GCSE Science Specification A

Exemplar of Extended Prose Questions – including QWC
With Candidate answers and Examiner Commentaries

Unit 1

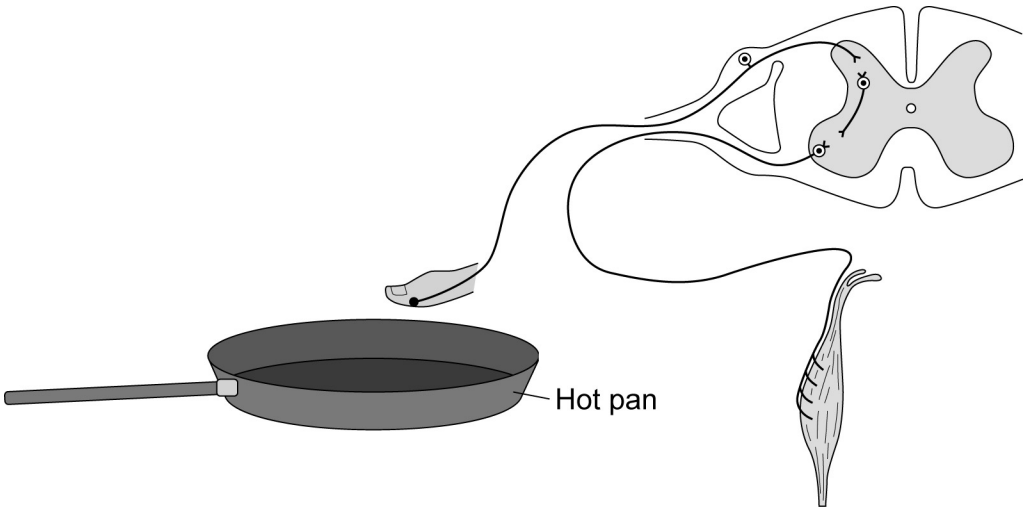
Version 1.0 Date: 0311

Biology Higher Tier

8 A person accidentally touches a hot pan.

Her hand automatically moves away from the pan.

The diagram shows the structures involved in this action.



8 (a) Describe fully how the structures shown in the diagram bring about this reflex action.

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(6 marks)

8(a)	stimulus / heat detected by temperature receptors in skin		1
	impulses travel along sensory neurone to spinal cord / CNS		1
	chemical transmission across synapse		1
	via relay neurone		1
	impulses to muscle / effector via motor neurone		1
	muscle / effector contracts, moving the hand away		1

Exam technique

Before answering the question:

- Label as many structures as possible on the diagram.
- Decide what the stimulus is and which type of receptors are involved.
- Put arrows on the diagram to show the path taken by impulses.
- Start the answer with the stimulus then describe the path taken by the impulse using the structures you have labelled and the arrows you have drawn.
- Include transmission by neurones and across synapses in your answer.

Student answer

The hot pan is the stimulus. The heat is detected by the skin.(1) Information (2) is sent along a sensory neurone to the spinal cord. Here the information is passed onto (3) a relay neurone √ and then to a motor neurone. When the information reaches the muscle √ he muscle contracts, √ pulling the arm away from the pan.

Commentary

The candidate obviously understands the mechanism of the reflex action and has described most the processes in the correct sequence. However,

The candidate receives three marks for the last three points on the mark scheme.

The answer could have been improved by:

(1) The candidate should have stated specifically that temperature receptors detected the stimulus rather than a sense organ(the skin).

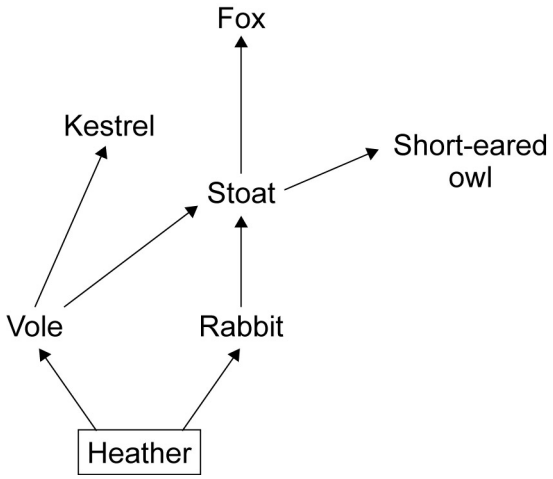
(2) On the higher tier paper candidates should use the correct terminology. ‘Impulse’ should have been used rather than ‘information’. This ‘error’ is penalised only once.

(3) To gain full marks for an answer about reflexes on the higher tier paper there should be reference to chemical transmission across a synapses from neurone to neurone.

Science A
Biology Unit 1

13 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The diagram below shows a food web for some of the organisms that live on moorland.



Only a small percentage of the Sun's energy captured by the heather is eventually incorporated into the body tissues of the fox.

Explain, as fully as you can, what happens to the rest of the energy captured by the heather.

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(6 marks)

Turn over▶

13

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2.

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of at least two ways in which the energy captured by the heather is transferred, which has little clarity and detail. Credit may be awarded either for references to general ways in which organisms transfer energy or to ways in which specific organisms in the food web transfer energy.	There is some description of a range of the ways in which the energy captured by the heather is transferred. Credit may be awarded either for references to general ways in which organisms transfer energy or to ways in which specific organisms in the food web transfer energy.	There is a clear, balanced and detailed description of a large variety of ways in which energy captured by the heather is transferred Credit may be awarded either for references to general ways in which organisms transfer energy or to ways in which specific organisms in the food web transfer energy.

examples of biology points made in the response

- respiration releases energy (allow this point even if given for named organism) NB: to gain full marks, candidates must gain this mark.
- some energy lost in animals / named animal's waste materials
- some energy used in maintenance / repair energy (allow this point if given for named organism)
- some energy used for movement energy (allow this point if given for named animal)
- energy lost as heat to surroundings (allow this point if given for named organism)
- some organisms die (rather than being eaten) (allow this point if given for named organism)
- reference to detritivors / microbes

Science A: Biology Unit 1 Exemplar Answer QWC Q.13

Candidate A

The heather plants are producers. Light energy captured by the algae is converted into carbohydrates which are then converted into a wide range of organic compounds. Some of the carbohydrates are used in respiration by the heather plants. Respiration releases energy, some of which is transferred to the environment.

Heather plants are eaten by herbivores such as voles and rabbits. However, these herbivores do not eat all the heather plants. Some of the heather plants eventually die and the organic compounds in their cells are broken down and absorbed by microorganisms such as bacteria. The bacteria use some of the organic compounds in respiration, transferring energy to the environment.

The herbivores cannot digest all parts of the heather, so some of the organic compounds pass out of the herbivore's bodies in the faeces. Herbivores respire, releasing energy. Some of the energy is use for growth and some is used in locomotion. Much of the energy released is transferred to the environment as heat. Thus only a small proportion of the energy that the herbivores obtain from the heather plants is transferred to the carnivores such as stoats and kestrels. The stoat lose energy in much the same way as the herbivores so even less energy is transferred to the fox when it eats stoats

6 marks

Commentary

- The candidate has described a wide range of ways in which energy is 'lost'
- The spelling, punctuation and grammar are all very good.
- The energy transfers are presented in the correct sequence, beginning with the heather and finishing with the fox
- The answer contains a wide range of specialist terms such as *producer, herbivore, carnivore, respiration, faeces, bacteria, organic, carbohydrate, environment, energy transfer*
- The information is presented coherently and logically
- All the criteria for six marks have been satisfied.

Candidate B

The heather is eaten by vegetarians such as voles and rabbits and the vegetarians are eaten by meat eaters such as stoats and kestrels the stoat is then eaten by the fox.

All of the animals respire. respirtion produces heat energy which is lost to the surroundings.

All of the animals lose waste materials such as feces. The energy in these is used by germs.

Animals also lose energy when they move around.

3 marks

Commentary

- There is some structure to the answer – energy transfers are described in the correct sequence
- There are errors in spelling and punctuation – the first paragraph is not punctuated at all. The second paragraph has a sentence beginning with a small letter. Respiration and faeces are misspelled.
- There are some technical terms such as respiration and faeces, but ‘vegetarian, ‘meat eater’ and ‘germs’ and do not qualify.

Chemistry Higher Tier

7 This drinks bottle is made of thermosoftening plastic.

Drinks bottles of this type can be recycled.

Describe and explain how these used plastic bottles can be changed into new plastic objects.

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(4 marks)

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7	used plastic bottles are heated	accept used plastic bottles are melted	1
	these polymer chains/molecules have only weak intermolecular forces		1
	therefore the polymer chains/molecules in the plastic become mobile when heated		1
	then they are moulded/ extruded into a new shape / object		1

Exam technique

Before answering the question:

- Read all the information and look at the picture.
- Find and highlight the command words - '*describe and explain how*'.
- Plan your answer – the question requires you to:
  start with 'used plastic bottles'
  'describe and explain' how these bottles are changed to
  end with 'new plastic objects'.
- Check whether any other part of the information is useful for your answer, for example, the bottle is made of 'thermosoftening plastic'. (The picture just shows what a plastic bottle is.)

Student answer

Used plastic bottles are collected and transported to a recycling plant. (1) The used plastic bottle is heated. ✓
It melts because it is a thermosoftening plastic. (2) The melted plastic can be moulded into a new object. ✓

Commentary

The candidate has described how used plastic bottles can be changed into new plastic objects. However, this candidate has not provided an explanation of how this plastic is able to be melted when heated.

The candidate only receives two marks for the first and fourth marking points on the mark scheme.

The answer could have been improved by:

(1) The candidate starting with the heating process and avoiding information not relevant to changing used plastic bottles into new plastic objects.

(2) The candidate considering what is a 'thermosoftening plastic' in terms of molecular structure.

(3) On a higher tier paper the candidate explaining how the 'thermosoftening plastic' melts in terms of structure and intermolecular bonding. (Note that the candidate only receives a mark for either 'heat' or 'melt'.)

8 (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

There are millions of plastic bags in use. After use most of these plastic bags are buried in landfill sites. The amount sent to landfill could be reduced if the plastic bags:

- could be reused
- could be recycled by melting and making them into new plastic products
- could be burned to release energy.

Use the information above and your knowledge and understanding to give the positive and negative environmental impacts of using these methods to reduce the amount of plastic bags sent to landfill.

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(6 marks)

8(c)

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2.

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of a positive and a negative environmental impact involved with one or more methods used to reduce the amount of plastic bags sent to landfill	There is some description of both positive and negative environmental impacts involved with at least 2 methods used to reduce the amount of plastic bags sent to landfill	There is a clear, balanced and detailed description of both a positive and a negative environmental impact of using each of the 3 methods used to reduce the amount of plastic bags sent to landfill

Examples of the points made in the response

Reuse:

Reuse means less bags used so:

Positive environmental impact

- Saves raw materials/crude oil
- Saves energy
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Could cause litter
- Could still be sent to landfill

Recycle:

Bags can be recycled so:

Positive environmental impact

- Used to make new plastic bags / objects
- Saves raw materials / crude oil
- Saves energy compared to producing plastic bags from crude oil
- Cuts down on CO_2 emissions
- Less global warming

Negative environmental impact

- Collection point sites cause an eyesore / litter problem
- Transportation to recycling plant releases carbon dioxide / causes global warming

Burn:

Bags can be burned so:

Positive environmental impact

- Could provide energy for heating buildings
- Could provide energy for generating electricity

Negative environmental impact

- Increases CO_2 emissions
- Increases global warming
- Could release toxic gases

Does not conserve raw materials / crude oil

Total			**10**

Science A: Chemistry Unit 1 – QWC Exemplar Answer

Candidate A

Reusing

Most of the millions of plastic bags are sent to landfill sites. It would be better to reuse them because it saves crude oil used to make new plastic bags. Reused plastic bags may break so they could end up in a landfill.

Recycling

No bags would be sent to landfill if they were recycled to make new plastic bags. Recycling is hard because some way of collecting the millions of bags is needed and transporting them gives off carbon dioxide from burning fuel.

Burning

Plastic bags could be used as a fuel because if they are burned in a furnace the energy could heat swimming pools and schools. Burning these bags would release locked up carbon causing global warming or dimming.

6 marks

Commentary

- Information presented coherently and logically
- Candidate has referred clearly to all three methods and to both positive and negative effects on the environment
- Spelling, punctuation and grammar are all very good
- “saves crude oil” is a positive environmental effect of reuse
- “could end up in landfill is a negative environmental effect of reuse
- “to make new plastic bags” is a positive environmental effect of recycle
- “transporting them gives off carbon dioxide” is a negative effect of the use of the energy released by burning
- “release locked up carbon causing global warming or dimming” is a negative environmental effect of burning. “Global warming” is one of the examples given on the mark scheme. “Global dimming” is not on the mark scheme however but carbon particles could be released so the statement is correct
- The answer satisfies the criteria for a top Level 3 response and is worth 6 marks

Science A: Chemistry Unit 1 – QWC Exemplar Answer

Candidate B

Plastic bags need to be reusing and not put in landfill. Reusing and recicling saves crude oil. Reciclin bags would make no waste but reusing them they could be thrown in streets. Burning plastic would release energy and toxic and harmful gasses. It is better to reciling because you can make new bags but when they are taken to recicling bins they can blow about and make a mess. Plastic bags should be resuing and burning but recicling is better.

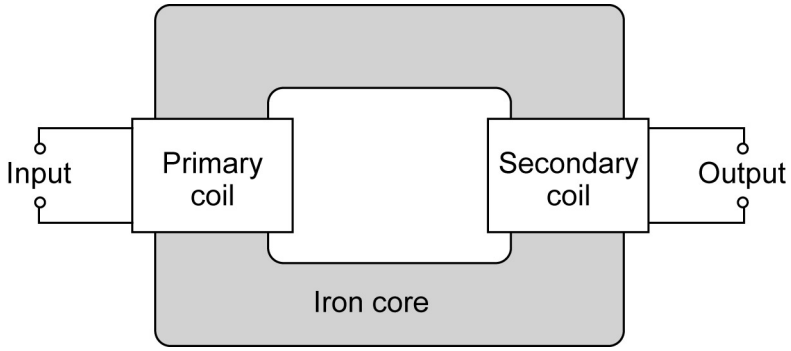
3 marks

Commentary

- Candidate has referred to all three processes and some of the scientific points given in the mark scheme.
- There is some structure to the answer.
- Both positive and negative effects are given. However, the information is rather muddled.
- There are a number of errors in spelling and grammar.
- Some technical terms are used correctly (e.g. crude oil, toxic)
- “saves crude oil” is a positive environmental effect of reuse. “Saves crude oil is also a positive environmental effect of reuse
- “could be thrown in the streets” is a negative environmental effect of reuse
- “release energy and toxic and harmful gases” is a negative environmental effect of burning. NOTE that “release energy” is given in the stem and does not indicate how this energy would be useful. Also “release harmful gases would not gain credit unless linked to the type of harmful gas
- “makes new bags” is a positive environmental effect of recycle
- “blow about and make a mess” is a negative effect of recycle, that is, a litter problem
- The answer satisfies the criteria for a Level 2 response and is awarded 3 marks.

Physics Higher Tier

9 The diagram shows the basic structure of a transformer.



9 (a) Explain how a transformer works.

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(5 marks)

9(a)	an alternating input / current is supplied to the primary (coil) which produces an alternating magnetic field in the (iron) core this magnetic field links with the secondary coil which induces an (alternating) voltage / p.d. across the secondary (coil)	 accept changing magnetic field for alternating magnetic field if first mark point scores then 'alternating' not required here	1 1 1 1 1

Exam technique

Before answering the question:

- Study the diagram and remind yourself of the parts that make up a transformer.
- Think about what happens within each part.
- Work through a sequence that starts with the input and ends with the output.
  Input ⟶ primary coil ⟶ core ⟶ secondary coil⟶ output
- Remember that a transformer uses an alternating magnetic field and induces a potential difference. These are important terms and should be used in your answer.

Student answer

An alternating current (1) supplied to the primary coil √ produces a magnetic field √ (2) in the iron core. √ The magnetic field (3) then produces (4) a potential difference across the secondary coil.

Commentary

The candidate shows an understanding of how a transformer works and has given a correct sequence.

The candidate receives three marks for the first three points on the mark scheme.

(1) Alternating current and alternating input are equally acceptable for the first mark point.

(2) Since the word alternating has already been used it does not need to be used again with the term 'magnetic field'.

The answer could have been improved by:

(3) The idea of the magnetic field in the core linking with the secondary coil is implied but not explicit in the answer, therefore the 4th mark point cannot score a mark.

(4) The 5th mark point has almost been met. However 'induces' is a technical word that should have been used and not the more general word 'produce' which does not have the same meaning.

Science A
Physics Unit 1

11(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The water in the tank could be heated by using an electric immersion heater.

Outline the advantages and disadvantages of using solar energy to heat the water rather than using an electric immersion heater.

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(6 marks)

11(d)

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2.

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a brief description of the advantages and disadvantages of using solar energy to heat the water rather than using an electric immersion heater, including either advantages or disadvantages from the **examples** below.	There is a description of some of the advantages **and** disadvantages of using solar energy to heat the water rather than using an electric immersion heater, with at least **one** advantage and **one** disadvantage from the **examples** below.	There is a clear, balanced and detailed description of the advantages **and** disadvantages of using solar energy to heat the water rather than using an electric immersion heater, with a minimum of **two** advantages and **two** disadvantages from the **examples** below.

examples of the points made in the response	extra information
advantages	
• a renewable energy source • energy is free • does not pollute the atmosphere • no fuel is burnt • energy can be stored (in the water)	accept specific examples of polluting gases
disadvantages	
• only available in daylight hours • availability fluctuates • insufficient hours of sunlight in some countries • average low intensity in some countries	accept unreliable energy source

Science A: Physics Unit 1 QWC Question

Candidate A

Heating water using sola power is good as it doesn't cost money to use the energy is free they are cheap and easy to put in and simple. But if theres clowds the water wont get hot quick so the water is hot or cold with the wether.

2 marks

Commentary

- The candidate shows knowledge of basic information.
- An advantage has been given (energy is free) and a disadvantage (availability fluctuates) has been implied.
- The spelling, punctuation and grammar are weak.
- Very little use of technical terms
- This is a Level 1 response but is worth 2 marks

Candidate B

The advantage of using a solar panel compared to an electric immersion heater is that the solar panel gets all of its energy from the sun for free.
The dissadvantage is that the solar panel needs sunlight and on a gloomy day you wont get the same ammount of energy hitting the panel every second and so the output power will vary. When switched on the immersion heater gives a constant amount of energy.

4 marks

Commentary

- The candidate had organised the answer in two parts, the advantage and the disadvantage.
- The candidate had given one advantage (energy is free) and a disadvantage (availability fluctuates).
- The candidate has linked the changing energy input to a varying power output. The spelling, punctuation and grammar are reasonable with just a few errors.
- This is clearly a Level 2 response and is sufficient for 4 marks.

Candidate C

The advantages of using solar energy to heat the water rather than using an electric immersion heater are firstly that solar energy is a renewable source of energy. Secondly, in using a solar panel there is no need to burn any fuel, therefore CO_2 and SO_2 are not produced. So, solar panels do not cause any atmospheric pollution.

The disadvantages of relying on a solar panel are to do with the variation of energy input to the panel. Solar panels are ideal for countries that have reliable and long hours of sunshine. In some countries the numbers of hours of sunshine are not enough to make it worth the expense of using solar panels. In other places frequent cloud cover will reduce the power output and usefulness of the panels. So, compared to switching on an immersion heater the solar panel may not always work because the energy source is unreliable.

6 marks

Commentary

- The candidate has shown detailed understanding and is able to produce a balanced description of the advantages and disadvantages with two advantages and two disadvantages.
- The answer is coherent and follows a logical sequence. In particular the two disadvantages are linked to produce a single flowing argument.
- Some specialist terms (e.g. power output, CO_2) have been used. The spelling, punctuation and grammar are very good.
- This is a high Level 3 and has satisfied the criteria for the full 6 marks.

Quality of Written Communication and levels marking

Candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

In order to attain a mark within a certain level, **both** the science **and** the QWC must be of a standard appropriate to that level.