISTRY

**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A J244
CHEMISTRY A171-02 JANUARY 2012**

Overlap question with A171/01



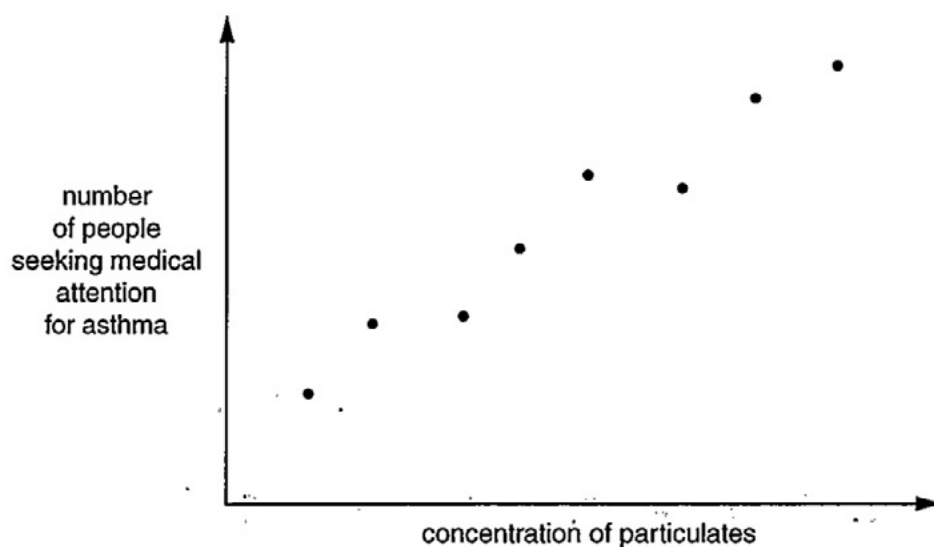
QUESTION 1(b)

1 Scientists measure the concentration of particulates in the air in a town centre.

They do this on several days.

They also count the number of people seeking medical attention for asthma on the same days.

They plot their results on a scatter graph.



(b) A journalist talks to the scientists about their data before it is published.

The journalist writes a newspaper article using the scientists' data.

The article makes the claim.

'Asthma is caused by particulates in the air'.

How much confidence can be placed in the newspaper claim?



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

MARKING CRITERIA

Question		Answer	Marks	Guidance
1	(b)	<p>[Level 3] Balance is for low confidence. Answer includes suggestions that will have an effect upon the confidence in the claim. Links each suggestion to the level of confidence. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Decision can favour high or low confidence. Answer includes some suggestions that affect the confidence in the claim with some idea of how they affect it. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer includes comments about what may affect the confidence in the claim. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Confidence is low because:</p> <ul style="list-style-type: none"> correlation does not mean cause there could be other causes no peer review so opinions of other scientists have not been given explanation of why peer review important no reproducibility of data so this set of results may not be a 'one off' journalist is not a scientist journalist could be biased so may have his/her own interpretation of data data not repeated so may not be reproducible only one town has been investigated data from other towns may disagree with this data more evidence is needed. <p>Claim may be correct because:</p> <ul style="list-style-type: none"> there is a clear correlation so asthma could be caused by particulates points are all close to straight line there are no anomalies/outliers so conclusions from data will have some validity. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

SAMPLE 1



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

Not much confidence because even though there is a correlation in the graph supporting the statement, other factors also need to be considered. Other factors could include genetics and other chemicals that have been breathed in. Particulates in the air are a factor of what causes asthma but it is not the direct cause of it. More confidence can be gained if further research is done to discover more factors to the point where a main cause can be seen.

COMMENTARY

Candidate scores 6 marks at Level 3.

The candidate indicates that there is a lack of confidence in the claim because other factors may cause asthma. Two of these factors are mentioned. Further research to find main cause is suggested. The candidate also mentions correlation so there is balance to the argument. Quality of written communication does not impede communication of science at this level.

SAMPLE 2



The quality of written communication will be assessed in your answer:

There can not be 100% confidence in this newspaper article because although the scientists experiment showed a correlation between the increase in particulates in the air and the increase in the number of people seeking medical attention for asthma this does not necessarily mean that particulates in the air cause asthma. The correlation could be coincidental as many other variables could be the factor that is actually causing asthma or worsening asthma. [6]

COMMENTARY

Candidate scores 3 marks at Level 2.

The candidate states an opinion that there is not much confidence in the claim. The assertion is made that there is a correlation but that this does not automatically lead to a cause. The idea that other factors may be involved is suggested, but examples are not given. No further research is suggested and there is no balance in the argument. Quality of written communication does not impede communication of science at this level.

SAMPLE 3

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

The journalist could have not investigated in depth the causes of ~~the~~ asthma so he could be just making a interpretation. If He went and experimented and found evidence then his results would be more reliable: His Hypothesis is wrong.

COMMENTARY

Candidate scores 1 mark at Level 1.

The candidate gives an opinion that the claim is incorrect and suggests that more evidence is needed. No mention is made of other factors that may cause asthma or why the evidence given in the question is not sufficient. Quality of written communication does not impede communication of science at this level.

QUESTION 2 (a)

2. Scientists analyse samples of dry air from a town centre.

They find the concentration of nitrogen dioxide.

They take eight samples at different times during one day.

Their results are shown in the table.

nitrogen dioxide concentration in $\mu\text{g}/\text{m}^3$							
sample 1	sample 2	sample 3	sample 4	sample 5	sample 6	sample 7	sample 8
38	42	41	39	42	38	43	40

(a) In the UK the concentration of nitrogen dioxide in the air should not be more than $40 \mu\text{g}/\text{m}^3$.

Use a best estimate to decide whether the true value was above the UK concentration limit on this day. Explain how much confidence the data give you that your decision is correct.



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

MARKING CRITERIA

Question		Answer	Marks	Guidance
2	(a)	<p>[Level 3] Answer includes accurate calculation of average as best estimate and identifies this is above limit (or gives rationale that answer is to 2 sig fig therefore 40 and says this is on limit). Arguments for high AND low confidence considered and reasoned judgement made. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer includes calculation of average as best estimate and identifies this is above limit (or on limit if rounded to 40). Confidence recognised as either high OR low with some idea of justification. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer includes calculation of average as best estimate and identifies this is above limit (or on limit if rounded to 40), OR makes valid comment about limit (eg some values above 40). Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*</p> <p>Calculation may include:</p> <ul style="list-style-type: none"> mean/average calculated as best estimate of true value mean/average = 40.4 (allow 40.375 or 40.38) best estimate of true value is above limit mean may be rounded to 40 so best estimate on limit. <p>Confidence above limit is high because:</p> <ul style="list-style-type: none"> small range no outliers measurements repeated (8 times) data includes values above 40 more values above 40 than below. <p>Confidence above limit is low because:</p> <ul style="list-style-type: none"> true value may still not be above 40 there are some values below 40 / not all are above 40 range is 38 to 43 so true value could be below 40 data may only be from one site in town centre this site may not be representative of the whole of the town true value could be different if samples taken from whole town centre. measurements made at only 8 times during the day concentration could vary between these times other factors may affect the measurements. <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

EXEMPLARS AND COMMENTARIES

SAMPLE 1



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

$$\underline{38 + 42 + 41 + 39 + 42 + 38 + 43 + 40}$$

$$\begin{matrix} 8 \\ = 40.375 \end{matrix}$$

I believe the true value was above the UK concentration limit. As there are no obvious outliers in the data, the best estimate for the concentration of nitrogen dioxide in the air is $40.375 \mu\text{g}/\text{m}^3$, which is just over the $40 \mu\text{g}/\text{m}^3$ limit. Although this is over the limit, I cannot be completely confident in the decision. One reason for this is the small number of tests done, so the result is ~~fairly accurate~~ not very accurate. Another reason is that the lowest ~~sample~~ result is below 40, meaning the true value could be. Finally, the equipment may have made errors and so could the people conducting the test. [6]

COMMENTARY

Candidate scores 6 marks at Level 3.

This candidate has calculated the best estimate correctly and used this to conclude that the nitrogen dioxide level is above the limit. Sound arguments for and against confidence in this conclusion are given with supporting ideas. Quality of written communication does not impede communication of science at this level.

SAMPLE 2



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

$$38 + 42 + 41 + 39 + 42 + 38 + 43 + 40 \div 8 = 40.375$$

From the data gathered it was above the UK concentration limit of $40 \mu\text{g}/\text{m}^3$ but only by a bit. However eight samples is not enough data to go on also the samples should be taken in different areas not all in the same place. Also other factors could affect the samples e.g. temperature, location and weather/winds. [6]

COMMENTARY

Candidate scores 4 marks at Level 2.

The best estimate is calculated correctly and recognised as over the nitrogen dioxide concentration limit. The candidate suggests that more samples are needed and gives some detail of how these tests should be carried out. There are also details of other factors that may affect the concentration. Does not say low confidence but this is implied, with some justification. A balanced argument is not presented. Quality of written communication does not impede communication of science at this level.

SAMPLE 3

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

The best estimate is 40.378
so it is already over what it
should be, but only by
a very small amount.

COMMENTARY

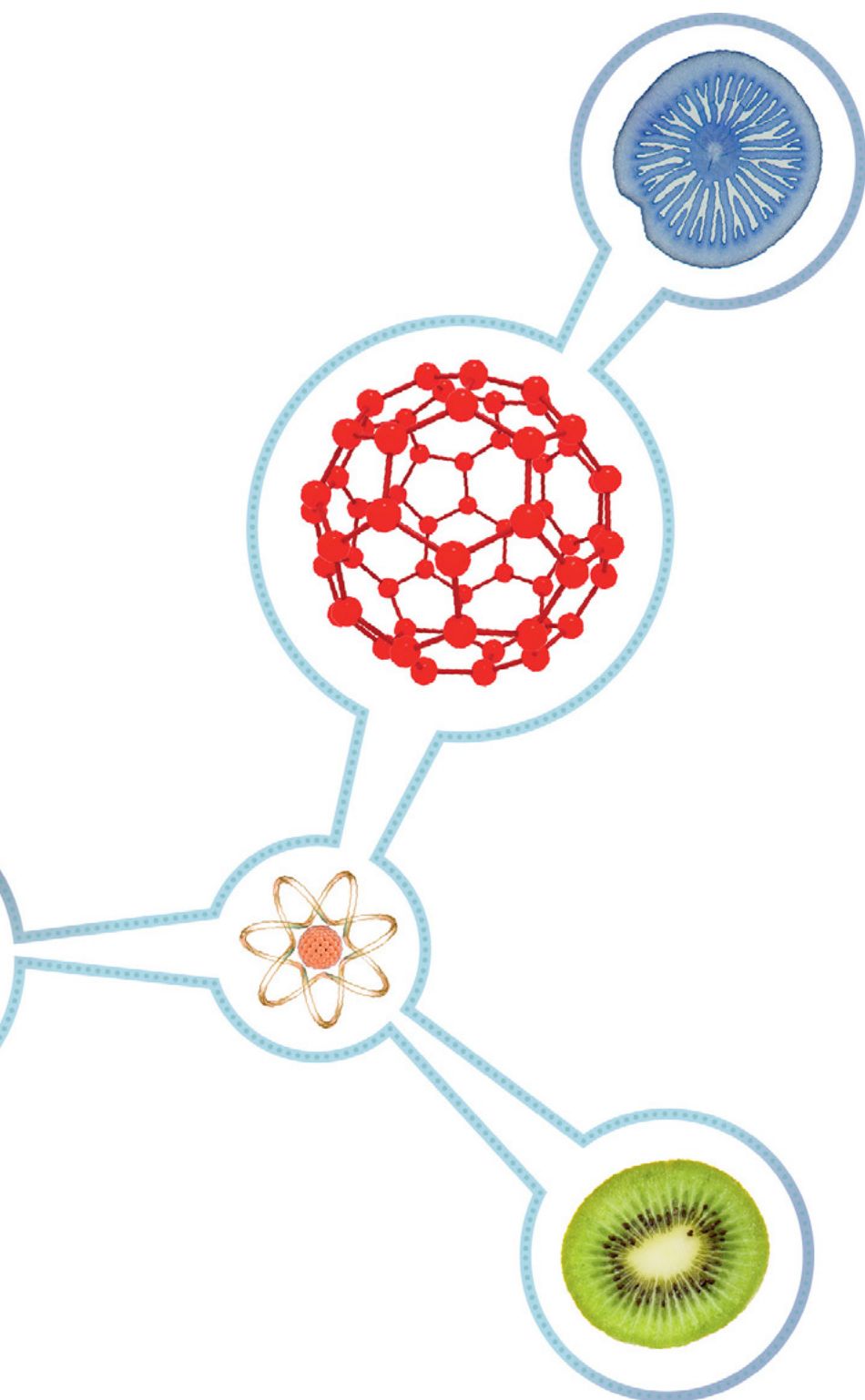
Candidate scores 2 marks at Level 1.

The candidate has calculated the best estimate correctly and recognised that the nitrogen dioxide concentration is over the limit. No mention is made of confidence or justification. Quality of written communication does not impede communication of science at this level.

PHYSICS

**GCSE TWENTY FIRST CENTURY SCIENCE
PHYSICS A J245
PHYSICS A181-02 JANUARY 2012**

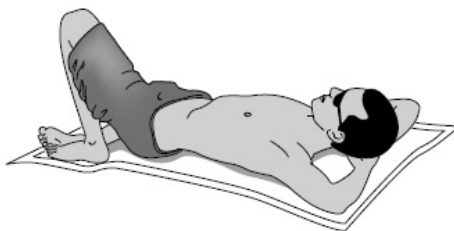
Overlap question with A181/01



QUESTION 4

4 Ultraviolet radiation can be harmful.

Sunbathing exposes people to ultraviolet radiation.



Why do people sunbathe in spite of the risks?

Your answer should consider the risks and benefits.



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

MARKING CRITERIA

Question	Answer	Marks	Guidance
4	<p>[Level 3] Considers balance of risk and benefit. Identifies a risk and identifies a benefit and considers methods of modifying risk. Gives explanations of at least two of risk, benefit or modifying risk. May give a perceived risk argument. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] A comparison between risks and benefits is at least implied. Identifies a risk and a benefit. Gives an explanation of at least one. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Identifies a risk and a benefit OR identifies either a risk or a benefit and gives some explanation. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <p>Risks e.g. exposure to UV - result in cancer or sunburn sunburn or sun stroke or cancer – bad effect on health damage to skin – less attractive affects eyesight – cataracts</p> <p>Benefits e.g. tan - social benefits e.g. more attractive / feel better relaxing – reduces stress reduction in other cancers – health benefit. accept vitamin D production – health benefits accept SAD – reducing depression</p> <p>Factors affecting the risk/ benefit decision e.g. exposure does not always lead to harm / cancer sunscreen blocks UV short exposures less likely to lead to skin cancer skin type may reduce risk the benefits are immediate, the risks may show up much later the sunbather does not know the risks</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

SAMPLE 1

Why do people sunbathe in spite of the risks?

Your answer should consider the risks and benefits.



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

People believe that ~~sunbathing~~ the benefits of sunbathing outweigh the risks. The benefits are that people get a nice tan and the skin soaks up vitamin D. The risks are that too much exposure without protection can cause the skin to burn as it is ionising radiation. This can lead to skin cancer or the cells of the body being killed. People who sunbathe are fine if they protect themselves by wearing clothes and sunscreen as these act as physical barriers. Also by limiting the amount of exposure time will insure that they just get a nice tan and not get burnt. There also isn't too much ultraviolet radiation as a lot of it is filtered out by the ozone layer.

[6]

[Total: 6]

COMMENTARY

Candidate scores 6 marks at Level 3.

Candidate has the idea of balancing risks and benefits, identifies both risks and benefits and explains risks and describes how to modify the risks. There is a mistake in mechanism of vitamin D production, but this is not required by the specification. The irrelevant comments about the ozone layer can be ignored when considering the quality of written communication at this level.

SAMPLE 2

Why do people sunbathe in spite of the risks?

Your answer should consider the risks and benefits.



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

- people sun bath despite the risks because they want to have tanned skin.
- Sun bathing gives you vitamin D
- but there are risks, UV can age your skin
- it can also lead to skin cancer.
- Ultra violet ~~rays~~ is ionising radiation, it can mutate your DNA.
- Ionisation causes a photon to remove the electron from a molecule or particle.

[6]

[Total: 6]

COMMENTARY

Candidate scores 4 marks at Level 2.

Candidate identifies both risks and benefits and there is an implied comparison 'but there are risks'. Candidate does not mention any ways of modifying the risk e.g. by reducing exposure. Although the bullets are not used appropriately, they do not impede communication of the ideas at this level.

SAMPLE 3

People buy sunbaths because they want to get a tan and because its relaxing for them. the Benefits for this are getting a tan and being relaxed. but there are risks for this such as skin cancer, heat stroke etc.

[6]

COMMENTARY

Candidate scores 2 marks at Level 1.

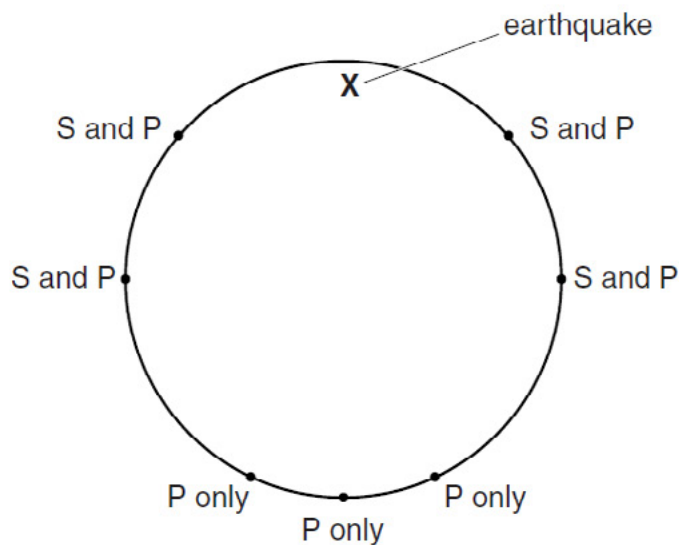
Candidate has identified benefits and risks but not explained any of them.

QUESTION 2

2 This question is about earthquakes and the structure of the Earth.

An earthquake occurs at **X**.

The diagram shows places where S-waves and P-waves from the earthquake are detected.



Explain what we can tell about the structure of the Earth from these results.

You may add to the diagram if this helps you.



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

MARKING CRITERIA

Question	Answer	Marks	Guidance
2	<p>[Level 3] Describes the behaviour of P and S-waves. Describes the conclusions about the structure of the Earth. Explains how the conclusion is linked to the evidence. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes the behaviour of P and/or S-waves. Describes a conclusion about the structure of the Earth. Explanations are incomplete or muddled. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Incomplete description of behaviour of P and/or S-waves and about the structure of the Earth. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A/A*</p> <p>Indicative scientific points may include:</p> <p>Points may be made on the diagram</p> <p>Relevant points include:</p> <p>S- waves only travel through solids P-waves travel through both liquid and solids S- waves are transverse waves P-waves are longitudinal</p> <p>Earthquake waves can tell us: Size of core / mantle / crust; Core is liquid because no S waves travel through it; Mantle is solid because S waves do travel through it.</p> <p>allow refraction of p-waves indicates presence of a solid inner core</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

EXEMPLARS AND COMMENTARIES

SAMPLE 1

Explain what we can tell about the structure of the Earth from these results.

You may add to the diagram if this helps you.



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

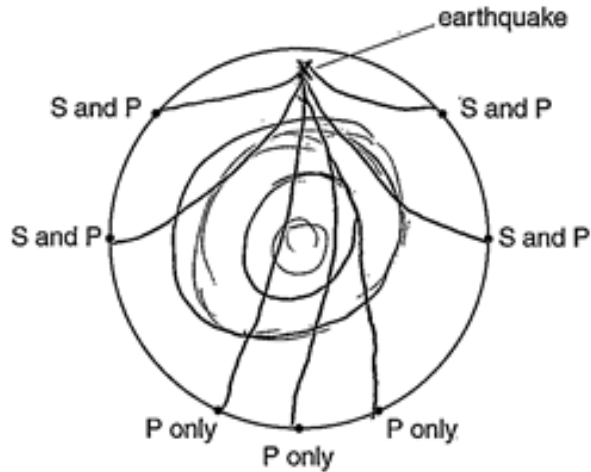
S-waves only travel through solids but P-waves travel through liquids and solids. S-waves aren't detected on the other side of the Earth's core but are detected the side where the earthquake occurred. This suggests that the ^{and crust} mantle is solid but the outer core is liquid. P-waves are detected at the same places as the S-waves and ^{around} ~~at~~ the opposite end to the earthquake but not in between. This suggests the the outer core is liquid because there must be a kink in its path where the properties change suddenly and it slows down. This also suggests that the inner core is ~~liquid~~ solid because P-waves speed up in the middle of the Earth and they travel fastest through solids. [6]

COMMENTARY

Candidate scores 6 marks at Level 3.

Description of P and S waves is complete in the terms of the question (note that transverse and longitudinal names are not necessary to explain the data or its conclusion). The S-wave shadow zone is linked to the liquid outer core and the fact that they travel to the other parts of the Earth's surface linked to the state of the crust and mantle, hence two conclusions about the structure of the Earth. P-wave detection confirms that the core is liquid. Discussion of the "kink in the path" is related to refraction of the waves in the layers and is beyond GCSE level.

SAMPLE 2



Explain what we can tell about the structure of the Earth from these results.

You may add to the diagram if this helps you.



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

- we can tell that the structure of the earth is solid and liquid.
- p waves can travel through solids and liquids because they are stronger than s waves which can only travel through solids.
- you can see this because p waves are detected at the opposite side of the earth and s waves are not.
- you can tell that the center of the earth is liquid and the outer is solid.
- you can see that the earth is built up of different density of material [6]

[Total: 6]

COMMENTARY

Candidate scores 4 marks at Level 2.

Bullet points here break up the explanation from the data in a way that is unhelpful (note, bullet points themselves are not unacceptable when used appropriately). Poor choice of way of presenting argument reduces the QWC. The description of P-waves given is correct, but there is no corresponding description of S-waves. A single conclusion is given about the 'centre of the Earth'. Level 2.

SAMPLE 3

Explain what we can tell about the structure of the Earth from these results.

You may add to the diagram if this helps you.



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

looking at this diagram we can see that S-waves cannot travel through liquid, as the outer core is a liquid. Only the P-waves have reached the other side of Earth, therefore the other side of the world would not be so affected as the S-waves are much powerful but haven't been able to go through the outer core. [6]

[Total: 6]

I think I have gone right off course...!

COMMENTARY

Candidate scores 2 marks at Level 1.

Reverse argument given – 'as outer core is liquid, the S-waves cannot travel through it'. This means that the candidate has not used the data to explain the conclusion about the Earth. Behaviour of P-waves is not described. No discussion of mantle or crust. Level 1 best fit.

Incomplete description of S-waves and the structure of the Earth, fully meeting the level 1 criteria, 2 marks.

