

Chapter 7 Exercise questions: Answers

7.1 Natural resources – uses and management

1. Renewable energy includes solar and wind; non-renewable energy includes oil and coal.
2. Natural capital is the stock/store of natural resources of the Earth.
3. Cultural services obtained from the sea include health and well-being, tourism/recreation/spirituality, knowledge, and wildlife watching.
4. Renewable resources are those that do not get depleted as they can be regenerated and/or replaced as quickly as they are being used. Non-renewable resources cannot be regenerated in the short term, i.e., within a human lifetime, and include nuclear power and fossil fuels such as coal, natural gas, oil and peat.
5. The 'intrinsic' value of something is the value it has in itself, not from any use it has. The intrinsic value of natural capital includes ethical, spiritual, and philosophical perspectives, e.g., the rights of organisms such as badgers or foxes in an ecosystem such as a deciduous forest are values in their own right, irrespective of economic value and regardless of their potential use to humans.
6. The potential benefits of having local people involved in development projects include harnessing local knowledge; giving a greater sense of ownership; providing a better response to user's needs and helping the EIA to address relevant issues.
7. The trend in overfishing between 1974 and 2017 was upwards, beginning at about 10% in 1974 and increasing three-fold to around 33% by 2017.
8. HL Answers may demonstrate:
 - understanding of concepts and terminology, e.g., economic development, consumerism, consumption, production, sustainability;
 - breadth in addressing and linking a range of indicators and their usefulness in understanding the concepts of sustainability, economic interests, production and consumption;
 - examples of specific resources, e.g., over-fishing of Grand Banks cod, blue fin tuna;
 - balanced analysis evaluating the extent to which fish have been over-fished in different fisheries, growth in demand, declining fish stocks, the growth of illegal, unreported and unregulated fishing, seabed trawling and bycatch;
 - a conclusion that is consistent with, and supported by, analysis and examples given, e.g., changes in Grand Banks cod stocks.
9. HL Answers may demonstrate:
 - understanding of concepts and terminology, e.g., globalization, interdependence, supply, demand, production, trade, availability, processing, retailing;
 - breadth in addressing and linking a range of indicators and their usefulness in understanding the concepts of economic globalization, national resource security, food availability, costs, foreign direct investment in food processing and retailing, global advertising;

- examples of specific foods that are 'global' rather than local, e.g., Indian food, Italian food, Chinese food, year-round supplies of avocados, strawberries, biltong;
- balanced analysis evaluating the extent to which different products are in demand globally and trade in them may reduce availability in the area that they originate from;
- a conclusion that is consistent with, and supported by, analysis and examples given, e.g., high-value fruits such as strawberries and avocados.

10. HL Answers may demonstrate:

- understanding of concepts and terminology, e.g., natural resources, renewable resources (e.g., fish and trees), non-renewable resources (e.g., oil), sustainability, maximum sustainable yield;
- breadth in addressing and linking a range of natural resources and their usefulness in understanding the concept of sustainability, e.g., fish stock, forest cover, freshwater resources;
- use of specific examples including forests, fish, soil, water;
- balanced analysis;
- a conclusion that is consistent with, and supported by, analysis and examples given, e.g., sustainable forestry, sustainable fishing, keeping within maximum sustainable yields.

7.2 Energy sources – uses and management

11. HL Global energy consumption expanded exponentially from the 1950s but has slowed down from the 2000s and is predicted to peak around 2030, mainly caused by an increase of renewables in the energy mix.
12. HL The increase was from c. 30 Tj to c. 120 Tj, an increase of c. 90Tj or 300%.
13. HL Energy security varies by country depending on resource availability, depletion of existing resources, demand for industrialisation/economic growth, geopolitical developments, impacts of global warming, standard of living in a country, e.g., HIC/LIC.
14. HL In general, as income increases, energy use increases. For example, Ethiopia has an income of about US\$ 2000 per capita and consumes less than 5000 kWh/person. In contrast, Qatar has an income of about US\$ 100,000 per capita and consumes about 200,000 kWh. An exception is Trinidad and Tobago with an income of about US\$ 30,000 per capita but a consumption of about 170,000 kWh.
15. HL Mountaintop removal destroys habitats, removes soils/rock and dumps them elsewhere; it disrupts river flows; it increases overland runoff and reduces interception; and is likely to lead to an increase in air pollution.
16. HL Rare earth elements are used in electric vehicles and wind turbines. As the demand for these increases, demand for/production of rare earth elements will increase, too.
17. HL Mining REEs can lead to respiratory problems; contamination of food could lead to food poisoning; high rates of cancer have been recorded close to some mines; miners may get killed in underground accidents; radioactive waste is produced.
18. HL Coal consumption in Norway has been fairly constant since 2000, but it makes up a very small percentage of overall energy use; most energy used in Norway is

hydroelectric power. Coal consumption in the USA is also falling, but coal still forms a larger proportion of overall energy used than in Norway.

19. HL Advantages of nuclear power include: a reliable source of energy, relatively low costs once operating and up to 60 years supply of uranium.
Disadvantages include: high start-up costs and decommissioning costs, safety issues over the disposal of used nuclear reactor fuel.
20. HL Battery storage produces emissions and pollution during mining, transport, processing and construction. However, it is important if the potential for renewable energy sources is to be maximized.

7.3 Solid waste

21. In general, there is a HIC/LIC contrast, with HICs generating large amounts of waste, e.g., USA > 2.5 kg/person/day and LICs generating very small amounts of waste, e.g., Kenya 0.0–0.49 kg/person/day. South Africa is an anomaly as it generates 2.0–2.49 kg/person/day.
- 22.
- a) 2016-2030: Sub-Saharan Africa 83%, South Asia 40%, North America 18%.
 - b) 2016-2050: Sub-Saharan Africa 196%, South Asia 100%, North America 37%.
- 23.
- a) Garments, textiles and insulation.
 - b) Textiles can be re-used directly as clothing if they are in good condition, or they can be recycled as yarn to be made into new products.
 - c) Leakage is minimized by composting and/or using for biogeochemical feedstock.
 - d) Textiles can be processed to produce biogas, which can then be used to produce electricity or heat.
24. Preventative strategies are more sustainable than restorative strategies as they reduce the amount of waste produced. Preventative strategies for managing waste include altering human activity, e.g., by reducing consumption rates or composting food waste. In addition, the release of pollutants can be controlled. Governments can create legislation to encourage recycling and reuse initiatives, and impose taxes on disposable items. Moreover, landfills can be claimed and refuse can be diverted to waste-for-energy programmes in which it is possible to incinerate waste to create energy.
25. Some HICs export their waste to LICs and MICs because they do not want to keep their own waste/they do not have room for any more waste, e.g., landfills may be full. In LICs/MICs labour costs are lower, governments may be keen to recycle waste because they get paid for doing so, and they can generate new resources/employment, land is available for waste disposal and, although long distances may be involved, the cost of transport is low.
26. For example, reeds absorb carbon dioxide in the air through photosynthesis but they also absorb nitrogen and phosphorus during growth and development. Thus, planting reeds can increase carbon sequestration and absorb nitrogen and phosphorus, thereby improving water quality.

27. Waste can be used to produce energy through incineration, e.g., Singapore incinerates about 8200 tons of waste every day and produces over 2500 MWh of energy, supporting 900 homes, daily. Waste-to-energy schemes use decomposing rubbish, e.g., Puente Hills in USA produces enough methane from landfill to generate electricity to 70,000 homes.
28. Waste-to-energy reduces the amount of waste in landfills, but it may produce toxins. Recycling uses materials many times, but it may use lots of energy, e.g., for cleaning bottles to be recycled.
29. The circular economy minimizes inputs, uses renewable forms of energy and reduces outputs/waste materials.
30. 'Prevent' is the best form of waste management as it reduces the amount of materials used/needed to be managed.

Chapter 7 Practice questions: Answers

1.

a) Answer to include the following points: [2 max]

- ecosystem services are the benefits that ecosystems provide to humanity; [1]
- they include supporting-, regulating-, provisioning- and cultural- services. [1]

b) Answer to include the following points: [2 max]

- cultural services are derived from places where people enjoy cultural goods and benefits, such as open spaces, e.g., parks, gardens, rivers, forests; [1]
- benefits include recreation, education and improvements to human health. [1]

c) Answer to include any two of the following points: [2 max]

- primary productivity;
- soil formation;
- cycling of nutrients.

d) Answer to include the following points: [2 max]

- ecosystem goods are marketable products, e.g., timber and grain; [1]
- ecosystem services are benefits such as flood- and erosion-protection, and climate regulation. [1]

e) air quality/climate regulation [1]

[Total 9 marks]

2.

a) gas = the red band = $69 - 47$ [1]
= 32% [1]

b) Answer to include the following points: [2 max]

- it is a very dry environment and has limited supplies of water; [1]
- it has very large deposits of oil and natural gas. [1]

c) total renewables = the top 3 bands:

$$\begin{aligned} \text{renewables} + \text{HEP} + \text{nuclear energy} &= 8 + 5 + 8 \text{ [1]} \\ &= 21\% \text{ [1]} \end{aligned}$$

d) Answer to include the following points: [2 max]

- it is based on non-renewable resources, so is finite; [1]
- oil and natural gas release greenhouse gases when burnt, so contribute to global warming. [1]

[Total 8 marks]

3.

a) High-income countries (HICs). [1]

b) Answer to include the following points: [2 max]

- population growth – there will be more people living in 2050 compared with now, more people = more waste; [1]
- there will be more middle-income population, so the amount of waste per person will increase. [1]

c) Answer to include the following points: [2 max]

- more waste is exported from HICs to LICs; [1]
- as people become wealthier, they consume more resources, so as countries make the transition from LIC to MIC, they generate more waste and so waste is becoming a greater problem around the world. [1]

d) Mobile phones and computers, that contain many components such as aluminium and copper. [1]

e)

(i) In urban areas, garden waste is often referred to as 'green waste'. [1]

(ii) Answer to include the following points: [2 max]

- there is more green waste in HICs than in LICs; [1]
- people in HICs are wealthier than people in LICs and are likely to have larger houses with gardens (although many live in apartments without gardens), whereas many people in LICs have smaller homes and are less likely to have gardens (those who do have gardens are more likely to use them for food production, and so less waste is produced). [1]

[Total 9 marks]

4.

a) Answer to include the following points: [4 max]

- resource security is the ability to ensure long-term availability of sufficient natural resources to meet demand; [1]
- e.g, food security is having enough good quality food so that people remain healthy and productive; [1]
- e.g. Finland, Ireland and Norway have the highest food security; [1]

- Ukraine (2022) and Gaza (2024) had reduced food security due to conflict in those areas. [1]
- b) Analysis including some of the following points: [7 max]
- water insecurity refers to a loss of water or water quality; [1]
 - increased temperatures due to global warming may lead to more evaporation losses; [1]
 - water pollution, e.g., eutrophication, can make water undrinkable; [1]
 - industrial discharges and effluent discharges pollute water; [1]
 - groundwater can be polluted due to overuse of fertilizers; [1]
 - increased population can increase the demand for water; [1]
 - there can be competition for water between different users; [1]
 - virtual water transfers, e.g., flowers grown in Kenya but sold in Europe. [1]
- c) Answers may demonstrate: [9 max]
- understanding of concepts and terminology, e.g., natural capital, sustainability, natural resources, finite resources, regeneration, recycling, re-use, upcycling, conservation, responsible consumption and production;
 - breadth in addressing and linking different forms of natural capital with sustainability;
 - examples, e.g., global fisheries, consumption of water, energy resources, mineral resources, forest and forest products;
 - balanced analysis including examples of where natural capital has been managed sustainably compared with examples where natural resources have been depleted, e.g., overfishing;
 - a conclusion consistent with, and supported by, analysis and examples.

[Total 20 marks]

5.

- a) Answer to include the following points: [4 max]
- renewable resources are those that do not get depleted; [1]
 - they can be regenerated or replaced as quickly as they are used either through natural growth or reproduction; [1]
 - non-renewable resources cannot be regenerated in the short-term; [1]
 - examples of non-renewable resources are coal, natural gas, oil. [1]
- b) Answer to include the following points: [7 max]
- availability and reliability of supply, e.g., Middle East oil and geothermal energy in New Zealand;
 - sustainability of supply, e.g., oil and gas are limited in the long-term;
 - pollution – fossil fuels release CO₂;

7

- energy efficiency – peat and wood have low efficiency, nuclear energy has high efficiency;
- economic factors – some forms of energy are very expensive, e.g., nuclear energy;
- energy security – dependency on Russian gas made the EU vulnerable during the conflict between Russia and Ukraine;
- award 1 mark for exemplification/examples used.

c) Answers may demonstrate: [9 max]

- understanding of concepts and terminology, e.g., energy conservation, energy efficiency, imports, self-sufficiency, dependence, renewable energy;
- breadth in addressing and linking different forms of energy and types of energy and their efficiency and forms of conservation, and how these can lead to a reduction of energy imports into a country;
- examples, e.g., loft and wall insulation, double/triple glazing of windows, lowering central heating temperature, wearing extra clothing rather than using more energy, switching off appliances when not in use, using public transport rather than private cars, using energy-efficient appliances such as fridges and LED light bulbs;
- balanced analysis of different methods of reducing energy consumption;
- a conclusion consistent with, and supported by, analysis and examples.

[Total 20 marks]

6.

a) Answer to include the following points: [4 max]

- sources of waste include domestic, industrial and agricultural; [1]
- types of waste include electronic, food and biohazardous; [1]
- more waste is created in HICs compared with LICs; [1]
- there has been a rapid increase in biodegradable waste, e.g., e-waste and plastics. [1]

b) Explanation to include some of the following points: [7 max]

- ecosystems can absorb some waste, but pollution occurs when harmful substances are added to an environment at a rate faster than they are transformed into harmless substances;
- some ecosystems are good at absorbing waste;
- reeds absorb nitrogen and phosphorus during growth and development, and so they can be used for pollution management;
- the carbon fertilization effect refers to the increase in plant growth due to increased CO₂;
- CO₂ is vital for plant growth, so increased atmospheric CO₂ should increase plant growth;

- however, since 1982 the average carbon fertilization effect has decreased from 21% to 12% per 100 ppm of CO₂ in the atmosphere;
- in some areas, levels of pollution are rising and ecosystems and crop yields are decreasing;
- wheat yields in Europe are decreasing due to high levels of ground level ozone.

c) Answers may demonstrate: [9 max]

- understanding of concepts and terminology, e.g., waste management, prevention, reduction, disposal, landfill, incineration, waste from energy, export of waste, recycling, composting;
- breadth in addressing and linking methods of waste disposal and alternatives to prevent waste, to reuse goods to extend their lifespan, to recover value, costs related to clean-up, and reduced consumption;
- examples, e.g., electronic waste, plastic waste, incineration, waste exports, plastic bag tax;
- balanced analysis of different methods of waste management;
- a conclusion consistent with, and supported by, analysis and examples.

[Total 20 marks]

7. HL Answers may demonstrate: [max 9]

- understanding of concepts and terminology, e.g., dependency, resources, resource insecurity, imports, balance of payments, environmental degradation, geopolitics;
- breadth in addressing and linking a range of indicators and their usefulness in understanding the concepts of resource dependence, imports, geopolitics;
- examples of specific cycles, e.g., European shortages of gas following the conflict between Russian and Ukraine, dependence on Middle East oil;
- balanced analysis evaluating the extent to which different countries rely economically on other countries and may need to keep geopolitical ties favourable;
- a conclusion that is consistent with, and supported by, analysis and examples given, e.g., countries that are lacking in resources, e.g., energy resources, may need to rely on other countries to supply their needs, and supplies can be affected if there are conflicts.

[Total 9 marks]

8. HL Answers may demonstrate: [max 9]

- understanding of concepts and terminology, e.g., battery storage, rare earth elements (REE), lithium-ion batteries, environmental degradation, geopolitics;
- breadth in addressing and linking a range of indicators and their usefulness in understanding the concept, e.g., sources of lithium, cobalt, supplies of rare earth elements, environmental degradation, health impacts, geopolitical relationships especially in relation to China and Russia, the two major manufacturers of batteries,

and recognising that large-scale battery storage is likely to become more widespread as batteries are needed in products such as electric vehicles and wind turbines;

- examples of areas of mining of lithium, e.g., Shabara mine, Kolwezi, DR Congo, Soquimich, Chile, and manufacture of batteries, e.g., Russia and China;
- balanced analysis evaluating the extent to which large-scale battery manufacture and storage impacts natural environments and geopolitical relationships;
- a conclusion that is consistent with, and supported by, analysis and examples given, e.g., DR Congo, Chile, China and Russia.

[Total 9 marks]

9. HL Answers may demonstrate; [max 9]

- understanding of concepts and terminology, e.g., solid domestic waste, sustainability, landfill, incineration, waste to energy, exporting waste, recycling, composting;
- breadth in addressing and linking a range of indicators and their usefulness in understanding the different methods of solid domestic waste management;
- examples of specific methods, e.g., landfill, incineration, waste-to-energy, exporting waste, composting, recycle, reduce, reuse;
- balanced analysis evaluating the sustainability of different methods of waste management;
- a conclusion that is consistent with, and supported by, analysis and examples given, e.g., composting, recycle, reuse, reduce.

[Total 9 marks]