AQA qualification support

AS/A-level Environmental Science

Preparing to Teach

Student exemplars and commentaries

BOOKLET 3

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Exemplar material

AS/A-level Environmental Science: Preparing to teach

Complete essay

Discuss the extent to which the development of new technologies has reduced the environmental impacts of the exploitation of energy resources.

[25 marks]

The use of energy has a big impact on the environment and better ways can be found to make these smaller. These can focus on the extraction of resources, how we get rid of wastes and how we can reduce overall energy use, therefore reducing general impacts.

Some problems can be solved completely but others can only be partially treated.

Some new technologies reduce the environmental impact unintentionally, just because they are different from what was done before.

All fossil fuels release carbon dioxide when they are burnt which causes global climate change. Carbon capture and storage involves a number of technologies such as amine scrubbing then storing the CO2 underground in depleted oil fields or aquifers. The collection of CO_2 is ok for point sources such as power stations, but it can't be done for sources such as cars or houses. Only about 10% of global emissions come from point sources.

Growing trees also reduces CO_2 levels by photosynthesis and carbon sequestration.

Oil tankers can be designed to make oil spills less likely.

Double hulls make leaks less likely if a tanker hits a rock. GPS navigation and tracking reduces the risk of tankers being off course or colliding with other ships. Double rudders and two engines make tankers much safer if there is a mechanical breakdown.

Natural gas supplies can be increased by fracking. Burning gas releases less CO_2 than burning oil or coal. Fracking works by making fine-grained shale rocks more permeable. High pressure water creates cracks and sand grains prevent them closing up so the gas can flow up the well pipe. Although it reduces CO_2 releases, fracking can cause earthquakes and pollute water.

Using nuclear power produces radioactive waste. Radiation from this can cause mutations and cancer. Higher levels can kill. The most dangerous waste is high level waste. This is stored in solid glass in metal cans underground. It is so radioactive that it heats up so it is cooled down by blowing air over it.

Some new technologies make nuclear power more efficient with a lower environmental impact.

Fast reactors use uranium 238 which is converted to fissile plutonium by neutron bombardment. Uranium 238 is much more common than uranium 235 so less mining is needed, so there is less habitat damage caused by mining and less pollution by fuel processing. Uranium 238 is also a waste from uranium 235 reactors, so mining may not be needed at all.

A new type of reactor uses thorium. Thorium reactors produce less radioactive waste and it has shorter half-lives than uranium reactors.

Fusion has big advantages. It doesn't produce any high level waste and the fuel does not need to be mined. There are two main projects. One uses a ring shaped reactor called a torus. The other uses beads of frozen fuel which are dropped in front of a laser beam.

There are lots of new renewable energy technologies have been developed. Some have lower environmental impacts because they are more efficient and produce more energy. So less equipment has to be made. Other new technologies have been designed to have lower impacts.

The newest solar panels are much more efficient so less material has to be produced. This is good because some solar panels contain heavy metals such as cadmium. One new design is multi-junction PV which has several layers that absorb more wavelengths of light. They are 40% efficient, instead of 15% for normal panels.

Wind farms kill lots of birds and bats. A new radar system has been developed that can turn off turbines if big birds are flying nearby. Putting wind farms offshore can also reduce deaths, especially for bats and land birds.

It has been found that white towers attract insects that attract the birds and bats that may be killed. Painting them purple may reduce deaths.

Hydro-electric power stations change river habitats. They block the route of migrating fish such as salmon. Fish ladders allow them to swim along a long row of pools to get around the dam

Early plans for tidal power were for tidal barrages that would have big environmental impacts by blocking the flow of water and changing the tidal range. They are a problem for migrating fish and bigger animals like seals and whales. This reduces the feeding areas for water birds like waders and changes turbidity and temperatures. More recent proposals are for lagoons which only affect part of the estuary and don't block the main channel. In stream turbines have even less impact but they don't produce as much electricity.

Some new technologies can be used to control the pollutants from using energy resources, mainly fossil fuels.

Burning coal and oil makes sulfur dioxide that causes acid rain. FGD is flue gas desulfurisation. One method uses a bed of crushed limestone. The sulfur dioxide reacts with the limestone so it does not get into the air. Gypsum is produced which can be used to make building plaster.

In the UK and Europe power stations hardly produce any sulfur dioxide and acid rain is not a big problem. In newly industrial countries acid rain is still a major problem.

This can also be used to treat gases from smelting sulphide ores.

Catalytic converters are used to treat gases from vehicle engines. They treat NOx, carbon monoxide and unburnt fuels, but they don't work as well on diesel engines.

In summary, all energy resources damage the environment but different resources do this in different ways and to different degrees. A range of new technologies has been developed to reduce these impacts. Some methods have completely removed the problem but some are only partly successful. New discoveries are constantly being made that reduce the impacts more.

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay without comments

Discuss the extent to which the development of new technologies has reduced the environmental impacts of the exploitation of energy resources.

[25 marks]

Student answer	Comments
The use of energy has a big impact on the environment and better ways can be found to make these smaller. These can focus on the extraction of resources, how we get rid of wastes and how we can reduce overall energy use, therefore reducing general impacts. Some problems can be solved completely but others can only be partially treated. Some new technologies reduce the environmental impact unintentionally, just because they are different from what was done before.	
All fossil fuels release carbon dioxide when they are burnt which causes global climate change. Carbon capture and storage involves a number of technologies such as amine scrubbing then storing the CO_2 underground in depleted oil fields or aquifers. The collection of CO_2 is ok for point sources such as power stations, but it can't be done for sources such as cars or houses. Only about 10% of global emissions come from point sources. Growing trees also reduces CO_2 levels by photosynthesis and carbon sequestration.	
Oil tankers can be designed to make oil spills less likely. Double hulls make leaks less likely if a tanker hits a rock. GPS navigation and tracking reduces the risk of tankers being off course or colliding with other ships. Double rudders and two engines make tankers much safer if there is a mechanical breakdown.	
Natural gas supplies can be increased by fracking. Burning gas releases less CO_2 than burning oil or coal. Fracking works by making fine-grained shale rocks more permeable. High pressure water creates cracks and sand grains prevent them closing up so the gas can flow up the well pipe. Although it reduces CO_2 releases, fracking can	

cause earthquakes and pollute water.	
Using nuclear power produces radioactive waste. Radiation from this can cause mutations and cancer. Higher levels can kill. The most dangerous waste is high level waste. This is stored in solid glass in metal cans underground. It is so radioactive that it heats up so it is cooled down by blowing air over it.	
Some new technologies make nuclear power more efficient with a lower environmental impact. Fast reactors use uranium 238 which is converted to fissile plutonium by neutron bombardment. Uranium 238 is much more common than uranium 235 so less mining is needed, so there is less habitat damage caused by mining and less pollution by fuel processing. Uranium 238 is also a waste from uranium 235 reactors, so mining may not be needed at all. A new type of reactor uses thorium. Thorium reactors produce less radioactive waste and it has shorter half-lives than uranium reactors.	
Fusion has big advantages. It doesn't produce any high level waste and the fuel does not need to be mined. There are two main projects. One uses a ring shaped reactor called a torus. The other uses beads of frozen fuel which are dropped in front of a laser beam.	
There are lots of new renewable energy technologies have been developed. Some have lower environmental impacts because they are more efficient and produce more energy. So less equipment has to be made. Other new technologies have been designed to have lower impacts.	
The newest solar panels are much more efficient so less material has to be produced. This is good because some solar panels contain heavy metals such as cadmium. One new design is multi-junction PV which has several layers that absorb more wavelengths of light. They are 40% efficient, instead of 15% for normal panels.	
Wind farms kill lots of birds and bats. A new radar system has been developed that can turn off turbines if big birds are flying nearby. Putting wind farms offshore can also reduce deaths, especially for bats and land birds. It has been found that white towers attract insects that attract the birds and bats that may be killed. Painting them purple may reduce deaths.	

Hydro-electric power stations change river habitats. They block the route of migrating fish such as salmon. Fish ladders allow them to swim along a long row of pools to get around the dam.	
Early plans for tidal power were for tidal barrages that would have big environmental impacts by blocking the flow of water and changing the tidal range. They are a problem for migrating fish and bigger animals like seals and whales. This reduces the feeding areas for water birds like waders and changes turbidity and temperatures. More recent proposals are for lagoons which only affect part of the estuary and don't block the main channel. In stream turbines have even less impact but they don't produce as much electricity.	
Some new technologies can be used to control the pollutants from using energy resources, mainly fossil fuels. Burning coal and oil makes sulfur dioxide that causes acid rain. FGD is flue gas desulfurisation. One method uses a bed of crushed limestone. The sulfur dioxide reacts with the limestone so it does not get into the air. Gypsum is produced which can be used to make building plaster. In the UK and Europe power stations hardly produce any sulfur dioxide and acid rain is not a big problem. In newly industrial countries acid rain is still a major problem. This can also be used to treat gases from smelting sulphide ores. Catalytic converters are used to treat gases from vehicle engines. They treat NOx, carbon monoxide and unburnt fuels, but they don't work as well on diesel engines.	
In summary, all energy resources damage the environment but different resources do this in different ways and to different degrees. A range of new technologies has been developed to reduce these impacts. Some methods have completely removed the problem but some are only partly successful. New discoveries are constantly being made that reduce the impacts more.	

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay with comments

Discuss the extent to which the development of new technologies has reduced the environmental impacts of the exploitation of energy resources.

[25 marks]

General comments

This is a good essay. It is generally well expressed with the inclusion of many technical terms. Many details demonstrate a deeper knowledge of the issues and an understanding of the extent to which the technologies have minimised the impacts of the exploitation of energy resources.

A wide range of issues are included but often not in great depth. However, within the time available it would be difficult to do both and allowance should be made for this in awarding a mark.

Student answer	Comments
The use of energy has a big impact on the environment and better ways can be found to make these smaller. These can focus on the extraction of resources, how we get rid of wastes and how we can reduce overall energy use, therefore reducing general impacts. Some problems can be solved completely but others can only be partially treated. Some new technologies reduce the environmental impact unintentionally, just because they are different from what was done before.	A good introduction that demonstrates an understanding of the different ways in which the use of energy resources affects the environment and that the technologies developed to reduce impacts vary in their effectiveness.
All fossil fuels release carbon dioxide when they are burnt which causes global climate change. Carbon capture and storage involves a number of technologies such as amine scrubbing then storing the CO_2 underground in depleted oil fields or aquifers. The collection of CO_2 is ok for point sources such as power stations, but it can't be done for sources such as cars or houses. Only about 10% of global emissions come from point sources. Growing trees also reduces CO_2 levels by photosynthesis and carbon sequestration.	The description of CCS includes good technical details such as the use of amine scrubbers and underground storage in specific locations. The understanding of point sources is important. Carbon sequestration is not a new technology, although it is relevant to the reduction of impacts.

Oil tankers can be designed to make oil spills less likely. Double hulls make leaks less likely if a tanker hits a rock. GPS navigation and tracking reduces the risk of tankers being off course or colliding with other ships. Double rudders and two engines make tankers much safer if there is a mechanical breakdown.	The selection of double hulls and duplicate equipment is good, although they are not described or explained fully. Other technologies could have been included such as inert gas systems, satellite navigation or any clean-up technologies.
Natural gas supplies can be increased by fracking. Burning gas releases less CO_2 than burning oil or coal. Fracking works by making fine-grained shale rocks more permeable. High pressure water creates cracks and sand grains prevent them closing up so the gas can flow up the well pipe. Although it reduces CO_2 releases, fracking can cause earthquakes and pollute water.	This is a good example of a technology that has both positive and negative aspects.
Using nuclear power produces radioactive waste. Radiation from this can cause mutations and cancer. Higher levels can kill. The most dangerous waste is high level waste. This is stored in solid glass in metal cans underground. It is so radioactive that it heats up so it is cooled down by blowing air over it.	Important issues have been included, but many more details could have been included, such as other levels of radioactive waste. How the methods reduce the impact could have been expanded, such as the materials involved and how exposure is reduced.
Some new technologies make nuclear power more efficient with a lower environmental impact. Fast reactors use uranium 238 which is converted to fissile plutonium by neutron bombardment. Uranium 238 is much more common than uranium 235 so less mining is needed, so there is less habitat damage caused by mining and less pollution by fuel processing. Uranium 238 is also a waste from uranium 235 reactors, so mining may not be needed at all. A new type of reactor uses thorium. Thorium reactors produce less radioactive waste and it has shorter half-lives than uranium reactors.	This paragraph shows a wider understanding of how environmental impacts can be reduced through the development of more effective technologies. The understanding of the features of different reactor types and their environmental impacts is useful.
Fusion has big advantages. It doesn't produce any high level waste and the fuel does not need to be mined. There are two main projects. One uses a ring shaped reactor called a torus. The other uses beads of frozen fuel which are dropped in front of a laser beam.	The inclusion of fusion is useful but the details included could have been expanded.

There are lots of new renewable energy technologies have been developed. Some have lower environmental impacts because they are more efficient and produce more energy. So less equipment has to be made. Other new technologies have been designed to have lower impacts.	A useful introduction to the renewable energy resources.
The newest solar panels are much more efficient so less material has to be produced. This is good because some solar panels contain heavy metals such as cadmium. One new design is multi-junction PV which has several layers that absorb more wavelengths of light. They are 40% efficient, instead of 15% for normal panels.	Useful specific details that demonstrate a deeper knowledge and understanding of the technology.
Wind farms kill lots of birds and bats. A new radar system has been developed that can turn off turbines if big birds are flying nearby. Putting wind farms offshore can also reduce deaths, especially for bats and land birds. It has been found that white towers attract insects that attract the birds and bats that may be killed. Painting them purple may reduce deaths. Hydro-electric power stations change river habitats. They block the route of migrating fish such as salmon. Fish ladders allow them to swim along a long row of pools to get around the dam.	Good details of the problems caused by wind farms and HEP, with some details of technologies that can minimise them. Fish ladders are not really a new technology, but the student understands that they were developed in response to a problem.
Early plans for tidal power were for tidal barrages that would have big environmental impacts by blocking the flow of water and changing the tidal range. They are a problem for migrating fish and bigger animals like seals and whales. This reduces the feeding areas for water birds like waders and changes turbidity and temperatures. More recent proposals are for lagoons which only affect part of the estuary and don't block the main channel. In stream turbines have even less impact but they don't produce as much electricity.	Several major impacts are included but more details of how this is achieved could have been explained.
Some new technologies can be used to control the pollutants from using energy resources, mainly fossil fuels. Burning coal and oil makes sulfur dioxide that causes acid rain. FGD is flue gas desulfurisation. One method uses a bed of crushed limestone. The sulfur dioxide reacts with the limestone so it does not get into the air. Gypsum is produced which can be used to make building plaster. In the UK and Europe power stations hardly produce any sulfur dioxide and acid rain is not a big problem. In newly industrial countries acid rain is still a major problem.	Good technical details and terminology are included, but there are many details that may have been expected such as fuel desulfurisation, urea sprays.

This can also be used to treat gases from smelting sulphide ores. Catalytic converters are used to treat gases from vehicle engines. They treat NOx, carbon monoxide and unburnt fuels, but they don't work as well on diesel engines.	
In summary, all energy resources damage the environment but different resources do this in different ways and to different degrees. A range of new technologies has been developed to reduce these impacts. Some methods have completely removed the problem but some are only partly successful. New discoveries are constantly being made that reduce the impacts more.	

Mark awarded

- The essay must be matched to the descriptors in the mark scheme.
- The essay covers all major aspects that could be expected with an adequate range of specific examples.
- The focus of the response is sustained, but more opportunities could have been taken to discuss the effectiveness of the methods.
- There are no significant errors.

Level 4

20 marks (out of 25)

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Complete essay

Discuss how poor soil management methods used on farmland may cause environmental problems in other areas.

[9 marks]

The way that farmland is cultivated can cause environmental problems in other areas.

Ploughing loosens and disturbs soil so it can be washed or blown away. It makes the land less productive so more land has to be cleared for farming somewhere else. Using machinery also compacts the soil so water doesn't percolate into the soil as easily and roots don't penetrate the soil. Compaction also reduces aeration so there are fewer soil organisms for processes like decomposition and nitrogen fixation.

The soil can be deposited in rivers where it covers water plants and chokes animals that filter food from the water. This can break food chains and affect other organisms.

The sediments that sink in the water reduce the volume of water in the river or in reservoirs. This increases the risk of flooding when it rains heavily and reduces the amount of water the reservoir can hold.

If the soil gets washed into the sea it can damage coral reefs and make the water cloudy so seaweeds don't get enough light and can't photosynthesise.

If it is very dry the soil may be blown away. This is more likely if windbreaks like hedgerows have been removed. Wind erosion is a big problem in North Africa and caused the dust bowl in the USA when a dry summer caused the soil to blow the soil away in an area that had been turned to arable land by ploughing.

Farmers often use artificial fertilisers to keep harvests high. These can get washed into rivers and lakes causing eutrophication. Some can be dangerous to humans, causing blue-baby syndrome. Manufacturing them also uses a lot of energy, causing atmospheric pollution. Farm machinery also releases emissions because of the fuel that is used. Livestock also release pollutant gases, especially methane which causes global warming.

If farmers change the way they cultivate the fields they could reduce environmental damage. This would involve better soil management to reduce erosion and reducing fertiliser use.

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay without comments

Discuss how poor soil management methods used on farmland may cause environmental problems in other areas.

[9 marks]

General comments	
Student answer	**Comments**
The way that farmland is cultivated can cause environmental problems in other areas.	
Ploughing loosens and disturbs soil so it can be washed or blown away. It makes the land less productive so more land has to be cleared for farming somewhere else. Using machinery also compacts the soil so water doesn't percolate into the soil as easily and roots don't penetrate the soil. Compaction also reduces aeration so there are fewer soil organisms for processes like decomposition and nitrogen fixation.	
The soil can be deposited in rivers where it covers water plants and chokes animals that filter food from the water. This can break food chains and affect other organisms. The sediments that sink in the water reduce the volume of water in the river or in reservoirs. This increases the risk of flooding when it rains heavily and reduces the amount of water the reservoir can hold.	
If the soil gets washed into the sea it can damage coral reefs and make the water cloudy so seaweeds don't get enough light and can't photosynthesise.	
If it is very dry the soil may be blown away. This is more likely if windbreaks like hedgerows have been removed. Wind erosion is a big problem in North Africa and caused the dust bowl in the USA when a dry summer caused the soil to blow the soil away in an area that had been turned	

to arable land by ploughing.	
Farmers often use artificial fertilisers to keep harvests high. These can get washed into rivers and lakes causing eutrophication. Some can be dangerous to humans, causing blue-baby syndrome. Manufacturing them also uses a lot of energy, causing atmospheric pollution. Farm machinery also releases emissions because of the fuel that is used.	
Livestock also release pollutant gases, especially methane which causes global warming.	
If farmers change the way they cultivate the fields they could reduce environmental damage. This would involve better soil management to reduce erosion and reducing fertiliser use.	

Marks awarded	
Level	**Marks**
3	7 8 9
2	4 5 6
1	1 2 3

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay with comments

Discuss how poor soil management methods used on farmland may cause environmental problems in other areas.

[9 marks]

General comments This answer includes a number of relevant principles and details, but it is incoherent as they are not linked or developed to the required extent. Many important points are missing and some of the content is irrelevant.	
Student answer	**Comments**
The way that farmland is cultivated can cause environmental problems in other areas.	It is not necessary to have an extensive introduction in an answer to a 9 mark question.
Ploughing loosens and disturbs soil so it can be washed or blown away. It makes the land less productive so more land has to be cleared for farming somewhere else. Using machinery also compacts the soil so water doesn't percolate into the soil as easily and roots don't penetrate the soil. Compaction also reduces aeration so there are fewer soil organisms for processes like decomposition and nitrogen fixation.	The conversion of new areas to farmland is relevant but is not developed. What sort of land? Where? The impact of compaction on percolation is only relevant if it is related to impacts elsewhere such as faster run-off or reduced groundwater recharge. The impacts on root penetration and aerobic processes are not relevant. No details are included about the ploughing eg down slope/contour, ploughing when rain is likely or ploughing steep slopes.
The soil can be deposited in rivers where it covers water plants and chokes animals that filter food from the water. This can break food chains and affect other organisms. The sediments that sink in the water reduce the volume of water in the river or in reservoirs. This increases the risk of flooding when it rains heavily and reduces the amount of water the reservoir can hold.	This lacks details on how sedimentation occurs and how a wider range of organisms are affected. These points could also be expanded.

If the soil gets washed into the sea it can damage coral reefs and make the water cloudy so seaweeds don't get enough light and can't photosynthesise.	Since coral reefs are a specific habitat that students study, more detail of the impact of sediments could be expected, including terminology such as polyps, symbiotic algae and cilia.
If it is very dry the soil may be blown away. This is more likely if windbreaks like hedgerows have been removed. Wind erosion is a big problem in North Africa and caused the dust bowl in the USA when a dry summer caused the soil to blow the soil away in an area that had been turned to arable land by ploughing.	More details could be included on the wind shadow effects of hedges, large fields and the effect of crop choices: long-term crops, strip cropping etc.
Farmers often use artificial fertilisers to keep harvests high. These can get washed into rivers and lakes causing eutrophication. Some can be dangerous to humans, causing blue-baby syndrome. Manufacturing them also uses a lot of energy, causing atmospheric pollution. Farm machinery also releases emissions because of the fuel that is used.	Details of eutrophication would be useful, such as: algal bloom, reduced light penetration, reduced macrophytes, broken food chains, decomposition, deoxygenation, death of fish, insects etc, toxins from cyanobacteria (blue-green algae). Nitrates could have been named. Emissions from nitrate manufacture are relevant, but the use of arm machinery is not a soil management factor unless it is explained more fully.
Livestock also release pollutant gases, especially methane which causes global warming.	This is not a soil management method.
If farmers change the way they cultivate the fields they could reduce environmental damage. This would involve better soil management to reduce erosion and reducing fertiliser use.	This is very vague and adds no useful details.

Marks awarded

Level 2?

- The answer is focused in parts but definitely lacks appropriate depth.
- No useful conclusion is present and there are no supporting judgements.
- A range of processes/systems is included, but little knowledge and understanding is shown.
- There are many omissions.
- Little terminology is used.
- Conclusion: Not Level 2

Level 1?

- The answer is unbalanced and lacks focus. Many points are fragmented but some are related to each other.
- The conclusion is vague.
- A range of processes/systems is included, some being related to the question, but some are just generally related to the impacts of agriculture.
- Little terminology is used.
- Understanding is limited rather than absent.

Award: 3/9

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Complete essay

Evaluate the extent to which recycling used materials affects the environmental impact of using mineral resources.

[9 marks]

Recycling extends the useful life of minerals. This means that less mining is needed to extract new minerals. This reduces habitat loss caused by more mining and environmental such as noise, dust, turbid drainage water and acid mine drainage.

Recycling also reduces the damage caused by processing the minerals. Smelting metal ores usually involves using fossil fuels which cause climate change and acid rain. It also produces solid wastes that are dumped on spoil heaps which destroys habitats.

However it is not possible to recycle all used materials. Mixed materials such as alloys and items made with lots of different materials such as computers or mobile phones are difficult to separate and there may be no objects that can be made with them. Good designs may make it possible to identify materials so they can be separated for their own recycling processes.

Recycling schemes may reduce some environmental problems but they can cause some new ones as well. More transport is needed because different trucks will be needed to collect different things like glass, paper and plastics. It may be much further to the factory that can recycle the materials than it is to the landfill site, so more diesel is used and more pollution created. If everyone recycled then the economies of scale would make it possible to build more local recycling facilities.

Recycling some materials produces toxic waste that may be released into the environment instead of it being trapped in a landfill site.

Overall, recycling solves more problems than it causes. Almost all materials can be recycled: paper, glass, most plastics, metals, concrete and bricks, batteries and lightbulbs. Good management and the cooperation of the public reduces the disadvantages maker recycling an even better option.

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay without comments

Evaluate the extent to which recycling used materials affects the environmental impact of using mineral resources

[9 marks]

General comments	
Student answer	**Comments**
Recycling extends the useful life of minerals. This means that less mining is needed to extract new minerals. This reduces habitat loss caused by more mining and environmental such as noise, dust, turbid drainage water and acid mine drainage.	
Recycling also reduces the damage caused by processing the minerals. Smelting metal ores usually involves using fossil fuels which cause climate change and acid rain. It also produces solid wastes that are dumped on spoil heaps which destroys habitats.	
However it is not possible to recycle all used materials. Mixed materials such as alloys and items made with lots of different materials such as computers or mobile phones are difficult to separate and there may be no objects that can be made with them. Good designs may make it possible to identify materials so they can be separated for their own recycling processes.	
Recycling schemes may reduce some environmental problems but they can cause some new ones as well. More transport is needed because different trucks will be needed to collect different things like glass, paper and plastics. It may be much further to the factory that can recycle the materials than it is to the landfill site, so more diesel is used and more pollution created. If everyone recycled then the economies of scale would make it possible to build more local recycling facilities.	

Recycling some materials produces toxic waste that may be released into the environment instead of it being trapped in a landfill site.	
Overall, recycling solves more problems than it causes. Almost all materials can be recycled: paper, glass, most plastics, metals, concrete and bricks, batteries and lightbulbs. Good management and the cooperation of the public reduces the disadvantages maker recycling an even better option.	

Marks awarded

Exemplar material

AS/A-level Environmental Science: Preparing to teach

Essay with comments

Evaluate the extent to which recycling used materials affects the environmental impact of using mineral resources

[9 marks]

General comments	
This is a good answer which shows a good understanding of most of the important issues. Some have been developed, but there is limited time for this in a 9 mark answer. For an AS answer, it is not expected that many details of pollution issues would be included.	
Student answer	**Comments**
Recycling extends the useful life of minerals. This means that less mining is needed to extract new minerals. This reduces habitat loss caused by more mining and environmental such as noise, dust, turbid drainage water and acid mine drainage.	This is a good introduction which includes the main advantages related to reduced demand for mining. Brief details of the problems and impacts would have been useful eg sulphide ores cause acid mine drainage which lowers pH and kills insect larvae.
Recycling also reduces the damage caused by processing the minerals. Smelting metal ores usually involves using fossil fuels which cause climate change and acid rain. It also produces solid wastes that are dumped on spoil heaps which destroys habitats.	The inclusion of named examples shows knowledge without adding too much time-consuming length.
However it is not possible to recycle all used materials. Mixed materials such as alloys and items made with lots of different materials such as computers or mobile phones are difficult to separate and there may be no objects that can be made with them. Good designs may make it possible to identify materials so they can be separated for their own recycling processes.	This paragraph shows a balanced understanding of recycling. The problem of mixed materials is described, along with a possible solution to the problem.
Recycling schemes may reduce some environmental problems but they can cause some new ones as well. More transport is needed because different trucks will be needed to collect different things like glass, paper and plastics. It may be much further to the factory that can recycle the materials than it is to the landfill site, so more	A useful point. Named pollutants released would be useful.

diesel is used and more pollution created. If everyone recycled then the economies of scale would make it possible to build more local recycling facilities.	
Recycling some materials produces toxic waste that may be released into the environment instead of it being trapped in a landfill site.	An important point. Named examples would be useful eg heavy metals
Overall, recycling solves more problems than it causes. Almost all materials can be recycled: paper, glass, most plastics, metals, concrete and bricks, batteries and lightbulbs. Good management and the cooperation of the public reduces the disadvantages maker recycling an even better option.	Again, a paragraph that shows a rounded understanding.

Marks awarded

Level 2?

- The response is focused throughout, not just in parts. It is better than 'lacking appropriate depth'.
- The conclusion includes a useful judgement and is all relevant.
- The range of knowledge and understanding is good. There are no real inconsistencies or errors. Any omissions are probably caused by the time limits for the question.
- Limited environmental terminology is used accurately.
- Conclusion: better than Level 2

Level 3?

- The conclusion could include more detailed judgements.
- Some more technical terminology and named examples could have been included.

Award: 7/9