GCE A LEVEL MARKING SCHEME

SUMMER 2022

A LEVEL (NEW)
GEOGRAPHY - UNIT 4
1110U40-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

UNIT 4: CONTEMPORARY THEMES IN GEOGRAPHY

SUMMER 2022 MARK SCHEME

Guidance for Examiners

Positive marking

Learners are writing under examination conditions and credit should be given for what the learner writes, as opposed to adopting an approach of penalising him / her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

The mark scheme for this component uses banded mark schemes.

Banded mark schemes

The mark scheme is in two parts to reflect the sections (A and B in the examination paper). Section A is 20 marks and Section B is 22 marks.

The first part of the mark scheme in each section is an assessment grid advising on bands and the associated marks that should be given in responses that demonstrate the qualities needed in the three AOs; AO1, AO2 and AO3 relevant to this component. The targeted AO(s) are also indicated, for example AO2.1c.

The second part of the mark scheme is advice on the indicative content that suggests the range of likely themes and specialised concepts, processes, scales and environments that may be included in the learner's answers.

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks. Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied. This is a two-stage process.

Banded mark schemes Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance, if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Banded mark schemes Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Where the specialised concepts are integral to knowledge and understanding, they are underlined in the indicative content.

The mark scheme reflects the layout of the examination paper. Mark the chosen question in Section A and the two chosen questions from Section B. If the candidate has responded to both questions in Section A or more than two in Section B mark all the answers. Award the higher marks attained for the correct number of required questions; further, possible rubric infringement will be discussed at the marking conference.

Be prepared to reward answers that give **valid and creditworthy** responses, especially if these do not fully reflect the 'indicative content' of the mark scheme.

Section A: Tectonic Hazards: Generic Mark Bands [20 marks]

	AO1 [6 marks]	AO2 [13 marks]	AO3 [1 mark]
Band	*Demonstrate knowledge and understanding of places, environments, concepts, processes, interactions and change at a variety of scales.*	*Apply knowledge and understanding in different contexts either to analyse or interpret or evaluate geographical issues and information.*	*Use a variety of relevant 'geographical skills' to construct arguments and draw conclusions.*
3	**5-6 marks** Secure factual knowledge and confident understanding of relevant concepts and principles. Developed exemplification used with supporting geographical terminology. Well-directed and well-annotated sketch maps / diagrams. Spelling, punctuation and grammar used with a high degree of accuracy.	**9-13 marks** Accurate application either to interpret or analyse or evaluate. Synthesis of the connections between different elements of the response to the question. Relevant application of the specialised concepts.	**1 mark** The response is appropriately structured.
2	**3-4 marks** Straightforward knowledge with some inaccuracies; some understanding of relevant concepts and principles. Appropriate exemplification and geographical terminology is partially evident. Annotated sketch maps / diagrams contain inaccuracies. Spelling, punctuation and grammar used with a reasonable degree of accuracy.	**5-8 marks** Some application either to interpret or analyse or evaluate with limited range, depth and development. Incomplete synthesis between different elements of the response to the question.	
1	**1-2 marks** Limited knowledge with errors and minimal understanding. Limited use of examples and terminology; no supporting sketch maps / diagrams. Spelling, punctuation and grammar used with limited accuracy.	**1-4 marks** Application either to interpret or analyse or evaluate is poor; occasional relevant points are made.	
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

Section A: Tectonic Hazards

1. 'Volcanoes only generate significant impacts at the local scale.' Discuss.
[20 marks]

AO1 [6] AO2 [13] AO3 [1]

Focus: 4.1.2

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- A description of primary and secondary hazards associated with volcanic activity and their effects (risk / scale)
- Pyroclastic flows consist of hot, dense mixtures of ash, rock and gas that can move downslope at speeds of up to 100 km/h for distances of up to 10km (causality / risk / scale)
- Lava flows are streams of molten rock that pour or ooze from an erupting vent. Lava is erupted during either nonexplosive activity or explosive lava fountains (causality / risk / scale)
- Ash falls comprise small, jagged pieces of rock, minerals and volcanic glass the size of sand and silt (<2mm) erupted by a volcano. Tephra is > 2mm (causality / risk / scale)
- Lahars comprise ash and debris mixed with water (rain or melted glacier ice - jökulhlaup in Icelandic) and can flow at very high speeds e.g. 22 m/s over long distances, usually along river valleys (causality / risk / scale)
- Volcanic landslides may be triggered by seismic activity (causality / risk scale)
- Toxic gases. Magma contains dissolved gases that are released into the atmosphere during eruptions. The most abundant gas typically released into the atmosphere from volcanic systems is water vapour (H_2O), followed by carbon dioxide (CO_2) and sulphur dioxide (SO_2) (causality / risk / scale)
- Demographic impacts: Mortality, migration, population structure changes (risk / scale / temporal scale)
- Economic impacts: costs of losses (risk / scale / temporal scale)
- Social impacts: Health, infrastructure, families (risk / scale / temporal scale)
- Environmental impacts: Biosphere, lithosphere, hydrosphere, atmosphere
- (risk / scale / temporal scale)
- Factors affecting risk and vulnerability e.g. preparation, prediction and mitigation / population density / proportions of age and gender groups that are susceptible to hazards / public education can reduce vulnerability / quality of governance / urban and rural environments - isolation will impact on access for emergency services. (adaptation / inequality / mitigation / resilience / risk / scale)

AO2

Application of knowledge and understanding is deployed to discuss whether volcanic activity only generates significant impacts at a local scale. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- Eruptions at constructive margins are generally less explosive than at destructive ones (risk / place / scale / vulnerability)
- The scale of the impacts varies according to the nature of the volcanic hazards (effusive or eruptive). Lava flows most dangerous to human life come from effusive fissure eruptions. (place / scale / risk / vulnerability)
- The magnitude of volcanic activity, with the assertion that the greater the magnitude the more widespread the impacts are likely to be (risk / place / scale)
- The location of an eruption plays a role too: Eyjafjallajokull (2010) was overlain by an ice cap and as the magma rose to the surface, the lava that was emitted passed through the ice and melted it. The mix of water and lava increased the explosivity and helped eject ash high into the atmosphere. (risk / place / scale / vulnerability)
- An examination of the severity of the risks associated with volcanic hazards. Pyroclastic flows pose a great demographic risk; however, ash falls can pose a greater risk to economic activity (place / risk / scale)
- Some volcanic activity may result in impacts that are concentrated locally, for example Eyjafjallajokull – Livestock was taken inside to escape ash / fluoride that was deposited from the volcano on grazing land. (place / scale / risk)
- Some volcanic activity may result in impacts that are more important at a regional or global scale, for example the Eyjafjallajokull eruption in April and May (2010) caused a range of problems: On one day in Heathrow alone, 1000 flights were cancelled / Europe lost $2.6 billion of GDP due to the eruption (place / scale / risk / sustainability)
- The globalisation of the world economy means that volcanic events are more likely to have widespread impacts than they did in the past. For example, following the Eyjafjallajokull eruption, the car industry was very badly affected. (place / globalisation / vulnerability / sustainability)
- Volcanic activity results in hazards operating over different time scales, initially volcanic activity can have local impacts, but over time these may spread more widely, for example, the outpouring of ash from the Eyjafjallajokull eruption led to the skies above Northern Europe being empty of air traffic for several days. (place / risk / time scale)

AO3

- The skill of presenting well-constructed, coherent and logical arguments about whether volcanic activity only generates significant impacts at a local scale
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about whether volcanic activity only results in impacts at a local scale

Credit other valid approaches.

2. 'Of all the hazards resulting from earthquake processes, liquefaction presents the greatest risk'. To what extent do you agree? [20 marks]

AO1 [6] AO2 [13] AO3 [1]

Focus: 4.1.3

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- The connections between the processes operative at tectonic plate boundaries, causes of earthquake hazards and their associated impacts (causality / place / risk / scale)
- A description of primary and secondary hazards associated with earthquake activity and their effects (place / risk / vulnerability)
- Liquefaction - the way in which the soil liquifies during an earthquake. The water separates from the soil particles and rises to the surface. (place / risk / scale / vulnerability)
- Liquefaction is more likely to occur in loose to moderately saturated granular soils with poor drainage, such as silty sands or sands and gravels - for example liquefaction in the Kobe earthquake (1995) was largely restricted to the reclaimed land of the port (place / risk / scale)
- The effects of soil liquefaction on the built environment can be extremely damaging. Buildings whose foundations bear directly on sand which liquefies will experience a sudden loss of support, which will result in drastic and irregular settlement of the building causing structural damage, including cracking of foundations and damage to the building structure, or leaving the structure unserviceable, even without structural damage (place / risk / sustainability / temporal scale)
- During the Canterbury earthquake (2010), the alluvial sediments underlying the city made it particularly vulnerable to liquefaction. The riverside areas of Avonside, Dallington, Burwood, Avondale, and Kaiapoi were badly affected. Damage from liquefaction may have been worsened by the high-water table from a wet winter. (place / risk / scale / temporal scale)
- Ground shaking - the vibration of the earth during an earthquake caused by seismic waves (place / risk / scale / vulnerability)
- Landslides - on steep slopes the vibration causes by earthquakes can trigger landslides and mudflows (place / risk / scale / vulnerability)
- Tsunamis - earthquakes cause the bodily displacement of large bodies of water by movement of the sea floor (place / risk / scale / vulnerability)
- Demographic impacts: Mortality, migration, population structure changes (inequality / place / risk / scale / temporal scale)
- Economic impacts: costs of losses (inequality / place / risk / scale / temporal scale)
- Social impacts: Health, infrastructure, families inequality / place / risk / scale / temporal scale)
- Environmental impacts: Biosphere, lithosphere, hydrosphere, atmosphere (inequality / place / risk / scale / temporal scale)

- Mitigation can be used to lessen the impacts of soil liquefactions. Artificial islands, such as the modern Rokkō Island and especially Port Island in Kobe, suffered severe subsidence due to liquefaction of the soil; However, the newly completed artificial island supporting Kansai International Airport was not significantly affected, due to being further away from the epicentre and because it was built to the latest standards (place / risk / scale / mitigation)
- The liquefaction risk at the Pegasus Town (Canterbury) site was identified in 2005, so the developers spent approximately $20 million on soil compaction, and the ground there held firm during the quake. (place / mitigation / resilience)

AO2

Application of knowledge and understanding is deployed to evaluate whether of all the hazards resulting from earthquake processes, soil liquefaction presents the greatest risk. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- Geographical factors associated with the location of the tectonic event can impact upon vulnerability. E.g. underlying soil / rock type and prevailing conditions (place / risk / vulnerability)
- Scale of the impact: Liquefaction leads to largely localised impacts, whereas a tsunami can have regional / global implications (inequality / place / risk / scale)
- An examination of the severity of the risks associated with different earthquake hazards. (place / risk / scale)
- Comparison of the severity of impacts linked to different earthquake hazards – demographic / economic / environmental / social (place / inequality / scale)
- Economic factors: wealth of the place or community. Influences preparation, prediction and mitigation (place / mitigation /adaptation / resilience / risk / vulnerability)
- Political factors such as good governance / hazard resistant design can reduce vulnerability of a population (mitigation /adaptation / resilience / risk / inequality)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about whether of all the hazards resulting from earthquake processes, soil liquefaction presents the greatest risk
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about whether of all the hazards resulting from earthquake processes, soil liquefaction presents the greatest risk

Credit other valid approaches.

Section B: Contemporary Themes in Geography: Generic Mark Bands [22 marks]

	AO1 [9 marks]	AO2 [11 marks]	AO3 [2 marks]
Band	*Demonstrate knowledge and understanding of places, environments, concepts, processes, interactions and change at a variety of scales.*	*Apply knowledge and understanding in different contexts either to analyse or interpret or evaluate geographical issues and information.*	*Use a variety of relevant 'geographical skills'* to construct arguments and communicate findings.*
3	**7-9 marks** Wide-ranging and thorough knowledge and confident understanding of relevant concepts and principles. Developed exemplification used with supporting geographical terminology. Well-directed and well-annotated sketch maps / diagrams. Spelling, punctuation and grammar used with a high degree of accuracy.	**8-11 marks** Accurate application either to interpret or analyse or evaluate. Synthesis of the connections between different elements of the response to the question. Relevant application of the specialised concepts.	**2 marks** A well-constructed, coherent and logical response.
2	**4-6 marks** Secure, straightforward knowledge and reasonable understanding of relevant concepts and principles. Appropriate exemplification and geographical terminology is partially evident. Appropriate, basically accurate annotated sketch maps / diagrams are included. Spelling, punctuation and grammar used with a reasonable degree of accuracy.	**5-7 marks** Some application either to interpret or analyse or evaluate with limited range, depth and development Incomplete synthesis between different elements of the response to the question.	**1 mark** The communication in the response is limited or incomplete.
1	**1-3 marks** Limited knowledge with errors and minimal understanding. Limited use of examples and terminology; no supporting sketch maps / diagrams. Spelling, punctuation and grammar used with limited accuracy.	**1-4 marks** Application either to analyse or interpret or evaluate is poor; occasional relevant points are made.	
	0 marks Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.	**0 marks** Response not creditworthy or not attempted.

Section B: Contemporary Themes in Geography

3. 'The most important function of ecosystems is the provision of goods.' To what extent do you agree? [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.2.1

Indicative content

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- **Ecosystem goods** are products that can be derived directly from the ecosystem e.g. timber from trees, water, food (and the nutrients derived from plants and animals) and medicines (inequality / place / sustainability)
- **Provisioning services** supply the goods themselves, such as food, water, timber and fibre. We rely on crops and plants for basic foodstuffs such as bread, rice and pasta, as well as the fruit and vegetables that make up a healthy diet. (place / sustainability)
- Estimates suggest that 1 billion people rely on 'wild foods'. It is also thought that 'wild foods' provide 20% of protein in around 60 poor countries. (place / sustainability)
- In Tanzania, wetlands are used extensively for cattle grazing and rice farming. (place / sustainability)
- Aquatic ecosystems are also vital. Fish provide 21% of animal protein in Africa and 28% in Asia. A clean water supply is crucial to human health and survival. (place / sustainability)
- Naturally occurring substances from plant species form the basis of more than 50% of prescription medicines. (place / sustainability)
- **Ecosystem services** are benefits that people obtain from ecosystems. These services result from the interactions among organisms and their natural environments e.g. purification of air and water, mitigation of floods and droughts, decomposition of wastes, pollination of crops and natural vegetation, control of potential agricultural pests, dispersal of seeds and translocation of nutrients, moderation of temperature extremes and the provision of aesthetic beauty and intellectual stimulation. (mitigation / place / resilience / sustainability)
- **Regulating services** govern climate and rainfall, water (e.g. flooding), waste, and the spread of disease. Wetlands, for instance, provide hydrological regulative functions, which include water storage (e.g. ground water recharge / flood prevention by flow regulation and mitigation), water purification (removal of pollutants) and retention of valuable nutrients and sediments. (mitigation / resilience / sustainability)
- **Cultural services** cover the beauty, inspiration and recreation that contribute to our spiritual welfare. An example of this can be found in the tourism industry surrounding coral reefs. Coral reefs may only cover 0.01% of the ocean floor but they support over 800 species of coral and more than 4,000 species of fish. (place / sustainability / globalisation)

AO2

Application of knowledge and understanding is deployed to examine to what extent the provision of goods is the most important function of ecosystems. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- Ecosystem goods are generally easier to value in a monetary sense than services. Ecosystem goods and services offer direct economic benefits and support economic activity at a range of scales from local to global (globalisation / scale)
- Ecosystem goods and services offer a variety of benefits: recreational benefits e.g. fishing and hunting; 'neglected' benefits e.g. scientific value; 'existence legacy value' e.g. philanthropic value and intergeneration equity. The global value of coral reef tourism is estimated to be around $9.6 billion and creates thousands of jobs. (place / sustainability / globalisation / interdependence / scale)
- Ecological goods are not only important; they are essential to our survival. Human life depends on the continuing capacity of the biosphere's ecosystems to provide a multitude of benefits (sustainability)
- It has been argued that human well-being depends on the services provided by ecosystems (The UN Millennium Ecosystem Assessment) (causality / sustainability)
- Provisioning services - It has been noted that many vulnerable communities obtain a significant amount of their food from the ecosystems that surround them. (place / scale / sustainability / vulnerability)
- Ecosystems play an important role in mitigating the impact of natural hazards. Wetlands absorb excess water in periods of heavy precipitation and can release water during dry seasons to help maintain stream flow. (mitigation / resilience / sustainability)
- The unsustainable use of ecosystem goods may destroy the realisable role of services and place humans at risk when the system loses equilibrium. (equilibrium / risk / thresholds)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about to what extent the provision of goods is the most important function of ecosystems
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about to what extent the provision of goods is the most important function of ecosystems

Credit other valid approaches.

4. 'At the local scale, physical factors influence ecosystem succession more than human factors.' To what extent do you agree? [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.2.5

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Physical factors will vary according to the nature of ecosystem succession selected (deciduous woodland, sand dunes and wetland areas.) Knowledge and understanding of physical factors (influencing, for example, psammosere succession) and human factors could include: Changes in soil moving from pioneer zone inland: increasing soil moisture/decreasing infiltration rates; decreasing alkalinity of soil; rise in humus, organic content and depth of soil. (causality / place)
- Changes in micro-climate include: increasing height of vegetation leading to diminishing wind speeds and increasing temperatures. (interdependence / place)
- Changes in vegetation coverage include: decreasing percentage of bare ground; changes in vegetation coverage; increasing numbers of species (diversity); increasing vegetation height/layers. (causality / place / scale)
- Increasing quality of soil allows larger and more diverse plants to become established (moisture, humus, depth improves conditions of growth) (interdependence / place / scale)
- Increasing shelter and stability promotes a greater range of vegetation (i.e. increases diversity/layers) (interdependence / place / scale)
- Human factors including fire clearance, deforestation, grazing and agriculture (causality / risk / vulnerability)

AO2

Application of knowledge and understanding is deployed to examine whether physical factors influence ecosystem succession more than human factors at the local scale. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- The initial physical conditions (water, rock or sand) are important in influencing the specific nature of succession (hydrosere, halosere, lithosere, psammosere) (causality / place)
- A prisere (primary succession) may not develop into a climatic climax community because of a physical factors such as geology, relief and poor drainage which arrests succession leading to a subclimax (causality / place)
- Variation in the amount of influence according to place, as more remote ecosystems at greater distances from human influences are more likely to be influenced by physical rather than human factors (causality / place / scale)

- Changes over time (temporal scale) as initially succession will be influenced more by physical factors, with human factors assuming greater importance as the vegetation becomes more established (scale)
- Human factors such as fire clearance may restart succession at a higher level of plant organisation (secondary succession) (causality)
- Maintained human activity, such as regular burning, deflects succession to form a plagioclimax (adaptation / causality)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments, which examine whether physical factors influence ecosystem succession more than human factors at the local scale.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the extent to which physical factors influence ecosystem succession more than human factors at the local scale.

Credit other valid approaches.

5. To what extent is climate the most important influence on the characteristics of the Arctic tundra biome? [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.2.6

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- The Arctic tundra biome is a cold, barren and treeless region, located between the polar ice cap and the taiga. It encompasses areas of Alaska, Canada, Greenland, Scandinavia and Russia. (place)
- The Arctic tundra has a very distinctive climatic regime, which in turn influences the soils, plants and animals of the region. (causality / interdependence / place)
- This biome is characterised by long and harsh winters. The summers are short and cool – it is unusual to see average temperatures rising above 10 degrees Celsius. (place / temporal scale)
- The biome suffers from physiological drought, as for the majority of the year, much of the moisture is frozen. In addition, precipitation levels are very low and are similar to those of deserts. (place)
- Average monthly temperatures range from −45.8 °C (−50.4 °F) in January to 16.9 °C (62.4 °F) in July. Verkoyansk has a dry climate with little rainfall or snowfall. (place)
- Permafrost underlies approximately a quarter of the earth's land surface. However, in regions like Verkoyansk, this figure can be around 50% and in Alaska the figure can surpass 80%. (place)
- Where bedrock is close to the surface, the parent material is weathered by freeze – thaw action. The shattered angular fragments are raised to the surface by frost heave, preventing the formation of horizons. (causality / place)
- There are no trees but dwarf species such as willow and birch will develop in the tundra. Plants have special adaptations, which enable them to cope with the extreme environment. (place / adaptation)
- Caribou have large spreading hooves that allow them to walk on snow or boggy ground and they have a thick coat of hollow hairs which gives them excellent insulation. (interdependence / adaptation)
- Impact a changing climate has on the interrelationships between these characteristics (causality / risk / adaptation)
- More than 180 native communities in Alaska (86% of the total) are flooding and losing land because of the ice melt that is part of the changing global climate. The state's northern parts have seen an average temperature rise of three degrees Celsius in recent decades. (place / risk / sustainability)
- Other impacts of climate change could be the increase of tundra fires due to the drying of the vegetation and the increased frequency of thunderstorms. In addition, there is a risk of invasive species, as typically southern species would find new habitats in the warming Arctic. (place / risk / sustainability)
- The impacts of fishing and mineral exploitation play a key role in changing the characteristics of the Arctic Tundra biome too. (place / risk / sustainability)

AO2

Application of knowledge and understanding is deployed to discuss to what extent climate is the most important influence on the characteristics of the Arctic tundra biome. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- For most of the year, temperatures are below freezing, which results in the creation of permafrost. During the brief summer period, the temperatures rise above freezing, providing a short growing season for vegetation. (place / causality / temporal scale)
- The extreme climatic conditions of the tundra environment create unique soils. (place / causality / interdependence)
- During the summer thaw, the uppermost layers of the permafrost begin to melt. This leads to rapid waterlogging, as the underlying permafrost acts as an impenetrable barrier. (place / causality / interdependence)
- The extreme climate coupled with the poorly developed soils severely limits plant growth in this biome. (causality / interdependence)
- The extreme conditions, which include low levels of sunlight, freezing temperatures, strong winds, a lack of moisture and poorly developed soils lead to low levels of NPP (net primary productivity) – the growing season is three months or less due to the adverse conditions. The NPP is typically less than 250g / m^2 / year. (place / causality)
- The extreme conditions of the tundra environment produce unique animals, which are specially adapted to survive. There is a low diversity of species, linked to the short growing season and extreme climatic conditions. (causality / interdependence / temporal scale)
- Examination of the extent to which climate is the most important influence on the characteristics of the Arctic tundra biome. (interdependence / scale)
- Examination of the impact a changing climate has on the characteristics of the Arctic tundra biome. (causality / thresholds / adaptation / risk / sustainability)
- Examination of the extent to which human activity influences the characteristics of the Arctic tundra biome. (causality / thresholds / adaptation / risk / sustainability)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about the extent to which climate is the most important influence on the characteristics of the Arctic Tundra biome.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the extent to which climate is the most important influence on the characteristics of the Arctic Tundra biome.

Credit other valid approaches

6. Discuss the factors affecting demographic change in India. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.2

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- India's population size, distribution, growth and structure (place)
- Cultural factors influencing population growth and structure including the caste system (causality / place / scale / inequality)
- Physical factors influencing population distribution (causality / place / scale / inequality)
- Economic factors influencing population distribution, growth and structure (globalisation / inequality)
- Social factors influencing population growth and structure including education (causality / place / scale / inequality)
- Political factors influencing population distribution, growth and structure (causality / place / scale / inequality)
- Religious factors influencing demographic characteristics, especially gender balance (causality / place / scale / inequality)
- The contrasts between rural and urban communities in terms of tradition (causality / place / scale / inequality / temporal scale)
- The role of processes such as globalisation, modernisation, westernisation and rural to urban migration as drivers of demographic change (causality / place / scale / inequality / temporal scale)

AO2

Application of knowledge and understanding is deployed to discuss the factors affecting demographic change in India. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- The interdependence of cultural, economic, physical, political and social factors (interdependence)
- Changes in the importance of factors over time influencing population distribution. India's urban communities have grown significantly associated with the unprecedented rate of urbanisation since the economic reforms of 1991 (place / globalisation / time)
- Variation over space as there are differences between states. E.g. Political factors have been important influences in Kerala which has a very progressive population management programme involving the education and empowerment of women and the lowest rate of population growth. Delhi's population growth can be related to rural-urban migration fuelled by economic development and employment opportunities. The highest growth rates, in Nagaland, can be linked to the political factor of the influx of refugees from Burma. (globalisation / inequality / place)

AO3

- The skill of presenting well-constructed, coherent and logical arguments, which discuss the factors affecting demographic change in India.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question.
- The skill of reaching conclusions, which discuss the factors affecting demographic change in India.

Credit other valid approaches.

7. Evaluate the role of government in the location and development of economic activity in India. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.4

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- The socialist government post 1947 ensured a high level of state control of key industries. Today the economy has had a major about-turn, opening it up to economic globalisation since economic reform in 1991 (causality / globalisation / temporal scale)
- India faced a major economic crisis in 1991 which forced the governing Congress Party to borrow money from the International Monetary Fund (IMF). This opened up the economy to economic globalisation. India is now among the ten fastest-growing economies in the world (causality / globalisation / temporal scale)
- From 1991 import quotas (fixed limits on quantities of goods imported) were removed, tariffs (taxes on imports) were reduced, the currency was devalued and – very significantly – foreign investment liberalised. This opened the Indian economy to FDI. In the 1990s, the sums were huge (averaging nearly $4 billion) (interdependence / globalisation / scale / temporal scale)
- Manufacturing includes the growth of modern steel, pharmaceuticals, textiles, clothing, and a substantial high-tech electronics sector (place / scale)
- Locations of economic activity include rural areas (agribusiness), SEZs (manufacturing), Bangalore (Business Process Outsourcing), Mumbai (Bollywood) (place)
- Business process outsourcing in India, which started around the mid-90s, continues to grow. India is now the world's favoured market for BPO companies. The BPO sector in India is estimated to have reached a 54 per cent growth in revenue. The demand for Indian BPO services has been growing at an annual growth rate of 50%. (place / globalisation / scale / temporal scale)
- Special economic zones (SEZs) in India are certain localities which offer tax and other incentives to their resident businesses. Up until 2000, India did not have SEZs, and instead had a number of export processing zones (EPZs), which, although similar in structure to the modern SEZ, failed to attract many firms to India. The government, accordingly, introduced the SEZ in April 2000. (globalisation / place / temporal scale)
- India's Special Economic Zone Act, 2005 further amended the country's foreign investment policy and converted its EPZs to SEZs, with notable zones including Santa Cruz (Maharashtra state), Cochin (Kerala state), Kandla and Surat (Gujarat state), Chennai (Tamil Nadu state), Visakhapatnam (Andhra Pradesh state), Falta (West Bengal state), Noida (Uttar Pradesh state), and Indore (Madhya Pradesh state) (place / scale)
- As of September 2017, 221 SEZs are in operation, and by January 2018, a massive 423 have received formal approval for operation. Although India's SEZs are relatively new, they have become important sourcing and manufacturing destinations for foreign investors. (globalisation / scale / temporal scale)

- The National Highways Act has been modified to help reduce tolls on national motorways, bridges and tunnels. The government is also implementing a new policy that aims to improve India's telecommunication systems. (causality / scale / sustainability)
- In addition to national government, the role of state governments cannot be ignored. State governments play an important role in the development of industry. For example, Kerala is a communist state. However, other states favour a free-enterprise approach. This results in different levels of commitment to enacting land, labour or other business-friendly reforms. Maharashtra is one of the most industrialised states and Bihar one of the least. (causality / inequality / place)
- In addition to the role of government, factors responsible for the rapid growth of manufacturing industries include the emergence and investment policies of TNCs e.g. R&D (Research and Development) functions. Hewlett Packard set up Software Universities in 8 cities (it opened in 2009 in Mumbai, Delhi, Pune, Kolkata, Hyderabad, Noida, Chennai and Bangalore) (causality / globalisation / interdependence)
- Another contributing factor is the growth of an urban, educated, middle-class population whose members have become consumers themselves and who provide a large market for new consumer goods (Feedback)
- India is benefitting from the demographic dividend – it has an increasing proportion of productive teenagers and young adults. A large, young workforce serves as a magnet for FDI (causality / globalisation / place)
- Technological factors have also played a significant role, particularly the speed and distance over which communications and movement can now take place due to changes in computer, transport and communication technologies (causality / globalisation / scale)
- ICT skills shortages in some developed countries. It is estimated that 52,000 British jobs have been outsourced to India since the 1980s. (globalisation / interdependence / scale / temporal scale)

AO2

Application of knowledge and understanding is deployed to evaluate the role of government in the location and development of economic activity in India. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- The relative importance of physical / demographic / social / cultural / economic / political / social / technological factors and TNCs on the location and development of economic activity in India. E.g. Traditional heavy industry is concentrated in the Damodar valley. The presence of coal mining operations and the availability of iron ore prompted the establishment up of many steel and power plants in the basin area. (causality / inequality / interdependence / place / scale)
- An examination of the interdependence of physical / demographic / social / cultural / economic / political / social / technological factors and TNCs on the location and development of economic activity in India. E.g. The Indian Himalayan Region extends from the foothills in the south to the Tibetan plateau in the north. The region occupies a strategic position and borders 7 countries. The North Indian states benefit from scenic, mountainous terrain with dense forests and perennial water sources making it attractive for tourism. However, this region is also prone to natural hazards, particularly flooding and earthquakes and infrastructure is poor due to the steep terrain. (causality / globalisation / inequality / interdependence / place)

- Variations over space – The Indo-Gangetic Plain lies between the Himalayas and the Peninsular Plateau. The three major river systems of India – the Indus, Ganga and the Brahmaputra – fed by seasonal meltwater runoff from major glaciers have deposited alluvium across the plain to depths of 1,800 metres. This region supports fertile agriculture but is subject to flooding. The Coastal Plains occupy a narrow strip from the Bay of Bengal in the East to the Arabian Sea on the West. Important ports such as Mumbai and Cochin located on the Arabian Sea coast and Chennai on the Bay of Bengal coast promote trade. Cities with sector-specific SEZs in existence or under development include: Pharmaceuticals and biotechnology (Pune, Aurangabad, Nanded), Manufacturing, engineering and automotive (Amritsar), Information technology (Bangalore, Kolkata), Telecommunications (Sriperumbudur), Textiles (Hassam, Kolkata, Mahindra), Jewellery (Surat, Jaipur) (causality / globalisation / inequality / interdependence / place / scale)
- Changes in the relative importance of factors over time – After independence in 1947, India's aim was to develop economically without the participation or influence of foreign capital. As a result, economic policies developed a strong anti-export bias. Climate change will increase meltwater discharges in the short-term but may lead to dangerous water shortages in the future. (causality / interdependence / place / scale / temporal scale)

AO3

- The skill of presenting well-constructed, coherent and logical arguments about the role of government in the location and development of economic activity in India
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the role of government in the location and development of economic activity in India

Credit other valid approaches.

8. 'India is an important global power.' To what extent do you agree? [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.5

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Recent changes in the size and structure of India's economy: Post-reform India has emerged as a leading world economy. India has been one of the world's best-performing economies for a quarter of a century, lifting millions out of poverty. (causality / place / scale / temporal scale)
- Government policies became somewhat more business-friendly in the 1980s; and, at last, more market-friendly in the 1990s. Along with software, other sectors such as telecommunications, pharmaceuticals, motorised vehicles and air transport have also made impressive strides in recent years. The growth in investment and productive capacity has generated many jobs. Previously working-class families now qualify as belonging to the middle class. It is estimated that this equates to some 200 million Indians. (causality / place / scale / temporal scale)
- The global shift, outsourcing and offshoring including the role of India as the global outsourcing capita: Numerous examples can be found to illustrate this such as British Airways and American Express. (globalisation / interdependence / place)
- India's population size: It is certainly a global power with considerable influence worldwide. India, if only in terms of sheer quantitative resources, is a great military power. With over 1.3 million men and women in uniform, and an additional one million in reserve, the Indian Armed Forces constitute the third-largest volunteer war-fighting force in the world. (place / scale)
- The Indian Air Force has more than 665 combat capable aircraft in its inventory. India's Navy, often touted as a sign of India's growing military influence overseas, has over 40 ships and submarines on order, including aircraft carriers, large amphibious assault vessels, and nuclear submarines. (causality / interdependence / place / scale)
- Influence of India's use of political (soft) power in the wider world including its participation in global organisations, governance, conventions and treaties: India's rise in geostrategic terms is rendered all the more significant since its power resides at the confluence of the United States' two great challenges: counter-terrorism operations in Afghanistan and Pakistan, and the management of China's growing regional assertiveness. (place / interdependence)
- Barack Obama's enthusiastic endorsement of a permanent UN security council seat for India, as part of making the US-India relationship 'a defining partnership of the century ahead', speaks volumes for the global importance of how India defines its foreign policy. (interdependence)
- In 2005, India joined the UN Democracy Fund and contributed $25 million to it, making it the second biggest donor after the US ($38 million). (globalisation / place / scale / interdependence)

- Since the 1980s India has made a greater political investment in different regional institutions such as the South Asian Association for Regional Cooperation (SAARC), the South Asia Cooperative Environment Programme, the South Asian Economic Union and BIMSTEC which were created to enhance cultural and commercial ties. (place / scale / interdependence)
- India offers one of the most dynamic alternatives to Western cultural values. India's film industry, popularly dubbed 'Bollywood', is probably the largest and farthest reaching medium for Indian culture. It is today the world's largest film industry, surpassing Hollywood with an annual output of over 1000 movies. Another one of India's most successful and long-lasting exports, yoga, is now practiced around the world as a form of exercise, and Indian cuisine, with its distinctive use of spices, has become popular worldwide. More directly, cricket has proved to be a strong soft power resource for India, with cricket diplomacy having notably positive effects in reducing Indo-Pakistani tensions. (globalisation / interdependence / scale)
- India's large diaspora is also considered to be a major asset for Indian diplomacy. There are today millions of Indians spread as far as Fiji, Malaysia, Mauritius, South Africa and Trinidad. These immigrants have come to play major roles in the political spheres of these different countries. For example, the educated Indian-American community has played an important role in improving Indo-US relations by lobbying American politicians and by giving a positive image of India to the American public. (interdependence / globalisation / place / scale)

AO2

Application of knowledge and understanding is deployed to examine to what extent India can be viewed as an important global power. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- India's economic success continues to come with an environmental cost that is unsustainable. Rivers such as the Ganga and the Jamuna are effectively, dead. In recent years, the large-scale depletion of groundwater aquifers, the loss of biodiversity, the destruction of forests, and the decimation of fish-stocks have been major issues. (place / risk / sustainability)
- The still-entrenched divisions of caste structure are being compounded by the emergence of new inequalities of wealth stemming from India's economic success. (inequality)
- There remain, of course, very many Indians who still count as poor. The estimates vary widely – roughly 300 million according to official figures. (inequality / place / scale)
- Moreover, India has pressing security preoccupations. Domestically, insurgent violence affects large parts of India, creating risks and imposing additional costs on investment and economic development. Longstanding disputes necessitate that India focus its security concerns on its immediate borders and near-abroad, stymying efforts to define its strategic interests in a broader regional or global context. (place / risk / scale)
- If India wishes to become a global military power, it will need to break out of its continental shackles and take on the trappings of a truly oceanic power. Only once it has acquired an expeditionary capability will it be able to emerge as a net security provider in the Indian Ocean and beyond. (globalisation / scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about to what extent India can be viewed as an important global power
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about to what extent India can be viewed as an important global power.

  Credit other valid approaches

9. Discuss the factors affecting demographic change in China. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.2

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- China's population size (1.4 billion), distribution (concentrated to south and east and in cities), growth (transition to Stage 5 of DTM and negative demographic dividend) and structure (an ageing population with a gender imbalance) (place)
- Cultural factors influencing population growth and structure including the prejudice against girls and Confucianism (causality / place / scale / inequality)
- Physical factors influencing population distribution (water supplies, accessibility, upland interior and water shortages) (causality / place / risk. scale / inequality / vulnerability)
- Economic factors influencing population distribution, growth and structure (causality / globalisation / place)
- Social factors influencing population growth and structure including education
- Political factors influencing population distribution, growth and structure including the hukou system, population policies, family planning and women's reproductive health (causality / place / scale / inequality)
- The end of the One Child Policy in 2015 and its subsequent influence (causality / place / temporal scale)
- The contrasts between rural and urban communities in terms of tradition (causality / place / scale / inequality / temporal scale)
- The role of processes such as globalisation, modernisation, westernisation and rural to urban migration as drivers of demographic change (causality / place / scale / inequality / temporal scale)

AO2

Application of knowledge and understanding is deployed to discuss the factors affecting demographic change in China. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- The interdependence of physical, economic, political, social and cultural factors (interdependence)
- Changes over time (temporal scale). China's urban communities have grown significantly associated with the unprecedented rate of urbanisation since the economic reforms of Deng Xiao Ping's 'Open Door Policy' (globalisation)
- Variation over space (place). The highest population growth rates occur in ethnic minority areas such as the autonomous regions of Ningxia and Xinjiang where China's One Child Policy has been less strictly applied. Rural-urban migration to the core regions along the coast and increasingly along the Yangtze corridor is a response to economic forces and the employment opportunities in urban areas and SEZs. (causality / inequality / place / scale / temporal scale)

- The economic factors, such as the 'Open Door Policy' are driven by the Communist party and therefore it is difficult to disaggregate economic and political influences (causality / interdependence)
- The dominance of political factors as China is a Communist state with power coming from the top down (although there are some freedoms for minority groups) (causality / scale / temporal scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments, which discuss the factors affecting demographic change in China.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question.
- The skill of reaching conclusions, which discuss the factors affecting demographic change in China.

  Credit other valid approaches.

10. Evaluate the role of government in the location and development of economic activity in China. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.4

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Between 1949 and the late 1970s manufacturing in China was undertaken almost entirely by state-owned enterprises (SOEs), mainly heavy industries such as oil, chemicals, power, iron and steel (temporal scale)
- During Mao's era, rural industries called town and village enterprises (TVEs) produced heavy goods such as iron, steel, cement, chemical fertiliser and farm tools. After 1978 these enterprises expanded to develop a wider range of businesses. Many Chinese farmers preferred to invest their resources in rural industry rather than agriculture. This encouraged the growth of small businesses run by the most successful peasants. (interdependence / place / temporal scale)
- Transition made from the state-led economy to a market-led economy after Mao's death in 1976 (causality / temporal scale)
- Since 1979, five special economic zones (SEZs) and 14 open cities have been proclaimed. These offer reduced restrictions on land, labour, wages, taxes and planning regulations to overseas firms, especially those involved in high-technology industries. The result has been the emergence and dominance of economic activity in coastal areas, which have received most of the internal investment as well as having imported capital, technology and entrepreneurial skills, at the expense of the interior. (inequality / place / temporal scale)
- The PRC has established special economic zones in Shenzhen, Zhuhai and Shantou in Guangdong Province, Xiamen in Fujian province and designated the entire province of Hainan a special economic zone (causality / place)
- The 1980s focus on increased productivity forced SOEs towards reform. Large SOEs have improved their management and smaller SOEs eventually privatised. Chinese firms have gradually become more Westernised. (globalisation / interdependence / temporal scale)
- Although established by a communist government, SEZs were deliberately located far from the centre of political power in Beijing, minimising political influences. More specifically, the original four zones were sited in coastal areas of Guangdong and Fujian that had a long history of contact with the outside world through outmigration, and at the same time were near Hong Kong, Macao and Taiwan (globalisation / interdependence place / temporal scale).
- The choice of Shenzhen was especially strategic because it is situated near Hong Kong, the key area from which to learn capitalist modes of economic growth (globalisation / place)
- The growth in economic activity in these locations has been reinforced by high levels of rural-urban migration, infrastructure improvements and the investment policies of TNCs. The result has been the emergence and dominance of economic activity in coastal areas. (causality / globalisation / inequalities / interdependence / place)

- The government have been instrumental in implementing the Western China Development project, created in 2000, to help the western provinces to catch up with coastal areas. The main components of the strategy include the development of transport, hydropower plants, energy, and telecommunications, enticement of foreign investment, increased efforts on ecological protection, promotion of education and retention of talent flowing to richer provinces. (causality / inequality / interdependence / place)
- As the economy of China continues to evolve and government policy attempts to push economic development to the west and north, there will be further changes to the economic picture within China. (place / scale / temporal scale)
- FDI in China increased from US$3.5 billion in 1990 to US$139 billion in 2016. (globalisation / scale / temporal scale)
- The recent trade war between the economic powerhouses of China and the U.S.A. has placed increased pressure on China's economy. (globalisation / risk / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to assess the role of government in the location and development of economic activity in China. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- The relative importance of physical / demographic / social / cultural / economic / political / social / technological factors and TNCs on the location and development of economic activity in China. E.g. Raw materials such as coal influence the location of manufacturing industry: although coal deposits are widely scattered, most of the total is in the northern part of the country. Agricultural activity is concentrated on the fertile, low-lying plains and deltas to the east. (causality / inequality / interdependence / place / scale)
- An examination of the interdependence of physical / demographic / social / cultural / economic / political / social / technological factors and TNCs on the location and development of economic activity in China. E.g. China became the world's manufacturing hub following Mao Zedong's reforms, specialising in the labour-intensive, export-led production of cheap goods that enabled a gradual increase in product complexity. (causality / globalisation / inequality / interdependence / place)
- Variations over space – E.g. During Mao's era, rural industries called town and village enterprises (TVEs) produced heavy goods such as iron, steel, cement, chemical fertiliser and farm tools, as well as hydroelectric power. Latterly, these enterprises expanded to develop a wider range of businesses. Many Chinese farmers preferred to invest their resources in rural industry rather than agriculture. TVEs became the backbone of development in rural areas playing a catalytic role in transforming the Chinese economy from a command economy to a market economy. (causality / globalisation / inequality / interdependence / place / scale)
- Changes in the relative importance of factors over time – Between 1949 and 1976, government locational decisions were dominated by Marxism-Leninism, with a socialist, collectivist and centrally planned agenda dominating. Following the death of Mao Zedong in 1976, China's economy took a major change in direction. In 1978, Deng Xiaoping, the new leader of the Chinese Communist Party, implemented the 'Open Door' policy, which was designed to overcome China's isolation and embrace globalisation. The 1980s focus on increased productivity forced SOEs towards reform. Chinese firms have gradually become more like Western companies. SOEs have attracted TNCs as partners and FDI has been highly significant. (causality / globalisation / interdependence / place / scale / temporal scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about the role of government in the location and development of economic activity in China
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the role of government in the location and development of economic activity in China

Credit other valid approaches.

11. 'China is an important global power.' To what extent do you agree? [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.5

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Recent changes in the size and structure of China's economy: Deng Xiaoping (1978-1987) was instrumental and responsible for modernisation and reform, adopting the market economy in December 1978. President Jiang Zemin's (1993-2003), theory of promoting business and entrepreneurial class into the country's one-party system, helped China's economic expansion. The recent trade war between the economic powerhouses of China and the U.S.A. has placed increased pressure on China's economy. (causality / globalisation / risk / scale / sustainability / temporal scale)
- The global shift, outsourcing and offshoring including the role of China as the workshop of the world: About 80 percent of China's exports are manufactured goods - textiles and electronic equipment, and include toys, DVD players, mobile phones, shoes, clothes, food products, sea food, body jewellery and kitchen wares etc. 50% of cameras, 30% of air conditioners and televisions, 25% of washing machines, and 20% of refrigerators in the world are now being produced or assembled in China. (globalisation / scale / temporal scale)
- China is already an economic power: At purchasing power parity, which adjusts the value of a dollar for what it can buy in a given country, China now has a larger economy than the U.S. The gap is only likely to grow, given that China has far more people making and buying things, and they're likely to get richer than they are today. (scale / temporal scale)
- When it comes to technology, President Xi has made clear with his "Made in China 2025" initiative that he intends China to overtake the U.S. as the world's dominant technology power, and soon. The same goes for artificial intelligence, although the target date there is a little later, in 2030. As Russian President Vladimir Putin famously said last year, whichever nation leads in AI "will be the ruler of the world." China is investing and making impressive headway: It already leads the U.S. in supercomputers. (scale / temporal scale)
- China's drive for the development of non-fossil fuel energy could make it a world leader in energy exports and offer unmatchable prices on alternative energy in the world market. (sustainability / scale / globalisation)
- China's population size: It is certainly a global power with considerable influence worldwide. China, if only in terms of sheer quantitative resources, is a great military power. It has 2 million active duty personnel, 162 bomber aircraft / 1,966 tactical aircraft / 246 attack helicopters / 1 aircraft carrier / 57 attack submarines / 82 cruisers / destroyers / frigates / 70 ICBM launchers / 4 nuclear submarines. (place / scale)
- A major decision was to open to the free world and get out of the Soviet sphere of influence in the 1960s. It was prompted when President Richard Nixon sent his Secretary of State Henry Kissinger to China. The approach turned out to be very successful. It paved the way for China to open to the Western world, and the rest of the world, and eventually modify its system of political economy. Premier Zhu RongJi (1988-2003) paved the way for China's entry into World Trade Organization (WTO) (causality / temporal scale / globalisation / interdependence)

- Peacekeeping is another noncoercive way to project influence around the globe. From playing almost no role in United Nations peacekeeping missions 20 years ago, China is today the largest troop contributor by far. It also pays more than 10 percent of the UN's total budget. (globalisation / scale / temporal scale)
- China has a relatively small, if well-regarded cadre of diplomats. Their numbers are growing, and their budget for next year has increased by 15.6%, about twice the rate of increase for defence. As a result, the budget for foreign affairs will have doubled since Xi came to power in 2013. (scale / temporal scale)
- China has been rolling out Confucius centres around the world to promote the country and its views. It also sends tourists and students abroad by the millions. (place / scale)
- As the leading global emitter of CO2, China's stance on environmental matters is of increasing importance. This was illustrated during the Paris climate change negotiations in 2015. China's influence was significantly greater than it was during the Kyoto Protocol discussions two decades earlier. (globalisation / scale / temporal scale / sustainability)

AO2

Application of knowledge and understanding is deployed to examine to what extent China can be viewed as an important global power. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. This evidence could include:

- The costs of maintaining a large military, leading diplomatic missions and providing aid to foreign countries all add up. The more China extends itself around the globe, the heavier the burden will be. (risk / scale / vulnerability)
- While the country has deep pockets, there are economic and financial challenges at home, and if things go belly up domestically it could put strains on President Xi Jinping's ambitions. (place / risk / vulnerability)
- China is facing a demographic nightmare. As fertility rates have decreased and after decades of the one-child policy, the country is getting very old very fast. After the one-child policy was officially lifted in 2016, many couples were now found to only want one child or didn't plan to have any at all. According to the United Nations, China may have as much as 44 percent of its population retired by 2050. (risk / scale / temporal scale / vulnerability)
- China spends around $228 billion on defence. However, they currently have one aircraft carrier only. (scale)
- When it comes to the nuclear deterrent, though, China remains a bit player compared with the U.S. or Russia. China has 280 stockpiled nuclear warheads, in comparison to Russia & the U.S. with over 6,000. (scale / vulnerability)
- The same is true of military bases. The U.S. Department of Defence says it operates 516 military installations in 41 countries around the world, including 42 that are large or medium-size bases. China established its first official overseas base in Djibouti last year. (place / scale / vulnerability)
- The population of China stands at over 1.4 billion people. Although the country is geographically the fourth largest in the world, approximately 20% of the entire global population lives inside its borders. This places an enormous strain on its natural resources, particularly when living standards rise, and thus, demand for resources increases. It seems likely that China will become more dependent on foreign resources to meet its needs. (risk / scale / vulnerability)
- Although the "workshop of the world" exports many goods, they are largely inexpensive because of their poor quality. Eventually, when the standard of living goes up, the population will expect higher wages, which will inevitably drive up the cost of production, making the products they export too expensive. This will likely result in companies eventually pulling out of the country in search of cheaper nations, such as Vietnam and Bangladesh, to produce their goods. (globalisation / place / risk / temporal scale / vulnerability)

- There are several regions within China that are demanding more autonomy, which requires the country to devote a significant amount of resources to ensuring political stability within its borders. Until they can attain a certain level of regional stability, their foreign ambitions will be hampered. (risk / vulnerability)
- A recent report indicated that as many as 50% of the wealthiest Chinese citizens are considering moving out of the country to places such as the US, Australia, and Canada. (risk / globalisation)
- Trump's "America First" approach has given China something of a free pass to present itself as the new leader on open borders and free trade, but even so, it lags the U.S. in cultural influence. (place / scale)
- Although China has invested heavily in its military, and it is growing, they are still behind the most powerful militaries in the world in terms of equipment and training. Its organisational structure is flawed as well, since the primary objective of the People's Liberation Army is the protection and preservation of the more than 88 million members of the Communist Party rather than the general public itself. (risk / scale / vulnerability)
- Equally important is the lack of combat experience, as China hasn't engaged in combat with a foreign enemy since Vietnam in 1979. The lack of experience in comparison to countries such as the US, UK, and Russia places China at a disadvantage. (risk / temporal scale / vulnerability)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about to what extent China can be viewed as an important global power
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about to what extent China can be viewed as an important global power

Credit other valid approaches.

12. Social factors are the most significant influence on the development of selected SSA countries. Discuss. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.11

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Influence of social factors including education, health and welfare, social and cultural constraints including the role of women and ethnic divisions. E.g. Lack of equality in Uganda. Literacy rate = 71.5% (female) 85.3% (male) Women on average are less-educated and participate less in paid employment. School life expectancy: Female = 10 years … UK comparison = 18 years. Barely 37% of girls sit A-levels in Uganda. Birth Rate = 42.9 births/1,000 population (4th). Gender inequities also make fertility reduction difficult. Mother's mean age at first birth = 18.9 years. Contraceptive prevalence rate = 34.3% … UK comparison = 84%. Women have little say in decisions over childbearing and their own reproductive health. An estimated 7.1 million people were living with HIV/AIDS in South Africa in 2016, more than in any other country. (causality / inequality / interdependence / place)
- The constraining effects of climate variability, droughts and / or floods on development. E.g. Some 80% of Malawi's population grow their own food and rely on the rains to irrigate their soils but the food supply situation is precarious because of the climate. Mean maximum temperatures increased by 2% between 1970 and 2002 in the lower Shire. Before 2001 only nine districts in Malawi were classified as flood-prone. In 2001, 16 were affected, and a further 14 in 2002. By the end of January 2003, there was localised flooding in 22 districts, causing eight deaths and damaging homes and crops. (place / risk / vulnerability)
- 'The resource curse' - The Democratic Republic of the Congo is a good example. It is the world's second largest producer of coltan. Coltan fetches around 20 Euros a kilo on the global market. The recent history of the country is one of civil war and corruption. The vast mineral resources of the country have been at the centre of what some people have called "Africa's world war". The war has caused deaths, either as a direct result of the fighting or due to the spread of disease and malnutrition. The Democratic Republic of Congo is slowly recovering from the loss of some five million lives between 1994 and 2003. (place / risk / vulnerability)
- Influence of political factors including governance, colonialism and neo-colonialism, global organisations and corruption. E.g. Between 1885 and 1914 European countries colonised all of Africa, apart from Ethiopia and Liberia. Britain, France and Portugal were the main colonial powers in Africa, but Belgium, Germany, Italy, and Spain also had colonies. E.g. The Angolan War of Independence (1961–1974) began as an uprising against forced cotton cultivation, and it became a multi-faction struggle for the control of Portugal's overseas province of Angola among three nationalist movements and a separatist movement. Following this conflict, Angola was locked in a civil war between 1975 until 2002. 98% of bridges (more than 300), 80% of factories and schools, 60% of hospitals and most of the roads were destroyed in the civil war. (interdependence / globalisation)
- Influence of tourism and fair trade: E.g. The ecotourism strategies adopted in Rwanda are attracting more people every year. In 1975 there were 923 visitors to the most popular Volcanoes National Park; by 2010 there were 18,855. (globalisation / sustainability / scale / temporal scale)

AO2

Application of knowledge and understanding is deployed to examine whether social factors are the most significant influence on the development of selected SSA countries. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- The interdependence of physical, economic, political, social and cultural factors (interdependence)
- The relative importance of factors varies spatially and may vary according to the countries selected for examination. Physical factors may be more important for landlocked countries experiencing extreme climatic variability (causality / inequality / place / scale)
- The relative importance of factors varies temporally. Political instability may disrupt economic growth. E.g. political instability in The Gambia (causality / place / scale / temporal scale)
- The relative importance of factors may vary according to scale. Economic factors may be more important at the national scale, but cultural at the regional scale because of ethnic divisions, as in northern Nigeria (place / scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about whether social factors are the most significant influence on the development of selected SSA countries.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about whether social factors are the most significant influence on the development of selected SSA countries.

Credit other valid approaches.

13. Evaluate the environmental impacts of development in selected Sub-Saharan African countries. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.12

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Consumerism – e.g. Nigeria – The amount of traffic in Nigerian cities is increasing as more people can afford to run a car. However, they often buy older models which cause more pollution as their emissions contain higher levels of particulates and greenhouse gases including carbon dioxide. For decades, Nigeria relied on colonial-era fuel standards, which campaigners say were woefully inadequate for today's needs. It meant that retailers could export fuel to Nigeria that had 300 times the amount of sulphur of that which was legally allowed to be sold in Europe. (place / risk / scale / sustainability / temporal scale)
- Poor disposal of E-waste is an issue too – The import trade in used PCs is flourishing in Nigeria, as people can afford to purchase more electronic goods. One warehouse complex in Port Apapa in Lagos is handling up to 40 container loads each month. However, up to 75% of the PCs imported can be defective, which leads to them being dumped around Lagos. Old computers can contain mercury, and heavy metals like nickel, cadmium and chromium. Children are highly susceptible to toxic substances, which could lead to long term cancers affecting the lungs and all parts of the body. Toxic chemicals such as polychlorinated biphenyls (PCBs) which are found in electronic circuits, end up in the rivers and lakes. (place / risk / scale / sustainability / temporal scale / vulnerability)
- Exploitation of natural resources – As SSA countries aim to develop economically, they are often heavily reliant on fossil fuels – oil and natural gas are burnt to produce electricity but increase the amount of greenhouse gases. In addition, firewood is used for cooking and heating by many of the poorer people and there are many illegal oil fires. As urbanisation increases deforestation gathers pace with trees utilised as a source of building materials as well as fuel. (interdependence / place / risk / scale / sustainability / vulnerability)
- Agro-industrialisation – e.g. Lake Naivasha in Kenya. Since the 1980s, industrial horticulture and floriculture farms in Kenya have grown into the largest supplier of flowers to the European market. Exploitation of water resources is a continuing problem. More than 30 flower farms in the Lake Naivasha region pose several serious ecological problems for Kenya's rivers and for the lake, including loss of water. Scientists have concluded that Naivasha's water levels are 10 feet lower than what is healthy. Prior to the proliferation of the flower farms and the subsequent decline in water levels, Lake Naivasha was "one of the world's top ten sites for birds, with more than 350 recorded species." The number of hippos has dropped because of decreased water levels. There were 1,500 hippos in 2004, but their numbers fell to just over 1,000 in 2006. Thousands of labourers and their families have arrived in the region to work in the greenhouses and processing plants. The population rose from 7,000 in 1969 to some 300,000 in 2007. Deforestation is a major problem. People are venturing farther and farther to get wood and charcoal for making fires and there has been no replanting of trees. Another major problem is the amount of sediment going into the lake because of deforestation. (causality / place / risk / sustainability / temporal scale / vulnerability)

- Impact of manufacturing and extractive industries – The Nigerian government poorly regulates extractive industries, so there are many illegal gold mines deep in the jungle where conditions are difficult and dangerous. In the Itagunmodi gold mine, the miners use crude implements, including diggers and shovels to cut deep into the ground to find the gold. The landscape is left with unsightly scars. (place / risk / scale / sustainability / vulnerability)
- Nigeria has been dubbed the 'World oil pollution capital' by environmentalists. The village of Kpor, deep in the Niger Delta is a good example. Kpor is in Rivers State, an area abundant in oil and gas. On 12 May 2009, Shell's Bomo manifold exploded, leaking massive amounts of crude oil. Local people say 39 hectares were contaminated. (place / risk / scale / sustainability / temporal scale / vulnerability)

AO2

Application of knowledge and understanding is deployed to evaluate the environmental impacts of development in selected Sub-Saharan African countries. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- A comparison of the environmental impacts of development in selected Sub-Saharan African countries. (place / risk / scale / sustainability)
- An examination of the severity of the environmental impacts of development in selected Sub-Saharan countries. (place / risk / scale / sustainability)
- An assessment of the relative importance of different environmental impacts of development in selected Sub-Saharan African countries. (interdependence / place / risk / scale / sustainability)
- A discussion of how the environmental impacts of development in selected Sub-Saharan African countries vary spatially. For example, E-Waste results in hazards that are concentrated locally. However, oil spills can influence a much larger area. (place / risk / scale / sustainability)
- An examination of how the environmental impacts of development in selected Sub-Saharan African countries have changed over time. E.g. Consumerism leading to increasing levels of pollution. (place / risk / scale / sustainability / temporal scale)
- Interdependence of impacts – For example, agro-industrialisation causes impacts in the short-term and in the long-term. The population rose from 7,000 in 1969 to over 300,000 in the mid 2000's. (place / risk / sustainability / temporal scale)
- Variations in levels of development – Higher income Sub-Saharan African countries affected by the environmental impacts of development may have more strategies in place to mitigate against the impacts of agro-industrialisation, consumerism, exploitation of natural resources and the impact of manufacturing and extractive industries on the environment, thereby reducing their severity. (inequality / mitigation / place / resilience / vulnerability)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about the environmental impacts of development in selected Sub-Saharan African countries.
- The skill of constructing relevant diagrams, which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the environmental impacts of development in selected Sub-Saharan African countries.

Credit other valid approaches.

14. Evaluate strategies to manage desertification in selected Sub-Saharan African countries. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.3.13

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Causes of desertification include natural processes (drought, high rates of evapotranspiration and infrequent/intense precipitation) and socio-economic processes (overgrazing, over-cultivation, deforestation and poor irrigation) (causality)
- Consequences of desertification include physical (water table lowering, rivers and wells dry up, land degradation and vegetation loss) and human (migration, food supply problems, famine, malnutrition, and death) (place / risk / sustainability)
- Strategies to address the causes of desertification (sustainability / mitigation / adaptation) include livestock management, forestry management, water and land management and education
- Strategies to address the consequences of desertification include the development and promotion of good practices in terms of soil and water conservation techniques (stone bunds, magic stones in Burkina Faso) to mitigate against the effects (mitigation / resilience / sustainability)
- Adaptive strategies include the use of drought resistant crops (adaptation) and strategies implemented to manage the consequences of migration such as refugee camps, aid and the provision of health services.

AO2

Application of knowledge and understanding is deployed to evaluate strategies to manage desertification in selected Sub-Saharan African countries. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- Comparison of the success of different measures employed in different environments (place)
- Improvements in the use of strategies over time (time scales)
- Evidence for success by referring to indicators: indicators covered may include social, environmental and demographic measures of improvement indicative of progress made
- The scale of the strategies employed – local / regional / global (scale)
- The longevity of the strategies (sustainability)
- The interdependence of strategies to manage both the causes and consequences of desertification (interdependence) such as forestry management to prevent soil erosion and increase the water-holding capacity of the soil
- Different strategies (forestry management and introducing solar and wind power to reduce dependence on wood as an energy source) achieve similar objectives (interdependence)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about strategies to manage desertification in selected Sub-Saharan African countries
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about strategies to manage desertification in selected Sub-Saharan African countries

Credit other valid approaches.

15. 'The most important physical factors determining the supply of energy are geological.' Discuss. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.4.2

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content. Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Geological factors influence oil and gas traps and the formation of deltaic swamps in which coal formed. Direct access to fossil fuel reserves is a coincidence of geological history and international boundaries. For example, Saudi Arabia has large oil reserves and Russia has large oil and gas reserves. Geological factors also influence the location of active areas for geothermal energy such as Iceland (causality / place / scale / sustainability)
- Certain forms of renewable energy are constrained by climatic factors. Solar power requires high insolation rates; wind power relies on high, constant wind speeds characteristic of areas affected by westerly wind belts and hydropower is usually linked to areas of high precipitation (causality / place / scale / sustainability)
- Relief factors include the influence of relief on creating suitable locations for dam construction. The deep, narrow valleys of the west slopes of the Sierra Nevada in California provide sites for dams and reservoirs such as at Shasta in the Upper Sacramento River Basin and Oroville on the Feather River. Relief is also important for providing a 'head' of water which is stored and then released to drive turbines and generate hydropower (causality / interdependence / place / scale / sustainability)
- Certain locations provide favourable conditions for sustainable energy generation from waves, tides (tidal power is restricted to a few estuaries with a very large tidal range such as the River Severn) and biofuels (causality / interdependence / place / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to examine the importance of geological factors in determining the supply of energy. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- main physical factor determining the supply of energy varies by location (place). In terms of geological factors, the USA has the largest reserves of coal, followed by Russia, China, Australia, India and Ukraine. Russia is one of the world's major producers of oil and natural gas. The USA has large reserves of unconventional (shale) gas, with hotspots in Australia, China, South Africa and Europe. Geology is the most important factor in determining the location of active areas for geothermal energy; Iceland provides 87% of its demand for hot water and heat with geothermal energy (causality)

- The main physical factor influencing the supply of energy varies over time (temporal scale). Fossil fuels are finite and there is a general consensus between industry leaders and analysts that world oil production will peak between 2010 and 2030 (sustainability). Substantial changes in the volume of glacier ice associated with climate change will lead to large changes in the hydrology of glacial rivers in countries such as Iceland, with important implications for the hydropower industry. Glacier mass balance changes due to changes in climate and feedback effects caused by glacier dynamics may lead to migration of ice divides and subglacial watersheds and change subglacial water courses. This can in some cases cause locally very large relative changes in the discharge of rivers generating hydropower (systems / feedback / equilibrium)
- The main cause may vary according to the scale of analysis. At the regional scale, geological factors may be the most important, but at the local level it may be climate and relief generating large amounts of hydropower or estuaries generating tidal power (Swansea Bay tidal lagoon) (place / scale)
- Geological factors may be an important indirect factor as large nuclear power stations are best located on geologically and seismically stable foundations. This illustrates the interdependence of factors, making it difficult to isolate one main factor. (interdependence / place / risk / vulnerability)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about the importance of geological factors in determining the supply of energy.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the importance of geological factors in determining the supply of energy

Credit other valid approaches.

16. A country's level of development is the most important factor influencing its energy mix. Discuss. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.4.6

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- The energy mix of a country depends upon many different factors. These include energy security issues, the availability of indigenous energy resources, the level of economic development and government policies. (causality / interdependence / place)
- Geological factors influence oil and gas traps and the formation of deltaic swamps in which coal formed. For example, Saudi Arabia has large oil reserves and Russia has large oil and gas reserves. Geological factors also influence the location of active areas for geothermal energy such as Iceland (causality / place)
- Global distribution of fossil fuel stocks and reserves: Coal: Asia Pacific holds 46.5% reserves. Oil: The Middle East dominates. Almost 50% of reserves are in this region. Natural Gas: Once again, the Middle East dominates, as it possesses the largest proved reserves (79.4 trillion cubic metres / 42.5% of the global total). (interdependence / place / scale / sustainability)
- Certain forms of renewable energy are constrained by climatic factors. Solar power requires high insolation rates; wind power relies on high, constant wind speeds characteristic of areas affected by westerly wind belts and hydropower is usually linked to areas of high precipitation (causality / place)
- Relief factors include the influence of relief on creating suitable locations for dam construction. The deep, narrow valleys of the west slopes of the Sierra Nevada in California provide sites for dams and reservoirs such as at Shasta in the Upper Sacramento River Basin and Oroville on the Feather River. (causality / place)
- Geographical endowment: Nepal is a landlocked country, devoid of fossil fuels. However, the country is rich in water resources. Since 1996, in conjunction with the UNDP, nearly 400 micro-hydro power plants have been built in the most remote and impoverished areas. (causality / place)
- Certain locations provide favourable conditions for sustainable energy generation from waves, tides and biofuels (causality / place)
- R+D / expertise – Nuclear power: France is heavily reliant on nuclear power and derives about 75% of its electricity from this source, due to a long-standing policy based on energy security. The French have been at the forefront of developing nuclear technologies. Reactors, fuel products and services have been a significant export too. (place / sustainability)
- Economics / political policy: The United Kingdom has a highly developed economy with a GDP per capita of $40,367 (World Bank, 2016). As a result, it has been able to invest and develop an energy infrastructure, which meets its needs in the most effective, secure and sustainable fashion. The output from bioenergy and wind, solar and hydro is now nearly 10 times higher than coal, notable when coal was the higher in 2012. Renewables' share of electricity generation was a record 29.4 per cent in 2017, an increase of 4.9 percentage points on a year earlier. (causality / place / scale / sustainability / temporal scale)

- India is a developing economy with a GDP per capita of $1,709 (World Bank, 2016). 75% of Indian energy demand is provided by fossil fuels. Globally, India is the third largest coal producer. As a result, coal is the primary energy source, accounting for over 70% of power generation. (causality / place / scale / sustainability)
- Mali: Mali represents an impoverished nation with a GDP per capita of $779 (World Bank, 2016). As a result of its poorly developed energy infrastructure, the absence of coal reserves and largely untapped oil reserves in the north of the country, the majority of Mali's energy supply (around 75%) comes in the form of wood and charcoal, primarily for domestic use. (causality / place / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to examine whether a country's level of development is the most important factor influencing its energy mix. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- A comparison of the energy mixes used in different countries. (causality / inequality / place / scale)
- A comparison of the energy mixes used at a local / regional and national scale in different countries. (causality / inequality / interdependence / place / scale)
- An examination of the relative importance of factors, which determine the energy mix of different countries. (causality / interdependence / scale / temporal scale)
- An examination of the importance of physical factors. In terms of geological factors, the USA has the largest reserves of coal, followed by Russia, China, Australia, India and Ukraine. Russia is one of the world's major producers of oil and natural gas. The USA has large reserves of unconventional (shale) gas, with hotspots in Australia, China, South Africa and Europe. Geology is the most important factor in determining the location of active areas for geothermal energy; Iceland provides 87% of its demand for hot water and heat with geothermal energy. In response to dwindling oil reserves, India has implemented an extensive programme of renewable energy development. In particular, solar power. In addition, it has enhanced HEP provision and instigated an extensive nuclear programme. There are presently 21 reactors at 7 sites with an additional 6 nuclear power plants currently under construction. (causality / inequality / interdependence / place / vulnerability)
- An examination of the importance of economic factors. Building large scale hydroelectric projects is expensive and time consuming for countries like Nepal. As a result, simpler solutions are needed for remote rural communities – the answer is micro-hydro projects. Mali offers huge potential for HEP (e.g. The Felou project), solar and wind energy (e.g. average annual wind speeds reach 3 – 7 m/s in the Sahel and Sahara), but it is constrained by a lack of funds and technical expertise. (causality / inequality / interdependence / place / sustainability / vulnerability)
- An examination of how the energy mix of countries has changed over time. Fossil fuels are finite and there is a consensus between industry leaders and analysts that world oil production will peak between 2010 and 2030**.** (feedback / place / systems / sustainability / temporal scale).

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments about whether a country's level of development is the most important factor influencing its energy mix.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question.
- The skill of reaching conclusions about whether a country's level of development is the most important factor influencing its energy mix.

Credit other valid approaches.

17. Evaluate the sustainability of alternative energy sources. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.4.7

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Alternatives to conventional fossil fuel sources are many and varied. Critical / recyclable resources: e.g. Biomass and nuclear power. Non-critical / everlasting resources: e.g. HEP, Solar, tidal, wave and wind power. (sustainability)
- Nuclear power: While nuclear power is relatively clean in terms of its greenhouse gas emissions (28kg of carbon dioxide per MWh), there are many issues surrounding its use. The Chernobyl disaster of April 1986 highlights the significant issues associated with nuclear power. The town of Pripyat on the Ukrainian – Belarus border was blighted by the disaster. It is one of only two nuclear energy accidents classified as a level 7 event on the International Nuclear Event Scale, the other being the Fukushima disaster of 2011. (place / scale / sustainability / temporal scale)
- Solar power: Solar panel systems, also known as photovoltaics (PV), capture the sun's energy using photovoltaic cells. Solar power is a renewable energy source and doesn't release any harmful carbon dioxide or other pollutants. India and China are the leading developers of large-scale solar projects. China has 3 of the 5 largest solar power plants in the world. A typical home solar PV system could save between 1.5 to 2 tonnes of carbon per year. However, the main problem with renewable energy forms such as HEP, wind and solar are that they heavily dependent on the weather. (place / scale / sustainability)
- Ocean (wave / tidal) power: The world's oldest tidal barrage is the Rance Tidal Power Station, France. It was once the world's largest tidal power station, but it was surpassed by the completion of the Sihwa Lake Tidal Power Station in South Korea, which was completed in 2011. The Rance Tidal Power Station It is situated on the estuary of the Rance River in Brittany and started producing power in 1966. (place / scale / sustainability / temporal scale)
- Wind power: The UK is home to the world's largest offshore wind farm, London Array. The 175 turbines built by Siemens have a capacity of 3.6MW each. However, the technologies involved require huge financial outlays, ongoing maintenance and require careful planning and implementation. London Array's turbines need to be able to generate power around the clock for 20 years in a hostile marine environment. If atmospheric conditions are not favourable, there can be problems. For example, In December 2011, a wind turbine in Ardrossan, North Ayrshire, Scotland, burst into flames as gusts of up to 160 mph battered Scotland. (place / risk / scale / sustainability / temporal scale)
- Biomass: Wood-fuelled heating systems, also known as biomass systems, burn wood chips, logs or pellets to provide warmth in a single room or to power central heating and hot water boilers. A stove burns logs or pellets to heat a single room - and may be fitted with a back boiler to provide water heating as well. A wood-fuelled biomass boiler could save you up to £800 a year compared to electric heating. The carbon dioxide released when wood is burned is the same amount that was absorbed over the length of time that the plant was growing. The process is sustainable in the long term, if new plants continue to grow in place of those harvested for use as fuel. (place / risk / scale / sustainability / temporal scale)

- HEP: Iceland uses its climate and natural landscape to its advantage. Iceland's precipitation combined with extensive highlands, provides an enormous energy potential for up to 220 TWh/yr. In 2014, 20% of primary energy use in Iceland was provided from hydropower. However, The Bakun Dam Project in Malaysia has produced short and long-term implications. The dam has drowned vast areas of tropical forest – in time, the submerged vegetation could produce huge amounts of methane, which is four times more potent as a greenhouse grass than carbon dioxide. (place / scale / sustainability)
- Geothermal energy: The first plant used to produce electricity generated from geothermal power was built in Tuscany. It started providing power in 1904 and currently provides power for over 1 million Italian homes. Iceland relies heavily on this energy source too. Before this, Iceland was dependent upon peat and imported coal for its energy. Today, around 85% of primary energy use in Iceland comes from indigenous renewable energy resources. However, geothermal power is dependent on tectonically active environments. (place / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to evaluate the sustainability of alternative energy sources. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- An evaluation of the sustainability of alternative energy sources (place / sustainability / scale)
- An evaluation on the basis of the finances and human resources available at community/local, regional and national scales (inequality / interdependence / place / scale / sustainability / temporal scale)
- A comparison of the effectiveness of alternative energy sources at a range of scales (place / scale / sustainability)
- The level of economic development and technological expertise can determine which alternative energy sources can be utilised (causality / inequality / place / scale / sustainability)
- An examination of how the sustainability of alternative energy sources has changed over time (place / sustainability / temporal scale)
- Only certain locations are suitable for certain forms of alternative energy sources:
- For example, relief factors will influence suitable locations for dam construction and hydropower. The Sierra Nevada mountain range is a good example. The deep and slender valleys provide an ideal site for dams, such as the Shasta Dam. Solar energy can be harnessed anywhere that receives sunlight, so it is abundantly available, however, it can also be inconsistent. (inequality / place / scale / sustainability)
- Different locations and weather conditions will influence the volume of energy that can be generated. Cloud coverage can reduce the amount of solar energy received by an average of 20%. Wind power relies on high and consistent wind speeds. The minimum speed at which a turbine will generate power is between 7 and 10 mph for most turbines. The UK has the best wind energy potential in Europe. This is because of its position – it benefits from the uninterrupted prevailing south-westerlies from the Atlantic Ocean. (inequality / place / scale / sustainability)
- Geothermal power relies on tectonically active environments. (inequality / place / scale / sustainability)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments, which evaluate the sustainability of alternative energy sources
- The skill of constructing relevant diagrams, which are annotated to meet the requirements of the question
- The skill of reaching conclusions about the sustainability of alternative energy sources

Credit other valid approaches.

18. Discuss how air masses affect the weather in Wales and the United Kingdom.
[22 marks]

AO [9] AO [11] AO3 [2]

Focus: 4.5.3

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- The sources and characteristics of air masses and their influence on the UK'S weather (the Polar Continental, Polar Maritime, Arctic Maritime, Tropical Maritime and Tropical Continental air masses). (causality / place / scale / time)
- The climate and weather of the UK (Cool temperate western margin climatic type). This climatic type is characterised by relatively mild temperatures (average seasonal range 5–20ºC), along with high humidity and precipitation (averaging 600 mm) throughout the year. (place / scale / time)
- Precipitation totals are significantly higher over upland areas in the face of prevailing moist westerly winds coming off the ocean, e.g. in the Cambrian Mountains of Wales. Conversely, precipitation totals are low in rain-shadow areas, e.g. lowland East Anglia. (inequality / place / scale)
- The temperatures and precipitation figures are mainly influenced by the mid-latitude position, low-pressure belt and the mild westerly prevailing winds. The latter are warmed by warm currents, e.g. the Gulf Stream, on the west margin of landmasses. (causality / place)
- The weather is strongly influenced by variations in the position, pattern and amplitude of the jet stream influencing the passage of westerly moving depressions along the polar front with intervening spells of anticyclonic conditions. (causality / place / scale / time)
- Jet streams are narrow ribbons of fast-flowing air that are found at altitudes of around 35,000ft. They play a key role in bringing weather systems to Britain from America across the Atlantic. (causality / place / scale / time)

AO2

Application of knowledge and understanding is deployed to how air masses affect the weather in Wales and the United Kingdom.

Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- Although reference to air masses gives an important indication of expected weather, there are other important influences including altitude, latitude and the influence of the Atlantic Ocean. (causality)
- The weather of an area is influenced by a combination of factors, including air masses (interdependence). For example, when a tropical maritime air mass reaches the UK it brings with it low cloud and drizzle to windward coasts and hills, but to the lee of high ground, the cloud often breaks up and here the weather, particularly in the summer months, can be fine and sunny (place / scale / temporal scale)

- Where an air mass hits Wales and the UK determines how its passage is modified as it crosses the country. Polar Maritime air brings cold wet air and rain to north west Scotland and north west Wales, but it is drier as it reaches the south east. (inequality / place / scale / temporal scale)
- Air temperature of the air mass is modified by the land over which it crosses, potentially becoming colder in winter, or warmer in summer. The instability of an air mass depends very much on the temperature of the surface it is travelling over. (causality / temporal scale)
- The scale of analysis is important. In some regions where the weather is influenced by a particular air mass, locally human activities can modify or intensify (feedback) weather characteristics such as in built up areas, creating an urban 'heat island'. On a global scale, climate change is having an increasing influence on the UK's weather characteristics, mainly associated with extremes of precipitation and temperature (place / scale / thresholds)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments, which discuss how air masses affect the weather in Wales and the United Kingdom.
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question.
- The skill of reaching conclusions, which discuss how air masses affect the weather in Wales and the United Kingdom.

Credit other valid approaches.

19. Evaluate strategies used to manage low-pressure hazards. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.5.5

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- A description of strategies and how they manage hazards. The management may refer to how the strategy allows people to avoid the hazard, to absorb the impacts the impacts of the hazard or to alleviate the impacts of the hazard after it has occurred. (adaptation / mitigation / place / resilience / scale)
- Strategies that respond to the event can be divided into short and long-term responses. Reference could be made to the hazard management cycle. (adaptation / mitigation / place / resilience / scale / temporal scale)
- Strategies used to manage low pressure can be divided into:
  (a) Monitoring, predicting and warnings e.g. Hazard zone mapping / early warning systems / media broadcasts etc. Technological advances include: weather satellites, ocean buoys, radar and computer modelling to forecast, track and predict climatic hazards associated with low-pressure storms (adaptation / mitigation / place / resilience / scale)
  (b) Mitigating low pressure hazards and modifying the event, vulnerability and loss – e.g. education programmes / evacuation procedures / enhancing defences by raising embankments / insurance / rescue efforts / provision of aid etc. (adaptation / mitigation / place / resilience / scale)
  (c) those that respond to the event – e.g. reconstruction efforts / rehabilitation / building engineering e.g. hazard resistant design – building hurricane shelters / flood walls / control dams / planting mangrove trees to absorb future storm surges (adaptation / mitigation / place / resilience / scale)
- A description of the primary and secondary hazards associated with low-pressure hazards (place / risk)
- In tropical regions low-pressure systems hurricanes and cyclones are associated with torrential rain and high winds triggering secondary hazards of flooding, tidal waves and sea incursions, landslides, mudflows and wind-borne debris. (place / risk)
- In temperate regions low-pressure systems are associated with severe storms, heavy rainfall/snowfalls and gale force winds triggering secondary hazards of flooding, sea insurgences, landslides and wind-borne debris (place / risk)
- Demographic effects associated with low-pressure systems such as deaths and migration e.g. Hurricane Sandy (2012) - At least 286 people were killed either directly or indirectly by Hurricane Sandy. There were 147 direct deaths: 72 in the USA and the rest mainly in the Caribbean, including 54 in Haiti and 11 in Cuba. (risk / inequalities / place / scale)
- Economic effects such as losses due to the cessation of production and costs of damage, such as the effects on economic activity and infrastructure. e.g. Hurricane Sandy - More than 18,000 flights were cancelled leading to disruptions in business, tourism and trade. More than 70 per cent of crops, including bananas and maize, were destroyed in the south of Haiti. (sustainability / risk / place / scale)

- Social effects may include observations on health, homelessness and infrastructure e.g. Hurricane Sandy - More than 8.5 million homes and businesses were left without power. In Washington DC and other cities, many supermarkets ran out of essentials such as bottled water and batteries. (risk / inequalities / place / scale / sustainability / interdependence)
- Environmental effects: Hurricane Sandy - 346,000 houses were damaged or destroyed in New Jersey and 305,000 damaged or destroyed in New York. Makeshift shanty towns in Haiti were washed away. In areas such as New York and New Jersey, untreated sewage was washed into public drinking water, threatening human health. (risk / place / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to evaluate the success of strategies used to manage low pressure hazards. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- Measures may be evaluated based on the extent to which they reduce the impact of an event. (place / mitigation / scale)
- Variation in the effectiveness of the strategies provided according to the nature of the primary and secondary hazards associated with low-pressure hazards. (place / risk)
- Comparison with strategies in place elsewhere to meet a similar hazard event (mitigation / place / scale / sustainability)
- The interdependence of strategies. Evacuation (short-term response) is a very effective method of management, but it depends on effective long-term monitoring and prediction. (interdependence)
- Advances in strategy policies and implementation of them compared to those in place prior to the last hazard event (temporal scale)
- The level of economic development can determine which types of strategies local communities affected can afford and have a bearing on their effectiveness. (mitigation / place / resilience / sustainability)
- The finances and human resources available to the agencies involved in the formulation and implementation of measures at a local, regional, national or international level. (inequality / place / sustainability)
- Evaluation on the basis of the finances and human resources available to the agencies involved in the formulation and implementation of strategies at community/local, regional, national and in some cases international level or on the basis of advances in strategy policies and implementation of them compared to those in place prior to the last hazard event. (inequality / place / scale / sustainability / temporal scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments, which evaluate the success of strategies used to manage low-pressure hazards
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions, which evaluate the success of strategies used to manage low-pressure hazards

Credit other valid approaches

20. Evaluate the consequences of anthropogenic climate change. [22 marks]

AO1 [9] AO2 [11] AO3 [2]

Focus: 4.5.7

Indicative content

The indicative content is not prescriptive and candidates are not expected to cover all points for full marks. Credit other valid points not contained in the indicative content.

Likely themes and specialised concepts include:

AO1

Knowledge and understanding could include:

- Consequences of reaching atmospheric tipping point including demographic, economic, environmental and social impacts. (place / risk / scale / sustainability / temporal scale / thresholds / vulnerability)
- There is a high risk that the large magnitudes and high rates of climate change this century will result in abrupt and irreversible regional-scale changes to terrestrial and freshwater ecosystems. (place / risk / scale / vulnerability)
- More than 180 native communities in Alaska are flooding and losing land. The village of Newtok is one such example. It is home to 350 people, who inhabit 63 houses in the village. The cost of relocating Newtok's residents has been estimated at $130 million. (inequality / place / risk / scale / sustainability / temporal scale / vulnerability)
- Other impacts of climate change could be the increase of tundra fires due to the drying of the vegetation and the increased frequency of thunderstorms. (inequality / place / risk / scale / sustainability / temporal scale / vulnerability)
- Shifting climate belts: e.g. The UK – Research has suggested that the likely impacts for the UK in the 2020s are: temperatures are expected to rise at a rate of 0.2 degrees Celsius per decade. (place / risk / scale / temporal scale)
- Changes in the distribution of species: In the UK indigenous species may be lost. Montane plant communities may be lost and wetlands may dry out. (place / risk / scale / sustainability)
- Extreme weather: By 2050 it is estimated that the UK will be subject to more extreme weather events. e.g. Summer Heatwave of 2003 - More than 20,000 people died after a record-breaking heatwave left Europe sweltering. (place / risk / scale / temporal scale)
- Sea level change: e.g. Tuvalu is a string of nine picturesque atolls and coral islands in the South Pacific. It is estimated that a sea level rise of 20–40 centimetres in the next 100 years could make Tuvalu uninhabitable. (place / risk / scale / sustainability / vulnerability)
- Impact on economic activity: e.g. Bangladesh and the Bengal Delta. Although there is little industry along the coast, many fresh water fisheries are under threat. (place / scale / risk / sustainability / vulnerability)
- Costs of mitigation / protection: In Tuvalu, villagers are exchanging taro, their traditional root vegetable, for more saline resistant crops. (adaptation / mitigation / place / scale / sustainability / vulnerability)
- The consequences of anthropogenic climate change have led to positive responses e.g. replacing fossil fuel consumption with renewable energy options etc. (mitigation / place / scale / sustainability)

AO2

Application of knowledge and understanding is deployed to evaluate the consequences of anthropogenic climate change. Synthesis will be demonstrated by the drawing together of evidence to reach a rational conclusion. The evidence could include:

- An examination of the local / regional / national / global consequences of anthropogenic climate change (place / scale)
- The consequences of climate change would risk reducing biodiversity in an important ecosystem like the Amazon and would reduce the amount of carbon absorbed from the atmosphere through photosynthesis. (place / risk / scale / thresholds)
- Shifting climate belts: The highest rates of temperature increase will occur in the south east of the UK, especially during the summer months. It will be about about 1.5 degrees Celsius warmer by the 2050s. (place / risk / scale / temporal scale)
- Changes in the distribution of species: Coastal sand dunes may be invaded by alien species, such as the hottentot-fig. (place / risk / scale / sustainability)
- Extreme weather: Intense rainfall events and extreme wind speeds will become more common in the UK by 2050, particularly in the north. (place / risk / scale / temporal scale)
- Sea level change: In Tuvalu, a tidal gauge on the main atoll, Funafuti, suggests the sea level is climbing by 5.6mm a year, twice the average global rate. (inequalities / place / risk / scale / sustainability / vulnerability)
- Economic impacts: Freshwater fishing generates substantial income for Bangladesh and any intrusion of salt water in the Bengal Delta would disrupt the economy. It is estimated that a 1m rise in sea level by 2050 could reduce the GDP by 5%. (inequalities / place / scale / risk / sustainability / temporal scale / vulnerability)
- Costs of mitigation / protection highlights inequalities. (adaptation / inequality / mitigation / place / scale / sustainability / vulnerability)
- A comparison of the consequences of anthropogenic climate change in different places e.g. coastal and inland regions, upland and lowland regions, populated or unpopulated regions and different climatic regions (inequality / place / risk / scale)
- A discussion of the severity of the consequences of anthropogenic climate change. (risk / scale)
- Changes in the nature of the consequences over time (temporal scale)

AO3

Skills evidenced could include:

- The skill of presenting well-constructed, coherent and logical arguments which evaluate the consequences of anthropogenic climate change
- The skill of constructing relevant diagrams (qualitative skills) which are annotated to meet the requirements of the question
- The skill of reaching conclusions, which evaluate the consequences of anthropogenic climate change

Credit other valid approaches.