GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
GEOGRAPHY - COMPONENT 3
A110U30-1

© WJEC CBAC Ltd.

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

© WJEC CBAC Ltd.

GCE A LEVEL GEOGRAPHY

COMPONENT 3: CONTEMPORARY THEMES IN GEOGRAPHY

SUMMER 2024 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 38 marks and Section B is 45 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.

© WJEC CBAC Ltd.

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.

© WJEC CBAC Ltd.

Section A: Tectonic Hazards - Generic Mark Bands (38 marks)

	AO1 [14 marks]	AO2 [20 marks]	AO3 [4 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 quantitative and qualitative skills to construct arguments and draw conclusions*
4	**10-14 marks** Demonstrates thorough and accurate knowledge; confident understanding of relevant concepts and principles throughout the response that is wholly relevant to the question Demonstrates knowledge and understanding through the use of appropriate, accurate and well-developed examples Wholly appropriate, accurate and relevant supporting geographical terminology is well used Well-directed and well-annotated sketch maps / diagrams are included and should be credited	**16-20 marks** Demonstrates sophisticated application of knowledge and understanding either to analyse or interpret or evaluate in order to produce a full and coherent response that is supported by wholly appropriate evidence Demonstrates application of knowledge and understanding through the synthesis of the connections between different elements of the question Demonstrates application of knowledge and understanding through the confident application of the specialised concepts throughout the response	**4 marks** The response uses wholly relevant qualitative skills to construct clear, coherent and appropriately structured arguments and conclusions
3	**7-9 marks** Demonstrates secure factual knowledge and reasonable understanding of relevant concepts and principles for large portions of the response that is mostly relevant to the question Demonstrates knowledge and understanding through the use of appropriate, generally accurate and developed examples The use of appropriate and mostly relevant geographical terminology is evident Appropriate, basically accurate annotated sketch maps / diagrams are included and should be credited	**11-15 marks** Demonstrates accurate application of knowledge and understanding either to interpret or analyse or evaluate in order to produce a partial but coherent response that is supported by mostly appropriate evidence Demonstrates application of knowledge and understanding through the partial synthesis of the connections between different elements of the question Demonstrates application of knowledge and understanding through the mostly relevant application of the specialised concepts	**3 marks** The response uses mostly relevant qualitative skills to construct structured arguments and conclusions where coherence is variable

© WJEC CBAC Ltd.

	AO1 [14 marks]	AO2 [20 marks]	AO3 [4 marks]
2	**4-6 marks** Demonstrates straightforward knowledge with some inaccuracies; some understanding of relevant concepts and principles that is linked to the question Demonstrates knowledge and understanding through the use of limited examples that may not always be appropriate or accurate The use of geographical terminology is limited Annotated sketch maps / diagrams are basic and should be credited	**6-10 marks** Demonstrates some application of knowledge and understanding either to interpret or analyse or evaluate in order to produce a response which is limited in coherence and is supported by limited appropriate evidence Demonstrates application of knowledge and understanding through the limited synthesis of the connections between different elements of the question Demonstrate application of knowledge and understanding through limited application of the specialised concepts	**2 marks** The response uses limited qualitative skills to construct argument(s) and conclusion(s)that are superficial in structure with minimal coherence
1	**1-3 marks** Demonstrates poor knowledge with errors and minimal understanding and linkage to the question Basic use of examples or if evident, lack relevance to the question asked Geographical terminology is rarely used within the response	**1-5 marks** Demonstrates application either to interpret or analyse or evaluate in order to produce a response which lacks coherence and is unsupported by appropriate evidence Demonstrates application of knowledge and understanding through the superficial synthesis of the connections between different elements of the question Demonstrate application of knowledge and understanding through superficial application of the specialised concepts	**1 mark** The response uses qualitative skills superficially to construct an argument / conclusion that is incomplete and lacks coherence
	0 marks Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted

© WJEC CBAC Ltd.

Section A: Tectonic Hazards

1. 'The only places severely affected by tectonic activity are on plate margins'. Discuss.

AO1 [14] AO2 (1c) [20] AO3.3 [4] [38 marks]

Focus 3.1.1

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, substantial and logically structured.

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.

AO1
Knowledge and understanding of how tectonic activity associated with plate margins can have severe effects.

- Tectonic activity refers to both seismic and volcanic activity, but the scope of the answer permits reference to secondary activity, e.g. tsunami.
- The Earth's surface is made up of rigid lithospheric plates, seven major, seven smaller minor plates and many micro plates, which move slowly and irregularly in relation to each other, typically at rates of 4cm per annum.
- Plates are predominantly continental or oceanic plates with margins located on land, midocean or in shelf zones.
- Movement takes place along plate margins: - divergence (constructive), convergence (destructive) and transform (conservative) leading to tectonic activity.
- Volcanic activity also occurs at hotspots, localised areas with unusually high heat flow, found away from plate margins.
- Seismic activity is also associated with intra-plate locations (non-margin areas along zones of 'old' fault lines where isostatic recoil occurs. It can also be associated with human activity, for example, mega-dam building (Killari, India) or fracking (quasi-natural earthquakes)
- Severity can be measured by magnitude:-
  - For earthquakes, MM logarithmic scale, a modification of the earlier Richter scale or the Mercalli scale (measuring the amount of damage).
  - For volcanoes, by VEI logarithmic scale
- Severity can also be considered in relation to the scale of social (deaths, injuries etc), economic (destruction of infrastructure, loss of livelihoods etc) and environmental losses (ecosystem losses or atmospheric change)
- Reference may be made to mega disasters, extremely rare tectonic events.

Note:
1. Candidates may set their answer out by type of activity (seismic, volcanic etc) or by type of plate boundary (conservative/constructive etc).
2. Credit relevant examples of plate margins and movement, and tectonic activities and severity (see Table 1).
3. Coverage of all aspects of tectonic activity is not mandatory but answers that focus on only one aspect (volcano/earthquake) are unlikely to access the top of Band 4.

© WJEC CBAC Ltd.

Table 1: Tectonic settings

Setting	Motion	Hazards	Example
Constructive plate boundaries (Divergent)	Two oceanic plates moving apart	Basaltic volcanoes and minor, shallow earthquakes along transform faults	Mid-Atlantic ridge (Iceland), mostly submerged
	Two continental plates moving apart	Basaltic spatter cones. Minor earthquakes	Mt. Nyiragongo (DRC) in the E. African rift valley
Destructive plate boundaries (Convergent)	Two oceanic plates in collision	Island arc explosive andesitic eruptions and earthquakes	Soufrière Hills on Montserrat, Island arcs
	Two continental plates in collision	Major, shallow earthquakes along thrust faults	Himalayan orogenic belt collision zone
	Oceanic and continental collision	Explosive, andesitic eruptions and internal batholiths and major earthquakes	Andes mountain chain and volcanoes
Transform boundaries	Plates sliding past one another (Conservative margin)	Major shallow earthquakes. No volcanic activity	San Andreas fault, California, North Anatolian fault
Hot spots	Oceanic	Basaltic shield volcanoes; minor earthquakes	Hawaiian island chain
	Continental	Colossal rhyolitic mega-eruptions	Yellowstone ‘supervolcano’ USA

© WJEC CBAC Ltd.

AO2

Application of knowledge and understanding is deployed to consider whether the only places severely affected by tectonic activity are on/near plate margins.

Arguments will be focused around definitions of severe effects. They can be correlated positively to an extent with high magnitude tectonic activity and include social, economic and environmental.

Table 2 summarises the dominant role of earthquakes in causing severe effects, as ground shaking from especially shallow/surface waves leads to high numbers of deaths and huge destruction.

Table 2: Comparing the severity of impact of earthquakes and volcanoes. Results are averages over 25 years.

		Volcanoes	Earthquakes
Social impacts	People dead	1,019	18,416
	People injured	285	27,585
Economic impacts	People made homeless	15,128	239,265
	People affected	94,399	1,590,314
	Estimated damage. US$ billions	0.065	21.5

- High magnitude seismic activity is associated with:
  - Destructive (converging and collision movement) plate boundaries which cause compression, subduction along Benioff zones, in island arcs or mountain ranges (causality). Examples within circum-Pacific belt and Alpine Himalayas, e.g. 2011 Sendai earthquake 9.0 MM, 28,050 deaths (mainly from resultant tsunami) or 2004 Sumatra and Indian earthquake 9.1 MM, 250,000 deaths (impact of tsunami)
  - Conservative (Transform movement) plate boundaries which cause plates to jostle past each other. Examples include earthquakes along the San Andreas fault in California or 2010 Haiti MM 7.0, 200,000 deaths.
  - At Constructive (diverging) boundaries severe damage from seismic activity is rare as most earthquakes are low magnitude and most plate boundaries are oceanic (mid Atlantic ridge/mid Pacific ridge).
- High magnitude subduction volcanic activity results from explosive, andesitic and rhyolitic eruptions associated with destructive (converging) plate boundaries within island arcs or fold mountain belts such as the Andes.
- Eruptions VEI 3 or 4 can occur, but high numbers of deaths are very rare, though localised damage and impact can be severe. Examples of Mt. Pinatubo (VEI 5-6), Mt St Helens (VEI 5) – notable environmental impacts with global cooling.
- Activity at diverging boundaries results in basaltic rift volcanoes usually with VEI 1-2) and within oceans with non-severe impacts. Where constructive plate boundaries lead to rift volcanoes on land, e.g., in the East African rift valley, there is potential for more severe effects.
- The are many instances where severe effects occur at non plate boundaries.
  - Intraplate earthquakes, where isostatic recoil takes place along former fault lines can lead to very severe impacts largely because there is little prior knowledge of impacts/risks in these areas. These earthquakes are extremely unpredictable and hard to forecast. In 1976 in Tangshen, China, 240,000 deaths resulted as there was no prior monitoring in the area of risk. New

© WJEC CBAC Ltd.

Madrid in Missouri also experienced intra plate earthquakes which initially caused significant damage.

- Quasi-natural earthquakes generated by human activity have the potential to cause severe effects e.g. from dam building (Killari) or from fracking in e.g. Oklahoma, USA where frequent damage occurs. Again, these earthquakes are not related to plate margins, but the effects are potentially severe.
- Hot spot activity associated with rising plumes of low viscosity, basalt magma in oceanic areas, e.g. Hawaiian Islands, Iceland, Galapagos, are usually less hazardous for people even in populated areas but can cause considerable damage to infrastructure or property. Where continental hotspots occur, there is huge potential for cataclysmic eruptions to occur (Historical example – Yellowstone). In Iceland in 2010 Eyjafjallajokull hotspot eruption had an extremely severe economic impact as local conditions led to a plume of ash being transported around the world leading to total disruption of the world's air routes and trade in air cargo for nearly three weeks – a very severe impact.

- The spread of the Indian Ocean tsunami 2004 had impacts across the Indian Ocean, the absence of a warning system leading to deaths in many countries, widespread damage thousands of miles away from the original plate margin event off the coast of Indonesia and huge economic impacts for coastal settlements as well as the social impacts of over 250,000 deaths.
- A number of intrinsic factors such as the physical profile of the hazard event – e.g. spatial predictability, areal extent, depth of epicentre, duration (aftershocks – Christchurch 2011), predictability of occurrence – sometimes can amplify lower magnitude events.
- Of even more importance are extrinsic factors occurring at the location. Local geology promoting landslides or liquefaction can add to the severity of events, e.g. Nepal Gorka 2015, Christchurch 2011. Two very severe volcanic eruptions in terms of deaths, Lake Nyos, Cameroon where a gas cloud killed 1746 people or Nevado del Ruiz with 20,000 deaths, illustrate this. The level of urbanisation, density of population, vulnerability of population, level of development, quality of governance, quality of buildings can all play major roles in influencing the severity of the effects of tectonic activity whether located at a plate boundary or not.

An overall conclusion might argue that there are multiple exceptions to the statement that the only places severely affected by tectonic activity are sited on plate margins, depending on how severity is defined.

AO3

Skills evidenced in the question context include: -

- The skill in presenting well-constructed, coherent, evidenced and logical argument as to the role of plate margin movements in influencing severity of effects from tectonic activity.
- The skill of constructing relevant diagrams and tables, (for example of event severity) to support the argument.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion for and against the statement.

© WJEC CBAC Ltd.

2. 'Modifying the event and people's vulnerability play equally important roles in mitigating tectonic hazards'. Discuss.

AO1 [14] AO2 (1c) [20] AO3.3 [4] [38 marks]

Focus 3.1.5

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, substantial and logically structured.

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.

AO1
Knowledge and understanding of the two mitigation strategies. Tectonic activity can refer to both seismic and volcanic hazards, but the scope of the answer could mention tsunami and other secondary hazards.

Modify the Event

- **Directly**
  - Earthquakes
    Being able to control the physical variables (e.g. duration) of ground shaking is unlikely in the foreseeable future, although for human induced earthquakes such as those caused by dam failure or fracking, they could be prevented by restricting development in earthquake prone areas. Some experiments, with limited success, have been made to lubricate fault lines (e.g. San Andreas, California) to reduce earthquake potential in heavily populated Central California.
  - Volcanoes
    Some progress has been made in controlling lava flows, for example, using explosives to create artificial barriers to divert lava flows away from settlements (Mt Etna, Sicily 1983.1991,2001,2018), or using seawater surges to cool and solidify lava flows to stop them advancing further on important infrastructure (Heimaey harbour, Iceland 1973).
- **Indirectly**
  - Earthquakes
    - The main way of modifying the impact of an event is by hazard resistant building design to develop aseismic buildings, as their collapse is responsible for the majority of deaths, injuries and damage.
    - Sizing the structure appropriately to be strong and ductile to survive shaking with an acceptable level of damage.
    - Equipping it with base isolation by building on top of flexible pads.
    - Using a techno-fix of expensive aseismic designs, which can cope with structural vibration (important for high value buildings) such as the new Istanbul Airport which is designed to withstand earthquakes of up to MM 7.9.
    - Retrofitting of older buildings to withstand earthquakes is an important strategy.
    - Even in developing nations, practical, inexpensive building designs have been developed to withstand earthquakes.

© WJEC CBAC Ltd.

- Volcanoes
  - Limited progress has been made to design buildings which can withstand heavy falls of large particles (pyroclasts) or are more fire resistant to lahars and ash etc.
  - Note: Some candidates may argue that this is part of modify the vulnerability.

Modify the vulnerability (highly dependent on economic, social, political and technological factors).

- Land use planning and layout are key points of the strategy.
  - Risk mapping identifies the most hazardous areas, which can be regulated by building codes, especially where new developments or rebuilding is occurring, and high-risk areas can be avoided.
  - In areas of volcanic hazard risk past lava flows have been mapped (e.g. Big Island, Hawaii) and used as the basis for informed land use planning.
  - Avoiding continuous, high density, urban squatter settlements and incorporating public open spaces to create refuge areas away from fires and aftershock damage.
  - Locating strategically important public buildings in scattered areas of lower risk to reduce the chances of total collapse of services (e.g. Tokyo planning strategies).
- Community preparedness and education is a core strategy in modifying the vulnerability and increasing the resilience of people by educating them in adaptability.
  - Developing warning systems for both volcanoes and tsunami.
  - Most volcanic events are preceded by clear warnings of activity so communities can be educated as to what precursors to look for, how to evacuate an area (escape routes) and also how to develop greater resilience (emergency packs, drills etc).
  - Earthquakes are far less predictable, so training is concentrated on preparing coping strategies by organising emergency services and governments on managing events, before, during and after their occurrence. Smart technology is increasingly used.

Note:

1. A number of different approaches are possible. A case study approach may work well providing it is linked to modifying the event/vulnerability.

© WJEC CBAC Ltd.

AO2

Application of knowledge and understanding is deployed to consider the relative importance of the two strategies to mitigate tectonic hazards.

- Earthquake hazards are clearly far more important to mitigate (two million deaths in the last 100 years compared to under 100,000 for volcanoes), but overall, far more difficult to mitigate as they are almost impossible to predict. Whilst all these strategies can be important, some are clearly easier to manage.
  - Modify the event directly is only really possible for volcanoes, and even then, is limited to certain specialised circumstances (e.g. topography – Etna). Indirect modification is of vital importance for earthquakes, and to an extent volcanoes, by design of various kinds of aseismic buildings and retrofitting strategies. Buildings are a major killer because of ground shaking, and developed countries such as Japan, Chile or USA have both the resources (finance), technology and government frameworks (building legislation) to be able to invest (contrasts between Tohoku 2011, Tokyo and Haiti 2010 and Nepal 2015).
    Christchurch 2011 demonstrated the importance of this as all the aseismic modern buildings remained intact with older or non-regulated buildings collapsing. Some progress has been made in developing countries where buildings have been built at comparative low cost, but there are limitations with weak governance and corruption of building regulations. Retrofitting strategies are tied to available finance.
  - Modifying the vulnerability of people is probably the most significant strategy overall. Whilst communities in developing countries tend to be extremely vulnerable because of inherent poverty, for example, in high density urban squatter settlements, there are many heart-warming examples of community preparedness and training carried out by UN and other disaster agencies which have been extremely successful in building resilience to hazard risk. They are even more successful however when combined with monitoring and warning where again level of development is important because of the costs and technology needed for monitoring instruments etc. Often developing countries are reliant on targeted aid for these purposes. The development of land use planning again is costly, for example, contrast planned strategies in China and Japan, with chaotic land use in Port-au-Prince.

A conclusion might argue that both are important, but that this might vary spatially (importance of level of development/inequality) and temporally within the phase of the hazard/disaster management cycle, as well as in relation to the profile of the individual hazard event (intrinsic and extrinsic factors). Overall, students will probably consider modifying the vulnerability as the key factor, especially for earthquakes.

AO3

Skills evidenced in the question context include: -

- The skill in presenting well-constructed, coherent, evidenced and logical argument as to the relative importance of the two mitigation strategies.
- The skill of constructing relevant diagrams, (for example of hazard cycle management showing when the strategies are important or Kates' Three Pronged Model).
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion as to the relative importance of the two mitigation strategies.

© WJEC CBAC Ltd.

Section B: Contemporary Themes in Geography - Generic Mark Bands (45 marks)

	AO1 [20 marks]	AO2 [20 marks]	AO3 [5 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 draw conclusions*
5	**17-20 marks** Demonstrates wide ranging, thorough and accurate knowledge with a high order of conceptual understanding throughout the response that is wholly relevant to the question Demonstrates knowledge and understanding through the use of wholly appropriate, accurate and well-developed examples Wholly appropriate, accurate and relevant supporting geographical terminology is well used Well-directed and well-annotated sketch maps / diagrams are integrated and should be credited	**17-20 marks** Demonstrates sophisticated application of knowledge and understanding either to analyse or interpret or evaluate in order to produce a full, comprehensive and coherent response that is supported by wholly appropriate, wide ranging and relevant evidence Demonstrates application of knowledge and understanding through the sophisticated synthesis of the connections between different elements of the question Demonstrates application of knowledge and understanding through the confident application of the specialised concepts throughout the response	**5 marks** The response uses wholly relevant qualitative skills to produce well-constructed, coherent, sophisticated and logical arguments and conclusions

© WJEC CBAC Ltd.

	AO1 [20 marks]	AO2 [20 marks]	AO3 [5 marks]
4	**13-16 marks** Demonstrates accurate factual knowledge and confident understanding of relevant concepts and principles throughout the response that is relevant to the question Demonstrates knowledge and understanding through the use of appropriate, accurate and developed examples Appropriate, accurate and relevant geographical terminology is evident Appropriate, mostly accurate and relevant annotated sketch maps / diagrams are included and should be credited	**13-16 marks** Demonstrates accurate application of knowledge and understanding either to interpret or analyse or evaluate in order to produce a coherent response that is supported by appropriate evidence Demonstrates application of knowledge and understanding through the synthesis of the connections between different elements of the question Demonstrates application of knowledge and understanding through the relevant application of the specialised concepts	**4 marks** The response uses relevant qualitative skills to produce clear, coherent and appropriately structured arguments and conclusions
3	**9-12 marks** Demonstrates secure, straightforward knowledge and reasonable understanding of relevant concepts and principles throughout most of the response that is mostly relevant to the question Demonstrates knowledge and understanding through the use of mostly appropriate, mostly accurate and developed examples Mostly appropriate, accurate and mostly relevant geographical terminology is evident but is variable in its use Appropriate, basically accurate and partial use of annotated sketch maps / diagrams are included and should be credited	**9-12 marks** Demonstrates partial application either to analyse or interpret or evaluate in order to produce a partial but coherent response that is supported by mostly appropriate evidence Demonstrates application of knowledge through the partial synthesis between different elements of the question Demonstrates application of knowledge and understanding through the partial application of some specialised concepts	**3 marks** The response uses mostly relevant qualitative skills to produce a structured response but where coherence is variable

© WJEC CBAC Ltd.

	AO1 [20 marks]	AO2 [20 marks]	AO3 [5 marks]
2	**5-8 marks** Demonstrates some knowledge, but limited in scope with some inaccuracies; some understanding of relevant concepts and principles Demonstrates knowledge and understanding through the use of limited examples, which are mostly accurate but un-developed Limited geographical terminology is evident, not all of which is appropriate or accurate Basic sketch maps / diagrams are used but contain inaccuracies. Credit should be given when used appropriately	**5-8 marks** Demonstrates limited application either to analyse or interpret or evaluate in order to produce a limited response where most points are generalised or of limited relevance to the question Limited synthesis between different elements of the question Demonstrates application of knowledge and understanding through the limited application of some specialised concepts	**2 marks** The response uses some qualitative skills to produce a response with superficial structure, with minimal coherence
1	**1-4 marks** Demonstrates poor knowledge with errors and minimal understanding and linkage to the question No use of examples or, if evident, lack relevance to the question asked Geographical terminology is rarely used within the response	**1-4 marks** Demonstration of application either to analyse or interpret or evaluate is poor, producing a response which lacks coherence and is unsupported by appropriate evidence Synthesis between different elements of the question is poor Demonstrates application of knowledge and understanding through the superficial application of basic specialised concepts	**1 mark** The communication in the response is incomplete
	0 marks Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted	**0 marks** Response not creditworthy or not attempted

© WJEC CBAC Ltd.

Section B

Ecosystems

3. To what extent is temperature the main factor influencing the global distribution of biomes?

AO1 [20] AO2 (1c) [20] AO3.3 [5] [45 marks]

Focus 3.2.1

The question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

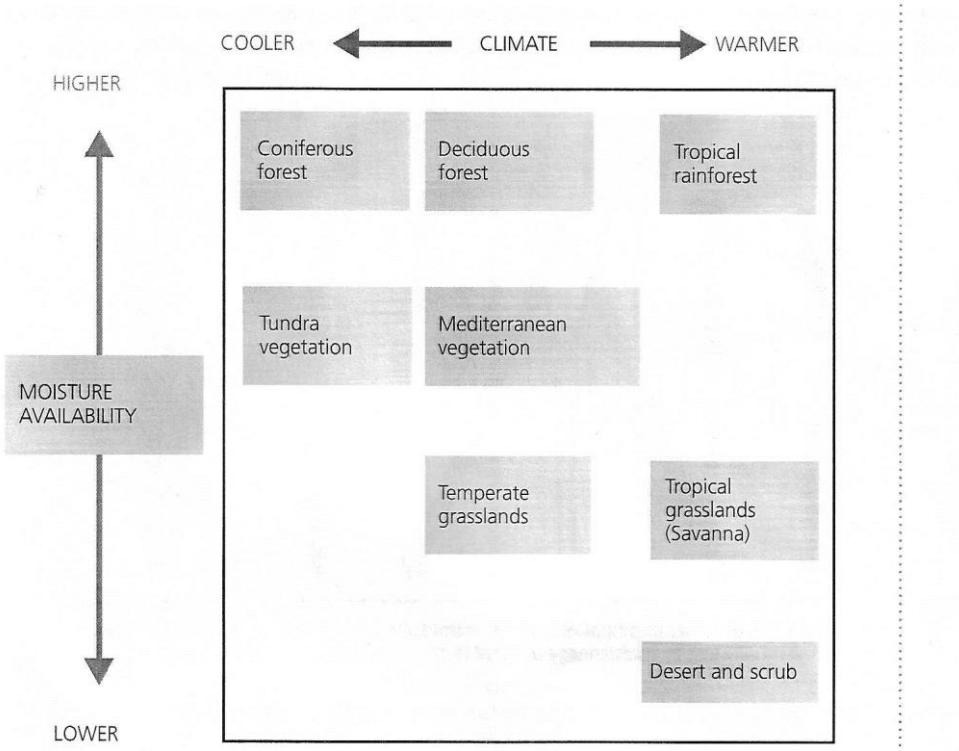
AO1
Knowledge and understanding of:

- Biomes are the largest ecosystem unit, identified by a shared characteristic plant community adapted to the specific environmental conditions of a region.
- Climate is a very important factor in controlling biome distribution.
  - Temperature influences evapotranspiration rates and plant adaptation and it controls the length of the growing season (ideally above 10°C for effective photosynthesis). Where temperatures are above 15°C throughout the year a continuous growing season results. Optimum growth temperature for most plants is 25°C. When winter temperatures fall below 6°C for up to 5 months a year, trees adapt by shedding leaves to protect themselves from frost (deciduous forest), but where temperatures fall below 6°C for more than 6 months, leaves/needles are retained in order to maximise photosynthesis as soon as temperatures rise above the critical temperature (taiga).
  - Precipitation has a major impact in terms of annual totals and seasonal distribution. It needs to be considered in relation to ambient temperatures as this impacts on evapotranspiration rates. Hence forests can occur in equatorial and temperate continental areas. The relationship between precipitation and biomass is not only about quantity and distribution, but also about effectiveness, e.g. summer drought coincides with high rates of evapotranspiration in Savanna and Mediterranean areas leading to negative soil moisture budgets and drought resistant vegetation.
- Other factors (other than climate). These lead to variations within biomes often operating at a more local scale and can influence boundaries.
  - Light (affects photosynthesis rates. Light availability and its intensity are influenced by latitude and season as well as local factors (relief).
  - Topography/altitude/aspect can all impact on temperature/precipitation.
  - Edaphic (soil) factors lead to considerable variations in biome distribution as a result of local differences in soil/underlying rock.
  - Wind direction and strength impact on both evapotranspiration rates and temperatures. Permanently windy locations support grassland rather than tree cover (Tundra as opposed to Taiga).
  - Biotic and Anthropogenic factors also play a major role.

Credit exemplification, for example, as shown on Figure 1 on basic distribution.

© WJEC CBAC Ltd.

Figure 1: Factors controlling the distribution of biomes.



Forests such as Tropical Rainforests (located between 10°N and 10°S of the equator) are associated with both high temperatures and abundant moisture availability, whereas grassland (tropical and temperate) are associated with a wider range of temperature and areas of low (often seasonal) moisture availability.
Areas with very low annual precipitation levels lead to desert biomes, classified as 'hot' or 'cold' depending on temperature. Accept reference to coral reefs as part of the wider marine biome. Coral reefs are mostly confined to between 35°N and 35°S of the equator. Light penetration and tropical water temperatures between 23°C and 29°C are vital for their growth. Increased ocean temperatures and changing ocean chemistry are the greatest threats to these parts of the marine biome.

AO2
Application of knowledge and understanding is deployed to evaluate the importance of temperature in influencing the distribution of biomes globally.

- The importance of temperature. Temperature has a number of vital functions both in absolute terms as a possible limiting factor of growth and also in its seasonal distribution when it controls the length of the growing season (deciduous vs evergreen vs coniferous forests). It influences both plant adaptation and evapotranspiration rates.
- However, many would argue that precipitation is an even more important factor and is the single most important determinant of vegetation type, be it forest, grassland or desert. In particular not only annual totals, but distribution throughout the year is key to which biome is dominant.
- However, it could be argued that it is the combination of temperature and precipitation which form the key elements of climate which together can be considered the major influences. It is temperature (absolute and seasonal variations) which determine evapotranspiration rates and effective soil moisture – so even where precipitation totals are lower in cold, high latitudes, forests (boreal) can develop as evapotranspiration demands on available moisture are

© WJEC CBAC Ltd.

significantly less than in areas of high temperatures. Again, where grasslands occur (both tropical and temperate) it is the result of prolonged dry periods in summer where high temperatures coincide with low rainfall meaning that plants need to be drought resistant to survive.

- A consideration of other factors, in particular soil, is very relevant, as, for example, the nature of the soil and the parent rock can have a major impact on the effectiveness of precipitation, for instance, leading to widespread occurrence of grasslands when conditions might be appropriate for forests to develop.

A quality answer will recognise and discuss inter-linkages. It would also be relevant and legitimate for an answer to consider the enormous significance of anthropogenic factors including pollution, deforestation/reafforestation, desertification, agricultural and grazing use all of which can have an enormous effect on the areal extent of biomes in heavily settled areas such as the tropical rainforest or temperate forests as well as heavily farmed grasslands. Equally, the impact of climate change might be considered as it is especially relevant in Arctic tundra areas as well as encouraging desertification in areas having a Mediterranean climate with increasingly frequent droughts and wildfires or even in Amazon forest areas where desiccation is occurring. Note: A response which concentrates only on climate change would be self-limiting.
A possible conclusion could argue both for and against the statement, with relevant supporting evidence. Most answers will recognise the interplay of these aspects of climate which operates as an overarching factor at a macro scale, but also understand that many of the other factors have an impact and are an important influence in modifying climate factors (both temperature and rainfall) and also cause variety within biomes at a more micro scale.

AO3
Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical argument as to the importance of temperature.
- The skill of constructing relevant diagrams, (for example figure 1) or supporting statistics as to the importance of temperature.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion as to what extent temperature is the main controlling factor.

© WJEC CBAC Ltd.

4. 'The greatest threats to biodiversity result from indirect actions of humans rather than their direct actions'
To what extent do you agree?

AO1 [20] AO2 (1c) [20] AO3.3 [5] [45 marks]

Focus 3.2.3, 3.2.4.

The question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of ecosystem biodiversity and threats to the ecosystem biodiversity from direct and indirect action could include:

- Ecosystem biodiversity refers to the number and variety of organisms within a particular area. It has three components – species diversity, ecosystem (or habitat) diversity and genetic diversity. It is used as a measure of the health of the biological system (resilience).
- Indirect threats include threats from population growth and all aspects of climate change - changing temperatures and rainfall patterns, rising sea levels, the increased impacts of extreme weather including droughts, floods, high impact storms, wildfires as well as ocean acidification (causality).
- Direct threats mostly relate to development and management practices, including deforestation and the spread of agriculture (soy, oil palms cultivation and cattle ranching in the rainforest), mining and industrial development, fishing, tourism, increased urbanisation as well as threats from disease, predation, pollution (e.g. acid rain) and invasive species (causality).

Credit examples from land based, marine and freshwater ecosystems of threats, for example, from rainforest, tundra, coral reefs and wetlands.

AO2
Application of knowledge and understanding is deployed to evaluate whether and why the indirect threats to ecosystems are greater than direct threats.

Arguments for:

- Climate change is considered to be the main indirect threat to ecosystems as it operates at a global scale and is also over time happening at an increased scale and pace. In spite of mitigation measures, development has led to ever increasing rates of warming to which people are having to adapt.
- Climate change affects all ecosystems and all locations (to a greater or lesser extent) with especially notable risks to tundra biomes (positive feedback loop) and also coral reefs (bleaching).
- Climate change has very widespread secondary impacts such as rising sea levels and increased frequency and intensity of storms, all of which cause rapid death and destruction to ecosystems, e.g. mangroves. Ocean acidification is a problem occurring at an enormous scale.
- Other indirect threats associated with global development include:
  - Globally population is rising, especially in the developing world (Africa).

© WJEC CBAC Ltd.

- In many emergent countries, especially China, poverty levels are falling, and consumerism is expanding (white goods plus Diet Revolution etc), contributing to rising levels of GHG and increasing demand for goods and services, so again there has been a recent increase in threat levels which impacts on ecosystems (for example, from pollution).

- Climate warming is the world's most wicked issue so is extremely hard to manage, as it requires cooperation globally with financial support for developing countries from developed economies (COP27 summit).
- Ecosystems in more remote areas, such as the Arctic, are more likely to see indirect threats as more important, so there is variation spatially as their remoteness impacts economic impacts.

Arguments against

- There is an enormous range of threats which are direct threats. Whilst it could be argued that many of these direct threats are at a local scale and therefore can be managed to an extent at a local or national scale, some such as the destruction of the Amazon or Indonesian rainforest could be considered regional and some, such as pollution from industrialisation become trans boundary problems (acid rain).
- Many of the direct threats are also extremely damaging as they have knock on impacts (interdependence). For example, the direct threat of deforestation reduces carbon sequestration. Tipping points are reached destabilising ecosystem equilibrium, threatening biodiversity even further (feedback loops, thresholds)
- Changes over time have had a definite positive impact of lessening direct threats, with a plethora of schemes developed by national governments, NGOs, international government organisations etc to conserve biodiversity as its enormous value has been realised. The range on the spectrum of conservation extends from total protection through extractive reserves through to sustainable development with economic development integrated into conservation. Even some exploitative schemes have token protection included. The UN/UNCN and other inter-governmental organisations have numerous frameworks to encourage these developments. Although there is fragmentation, some very large schemes across boundaries, with wildlife corridors (Y2Y), have been developed and there are some notable successes in managing direct threats with various species or habitats saved, e.g. wetlands conservation schemes, where the extraction of peat has been banned, or coral reef management schemes (SMMA St Lucia), or rainforest (Udzungwa/ Korup etc).
- It is however, still very difficult, even if every little helps, to keep up with the scale and pace of destruction as the latest Living Planet Report from WWF or the 2020 Dasgupta Report have stated.

A possible conclusion would be that the threat varies spatially depending on the level of development, density of population, remoteness of the area and also temporally as undoubtedly there have been many improvements in management of direct threats, for example, of local tourism, or fishing issues, especially where the problems are basic and solutions relatively straightforward to devise. There is, however, no doubt that in many cases, direct and indirect threats are interlinked as part of world systems and both direct and indirect threats are increasing. The complexity of climate change and the failure of various COP conferences to attempt to mitigate its increasing impacts would suggest that the complexity of its impact on biodiversity is very hard to manage.

© WJEC CBAC Ltd.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical argument about the threats to biodiversity and their relative importance.
- The skill of constructing relevant diagrams and supporting statistics (e.g. climate change) to meet the demands of the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion concerning the relative importance of the threats

© WJEC CBAC Ltd.

5. Evaluate the factors influencing India's population distribution.

AO1 [20] AO2 (1c) [20] AO3.3 [5] [45 marks]

Focus 3.3.2, 3.3.4

The question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of:

- Population distribution of India
  - Population distribution can be defined as the pattern of where people live in a country.
  - Around 66% of India's population live in rural areas with 33% living in urban areas (2020).
  - Population distribution is extremely uneven both by state and between rural and urban areas.
  - Four states, Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal contain nearly 25% of India's population with average densities of over 1,000 per sq. km.
  - Factors which influence population distribution include physical factors such as access to flat, fertile flood plains and reliable water supplies for irrigation as well as human and economic factors such as level of economic development and demographic factors such as growth rates from BR/DR ratio and migration. These differentials influence the varying densities and therefore the distribution.

Note:
1. Credit place-specific detail.

AO2
Application of knowledge and understanding is deployed to explain and evaluate the factors influencing population distribution of India.
Credit should be given for located details of the impact of physical, political, economic and demographic factors.

- Factors influencing distribution
  - Physical factors play a significant role in influencing the concentrations of population on the Indo-Gangetic coastal plains with relief, soil fertility and monsoon water availability and climate all playing a major role to permit settled agriculture (Green Revolution and irrigated farming). This contrasts with the generally lower densities of central Indian states, (Ghats and the Himalayan fringe) as well as the Thar desert where adverse physical factors lead to lower densities with fewer opportunities for development (both agricultural and industrial).
  - However, numerous other factors, historical, cultural, socio-economic and political factors, can also influence distribution. In particular, opportunities for economic development often encouraged by both state and federal governments have led to in-migration from rural areas to some of the largest

© WJEC CBAC Ltd.

cities such as Delhi or Mumbai (major centre for outsourcing and offshoring) or Bangalore (centre of IT industry) where there has been both rapid urbanisation and industrialisation with improved employment opportunities since the economic reforms of 1991. Improved transport networks in peninsular India have also encouraged this in-migration from rural to urban areas.

- Local factors also have significance, for example, availability of mineral or energy resources (Jharkhand). Currently Nagaland has the highest rates of increase (migration of refugees from Myanmar).

A possible conclusion would recognise that India is a very unequal country so there are likely to be variations in the importance of factors spatially, and also as an emerging nation with rapid economic growth, these factors will vary over time. Physical factors still remain of paramount importance, for historically they have affected population distribution, but demographic, social, cultural and economic, as well as political factors are becoming increasingly significant.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical argument concerning the relative importance of factors influencing population distribution in India.
- The skill of constructing relevant diagrams (e.g. population distribution map of India) which can be annotated to support answers.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion across the scope of the question to summarise and evaluate the importance of the key factors.

© WJEC CBAC Ltd.

6. 'India's mineral and energy resources have presented more opportunities than constraints for economic development.' Discuss.

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.3.3

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of India's resource base.

Mineral resources

- India has both a large and varied mineral resource base as its geological and metallurgical background is similar to mineral rich Australia, South Africa and South America, all of which formed a continuous land mass (Gondwana land) before its break up as a result of plate tectonics (causality).
- The resource base includes:
  - Iron ore (high grade haematite and magnetite – open cast mines) which forms the basis for heavy industry (steel in Damodar Valley) with significant exports to Japan and Korea (4th largest resource).
  - Large reserve of bauxite (for the aluminium industry), manganese, zinc (4th largest reserve), copper (3rd largest reserves in 2010).
  - A range of other minerals, including gold, chromite (mega reserve), lithium (small but significant supplies), titanium, diamonds and mica, as well as proven reserves of uranium and thorium where recent discoveries have suggested some very large reserves (needed for the nuclear industry).

Energy resources

- India's resource base includes abundant supplies of coal (4th largest in the world), with the second highest production after China, largely for the power industry.
- India has the second largest amount of oil reserves in the Asia-Pacific region, located on the Western coast, with potential offshore reserves in the Bay of Bengal, but is a net importer of oil.
- Natural gas is also found offshore on the western coast and in a number of onshore fields.
- The oil and natural gas are managed by state owned companies.
- India can be considered to be well endowed with both of these resources although it is, because of its huge demand, a net importer of both.
- India has potential for the development of HEP. Although there are currently few large mega dams (Narmada is an exception) there are many schemes with Bhutan and other Himalayan countries and plans to tap the headwaters of the large Indian rivers which start in the Himalayas.
- India also has the resources and technology for alternative sources of energy – nuclear, solar and wind, although development has lagged behind until recently.

For top Band 4, both mineral and energy resources must be considered, but balance is not required.

© WJEC CBAC Ltd.

AO2
Application of knowledge and understanding is deployed to discuss India's mineral and energy resource base and to evaluate the balance between constraints and the opportunities over time.

Minerals

- One of the greatest strengths of the Indian economy has been the geological endowment of abundant supplies of nearly all the mineral 'building blocks' (resources) for a range of industrial development – almost everything can be made in India.
- Opportunities exist because of the types and amounts of resources available to supply key materials for the production of steel, aluminium, cars and other engineering products leading to the development of a number of manufacturing hubs.
- However, accessibility can impact upon opportunities provided by mineral resources. Multiple structural and regulatory challenges have been a constraint. Until recently, much of the resource abundance remained unexplored (India's exploration spend as a proportion of global non-ferrous exploration has remained low at 0.25%) presenting constraints for future development.
- The importance of ownership of production from the supplies of mineral resources. The agencies controlling these supplies are largely TNCs, many of which are still foreign owned (notable exception TATA and JSW). This means there is some leakage of economic benefits which would accrue to India, in contrast to the growth opportunities indigenous TNCs would create (contrast with oil and gas – by state owned companies).
- Moreover, India's industrial development has until recently concentrated on the service sector failing frequently to take the maximum advantage of its excellent resource base as many of the mines are open cast (iron and bauxite) which leads to great economic benefits, but high environmental cost. Future constraints could include the need to manage these costs.

Energy resources

- Whilst India is well endowed with energy resources, as the economy has been growing at an average of up to 6-7% per annum over the last two decades with occasional highs of 10%, this has put pressure on energy resources, especially as all major sectors of the economy have grown leading to higher energy demands, so constraints are emerging.
- Moreover, the population has also been growing (currently 1.4 billion) and by 2030 India is expected to be the most populous country in the world (1.6 billion). Gradually as the economy develops, people are taken out of poverty, with again, greater demands on energy, especially for urban living.
- Nevertheless some 40% of rural people remain unconnected to the electricity grid and clearly there is a need for more energy supplies to do this with the Modi Plan designating coal to replace biomass/biogas. The poor-quality electricity grid in India leads to many breakdowns and guarantees for 24 hour power in areas such as SEZs again puts pressure on supplies.
- India's coal is currently largely consumed by the power industry and heavy industry such as steel, chemicals, paper and cement.
- With some of the fastest growth in the world for energy, India is actually importing some coal from Australia, in spite of its huge resources.
- Whilst India is a significant oil producer, oil consumption and a failure to develop some potential indigenous resources means India is highly dependent on importing to meet its consumption needs, which is a definite constraint. Equally

© WJEC CBAC Ltd.

for natural gas, India is again a net importer, but less so than oil with LNG coming from nearby Qatar.

- As increasing concerns are occurring internationally (COP summits) about the pollution and environmental damage (risk) associated with coal combustion (the dirtiest fuel), controls will lead to increases in the cost of environmental amenity and repair, which will place huge constraints on India's economy as it is reliant on coal for 55% of its electricity generation (2020).
- India has estimated that it would be impossible to 'phase down' coal till as late as 2070, but it is working hard to manage its energy gap between supply and rising demand and also, at the same time, change the make up of its energy mix to be more sustainable. This is currently a huge constraint on economic development.
- India has already cancelled plans for over 600 new coal power stations such is the scale of coal dependency and is filling the gap with mega HEP schemes and a handful of nuclear power stations. All have long lead in times so again a constraint is emerging.
- Attempts are underway to produce cleaner coal as well as development of alternative energy sources, often by more HEP generation and wind and solar power, many in rural areas for which there is considerable potential. There are considerable opportunities for a range of schemes.
- India has grandiose plans – the Desert Power Plan, India 2050, predicts that vast solar PV installations in for example, Rajasthan and the Thar desert will contribute substantial energy supplies.
- The National Action Plan for Climate Change aims to improve energy efficiency, especially of the grid, as well as developing many types of renewables, especially large wind farms. There is even a proxy carbon tax levied on both domestic and imported coal with the aim of investment moving towards alternative sources.
- The major issue is the huge increase in demand because of India's economic development, possibly to be the third largest economy by 2040 with many government strategies for development of all sectors of the economy.

A possible conclusion would support the notion that many opportunities are provided by the rich and diverse, albeit finite, resource base but recognise the increasing constraints of the energy resource base brought about by the massively developing consumption of this very large emergent economic power and also the need to fulfil environmental demands from global governance which has meant that a decarbonised, coal free future has to be planned for.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments concerning the relative balance of constraints and opportunities for both minerals and energy resources.
- The skill in constructing relevant diagrams (e.g. of energy generation or deposit size) which can be annotated to support answers in the question.
- The skills in covering both the breadth and depth of the question.

The skill in reaching an evidenced conclusion for both mineral and energy resources concerning the evaluation of opportunities versus constraints.

© WJEC CBAC Ltd.

7. Evaluate the factors influencing China's population distribution

AO1 [20] AO2 (1c) [20] AO3.3 [5] [45 marks]

Focus 3.3.2. (3.3.4)

The question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of:

- Population distribution of China
  - Population distribution can be defined as the pattern of where people live in a country.
  - Population distribution is extremely uneven across China and between rural and urban areas.
  - As China modernises, the balance between rural and urban populations is becoming more typical of that of developed nations. In 2007 44% of the population lived in urban areas, today (2022) more than 58% do with the figure expected to reach 80% by 2050.
  - Population is concentrated in the eastern and coastal regions and along the major rivers of Hwang He, Yangtse and Huai.
  - Factors which influence the distribution include physical factors such as relief, climate (water availability) and soils. Economic and political factors such as level of economic development which encouraged migration from rural to urban areas, e.g. from Hunan to Guangdong, and inland along the Yangtse, powered by reforms associated with the Open Door policy are increasingly important. Increased communications (HST and new roads) encourage the growth of population in the autonomous regions.

AO2
Application of knowledge and understanding is deployed to explain and evaluate the factors influencing population distribution, growth and structure of China.
Credit should be given for located details of the impact of physical, political, economic and demographic factors.

- Population Distribution
  - The key factor is undoubtedly geography which to a large extent explains the extremely uneven distribution overall. From the steep Himalayas to the west to the dry grasslands of the north-central and the Gobi Desert in the north. Much of China, a huge country, is sparsely inhabited (densities under 10 per sq.km) as a result of a hostile physical environment (relief, climate, poor soils).
  - Very high densities of over 400 per sq.km are found along the flat, fertile river valleys of the Hwang He, Yangtze and Huai, as well as the eastern coastal plains where physical factors, including coastal accessibility have encouraged settlement.
  - The climate, with, until 2022, reliable monsoon rainfall encouraged further development of the south which contains 80% of China's water supplies.

© WJEC CBAC Ltd.

- Economic factors have emphasised this unequal distribution with much of the manufacturing, and subsequently tertiary activity being located in the east coast area where five out of the six of the SEZs, and all 14 open cities, e.g. in Guangdong province, were established after the Open Door Policy (1978). The coastal locations had many advantages for trade and investment. The area around Beijing, the capital city, was also extremely popular as a result of its historic advantages, although pressure on water supplies led to the ongoing South-North water transfer scheme.
- Political factors – government policies in a totalitarian state have always played a major role in population distribution. Examples include:
    - In Mao's era many small scale SOEs were established in the rural areas to reduce levels of rural poverty.
    - The establishment of the Open Door Policy and the designation of economic development areas (SEZ, e.g. Pearl River Delta, and Open Cities, e.g. Shenzhen) reinforced the importance of coastal areas with only the North China Industry Zone inland.
    - So great was the in-migration for economic opportunities, e.g., over 20 million migrating to Guangdong, that the Chinese government devised the Hukou system in an attempt to manage rural to urban migration.
    - In subsequent years, the Chinese government has adopted regional policies to encourage joint ventures in to the poorer, less developed regions, e.g. car factories in Changchun. Equally, development has been encouraged along the Yangtse focused in Chengdu and Chongqing to spread the distribution more evenly.
    - Most recently there has been significant planned migration of Han people into Xinjiang and other autonomous regions, e.g. Tibet, Inner Mongolia, in a government attempt to increase social stability with improved communications (HST).

A possible conclusion would be that whilst physical factors were initially of key importance in influencing the initial distribution of the Chinese people, government economic policies are currently very important in a planned economy. Thus, the factors vary with time and also spatially across the huge country.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical argument concerning the relative importance of a range of social, economic, cultural and political factors influencing population distribution in China.
- The skill of constructing relevant diagrams (e.g. population distribution map of China) which can be annotated to support answers.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion across the scope of the question to summarise and evaluate the importance of the key factors.

© WJEC CBAC Ltd.

8. 'China's mineral and energy resources have presented more opportunities than constraints for economic development.' Discuss.

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.3.3

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of:
China has, as would be expected in such a large country, a very wide range of both energy and mineral resources.

Mineral resources
- China is one of the world's largest producers of gold and the world's largest producer of a number of rare minerals, including antimony, zinc and tungsten.
- It is also the third largest producer of iron ore. Other major minerals are bauxite, mercury, molybdenum, copper, zinc, tin and diamonds.
- However, many of these important metallic minerals are of low grade (of poor quality, including iron ore, copper and manganese) making them difficult and more costly to smelt. Only in the 21st century has China developed adequate mining and processing technologies to optimise their use.
- Magnesium is one of the few minerals to be exported.
- China accounts for 30% of the world's supply of phosphates, essential for fertiliser manufacture.
- China has supplies of several rare earths and minerals such as lithium.
- Minerals form a good resource base for China's rapid industrialisation, but there are increasing constraints which China aims to overcome via Neo-colonial strategies and OBOR.

Energy resources.
- China is the world's number one producer of coal (five times as much as any other country). It can be considered well-endowed with coal although proven reserves would suggest supplies could run out as early as 2050. Much of the coal is low quality and often 'very dirty' and its uneven distribution around China is a further constraint. In a standard year, over 5000 are killed in mining accidents, frequently in privately owned coal mines, with small teams of miners using low-tech methods. Thus, there are constraints, with China importing coal from countries such as Australia as the lack of high-grade coking coal (for steel) and anthracite has to be overcome.
- Oil and natural gas (largely in Sichuan and Xiangjiang) are also widely available, but in both cases, China is a net importer with oil from Angola, the Middle East and gas from Russia and Qatar. It is currently ranked 7th in the world for crude oil production but because of the huge demand it is a major importer.
- China potentially has the world's largest hydropower potential with huge dams such as the Three Gorges dam on the Yangtse, but also many developments in the Himalayas, using the headwaters of rivers such as the Mekong and the Salween with potential conflicts with countries such as Vietnam downstream.

© WJEC CBAC Ltd.

- China also has nuclear power potential with know-how, design and technology exported around the world (Hinkley Point, UK), but is constrained by limited domestic supplies of uranium (a constraint overcome by a 'deal' with Australia).
- China is now the world's biggest investor in renewables, with China's National Development and Reform Commission (NDRC) providing a draft policy which aimed to increase the percentage of renewables used to 35% by 2030. It is the abundant hydropower which is the foundation of China's energy transition with huge developments and also of solar and wind power in the south and west.

For top Band 4, both mineral and energy resources must be considered, but balance is not required.

AO2

Application of knowledge and understanding is deployed to discuss China's energy and mineral base and to evaluate the balance between constraints and opportunities over time. All evaluation has to be set against the phenomenal scale and pace of Chinese demand for resources fuelling industries which are resource heavy with annual rates of economic growth consistently high since the 1980s of 10%+.

- The availability of mineral resources has to be assessed in relation to demand and the diverse industrial base of China, with export orientated products across a huge range of goods.
- Whilst China may be the world's largest producer of minerals such as zinc or tungsten, it is also the world's largest user.
- China's policies referred to as 'neo-colonialism' in Africa or South America are driven by the desire to develop and import high quality mineral resources (many of its indigenous resources are of low quality) in order to overcome any constraints.
- Chinese mining deals are vital to ensure security and quality of mineral supplies (e.g. bauxite in Guinea). In return, Chinese government's FDI promises to invest billions in infrastructure in African countries to source mineral resources.
- The Chinese hunger for mineral resources has had a major impact on global prices of minerals and has also created demands for huge ships and trains to carry them being built all around Asia (globalisation).
- China is also undertaking exploration for minerals around the world, including sea bed areas (Indian Ocean) in an attempt to overcome constraints which it would otherwise face so it could be said to be maximising quite limited opportunities.

Energy Resources

China has huge demands for energy resources for a number of reasons, although it has made use of multiple opportunities for energy development.

- Although China's birth rate is one of the lowest in the world, its population of over 1.4 billion makes it currently the second most populous country.
- As many of China's people have been taken out of poverty, a burgeoning middle class has emerged, often migrating to urban areas. Their affluence leads to greater demand for electricity for appliances or fuel and electricity for cars.
- Demands for oil and gas vary across China with Guangdong Province having the highest needs (Pearl River Industrial Region).
- All sectors of China's economy (agriculture fuelling the diet revolution, industrial might as the 'workshop of the world' and growing tertiary and quaternary sectors) lead to increased energy demands and potential constraints.
- There have always been constraints in the energy resources base that China has sought to overcome by further domestic exploration and also by exploiting oil, gas and even coal reserves via deals with Angola (Africa) Russia/Kazakhstan and South America and other countries around the world to ensure energy security.

© WJEC CBAC Ltd.

- International concerns (COP summits) over the pollution and environmental damage (risk) caused by fossil fuels associated with consumption of China's very dirty low-grade coal will lead to increases in the cost of environmental amenity and repair and have already placed a constraint on China's economy.
- China has already taken dramatic steps to transition towards a green energy economy (sustainability) with plans ultimately to be a world leader in green technology, but as a result of the huge demands may need till 2050 as opposed to 2030 (general target for zero carbon) to transition fully to sustainability.
- The constraints for energy have always been there and short term may increase, but the Chinese leadership and government has seized initiatives to transform them into opportunities.

A possible overall conclusion would support the idea that constraints have always been there, especially for minerals and that the Chinese government/leadership has developed strategies to overcome these constraints. Short term the constraints may increase as the demand for resources is exponential, but longer term a range of strategies should provide more opportunities to ensure that coal is phased down and the renewable sources of energy are subsidised with fines from companies who do not meet pollution standards.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments concerning the relative balance of constraints and opportunities for both minerals and energy resources.
- The skill in constructing relevant diagrams (e.g. of energy generation or deposit size) which can be annotated to support answers in the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion for both mineral and energy resources concerning the degree to which opportunities for economic development have been significant in relation to constraints.

© WJEC CBAC Ltd.

9. 'All ways of measuring development have limited use in evaluating development progress in African countries'.
To what extent do you agree?

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.3.8

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of the ways in which development can be measured and the possible uses of the results. Responses could include:

- Development is a contested concept. It can be defined as 'the progressive improvement in standards of living and quality of life for an increasing proportion of a country's population'. Over the years it has been defined in many different ways; initially using economic factors and then including in human factors (MDGs) and increasingly including the environment in terms of sustainability (SDGs).
- Development measurement can be done by using quantitative measures based on single statistics such as GDP/GNP or GNI per capita, (economic indicators), or using social indicators such as literacy rates or Life Expectancy, IMR, CBR, CDR.
- There is a range of qualitative measures such as freedom, security, plight of indigenous groups, quality of life/happiness which are increasingly useful.
- Many ways of measuring development rely on composite measures which include several quantitative indicators in combination to give a broader, more accurate picture. HDI, PQLI are commonly used.
- As development is a dynamic process new indicators are becoming increasingly available, for example, EPI (Environmental Performance Indicator), IOH (Index of Happiness) or IIAG (Ibrahim Index of African Governance) in order to gain a more accurate picture of the situation.
- UN programmes such as the MDGs and subsequent SDGs provide Development Progress Profiles across a whole range of indicators for global comparison.
- The indicators can be used nationally for various regions within the country e.g. divisions of Nigeria, or internationally in order to gain an insight of progress globally – with marked spatial variation. This can help in future planning, for example, of aid allocation.
- The indicators also can be used to chart progress temporally as to how countries progress (e.g. Rwanda) or even regress over time (e.g. Ethiopia, Nigeria).

© WJEC CBAC Ltd.

AO2

Application of knowledge and understanding is deployed to discuss whether development measures are useful or whether their use is very limited and why. The evidence could include:

- So much depends on the nature of the indicator. Whilst single statistical indicators may provide useful data for SSA' national planning, they are often more useful as part of a 'basket' of economic, social or environmental indicators. Quite often the results are diametrically opposed, for example, GNI per capita vs Index of Happiness.
- Composite indicators such as the HDI (the most widely used indicator) provide a more comprehensive view of development where indicators are combined to create an index. The HDI combines life expectancy, adult literacy levels and GDP per capita using PPP to produce one single measure that is put on a scale from zero to one, with a score closer to one indicating high levels of development which together measure health, education and living standards. The indicator is very widely used as it is reliable (updated annually) and useful for governments in devising education or health provision. Yet there is concern that the three components are equally weighted, with GDP per capita overly influential. Even if it was converted to GNI, it fails to consider the 'hidden/informal economy' which makes a significant contribution of developing countries' economies, e.g. bartering or informal trading.
- Other criticisms are that although a country may be experiencing economic growth and improved living standards, environmental issues, e.g. pollution, and political issues e.g. corruption, are not taken into account.
- The GPI (General Progress Indicator) shows how composite indices have developed by including measures of the impact of economic growth on the environment and are indicative of how measures have been defined and developed to reflect the dynamism of development.
- Many recently developed indices combine the use of quantitative and qualitative indicators which can give greater insights into a country's progress. Qualitative indicators are more likely to include opinions of people, although these are complex to survey and analyse. They make national comparisons more useful.
- The indices are vital at an international scale for seeing progress over time, for example, enormous progress in Rwanda.
- Information on development provided by indicators may vary in its usefulness due to scale. Measures can be very useful in identifying level of development at a national scale, but measures quoted at a national scale hide serious regional and local inequalities. There are often significant variations in levels of development within countries including regional, ethnic and gender differences or between urban and rural areas, for example, in educational provision, participation rates and standards or health provision (number of people per doctor).
- Credit examples of particular countries, Kenya/ Nigeria are useful examples. However, it could be argued that the limitations can be related to the indicators themselves.
- The reliability of some quantitative statistics - as they are less reliable for a number of reasons, as in war zones (Ethiopia, Somalia etc) the sampling process is unreliable and there are many gaps in data collection with only dated data available. With qualitative opinion surveys, the situation on sampling makes measures – gender inequality or freedom – extremely unreliable. For some countries, e.g. South Sudan, the non-availability of most forms of data for this new country is a major problem when trying to evaluate its development progress.
- Moreover, data can be manipulated by governments for a number of reasons including a desire to 'look good' or conversely to over emphasise a need for

© WJEC CBAC Ltd.

support (this applied in Nigeria where three regions were competing for Federal funding).
- For many countries the limited availability of technology adds to unreliability (e.g. of sampling and coverage). Census data can have an error of +/- 10%. Many governments lack resources and finance to collect data collection for a census. Nomadic populations roam across borders.

An overall conclusion would depend on the type of data collected and its usage as well as the nature of the country itself. Both spatial and temporal factors are significant.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments about the various measures of development.
- The skill in constructing relevant diagrams (e.g. Rostow model) and using supporting statistics, (e.g. on regional disparities of health and education provision).
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion about the value of the various development measures in evaluating development progress.

© WJEC CBAC Ltd.

10. Evaluate the effectiveness of strategies used by international organisations and aid agencies to promote development in two or more sub-Saharan African countries. [45 marks]

Focus 3.3.14

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of the strategies introduced by international organisations and aid agencies in two or more Sub-Saharan African countries.

- Development can occur environmentally (adaptation to climate change), socially (e.g. health and education), economically (e.g. infrastructure and economic activities) and politically (improving quality of governance).
- International organisations such as the World Bank and the IMF provide direct grants and loans to indebted SSA countries, but the support is governed by strict conditions, for example, adopting a structuralist free trade approach.
- UN agencies administer an ever-growing number of programmes and funds. Specialised groups include UNICEF, UNHCR, UNDP, FAO, WHO etc. The UN has been a major driver of environmental, economic and social development through its MDGs, now superseded by SDGs (sustainability/globalisation).
- There are a wide variety of international aid agencies working to promote development in SSA countries. Some BINGOs (Big, international NGOs) operating at a global scale (e.g. Oxfam, Save the Children, Christian Aid, WWF, World Vision, Islamic Relief) not only have a recognised lobbying role as part of global governance, but fund local NGOs 'on the ground' encouraging resilience and capacity building, (e.g. by adapting to climate change), technological support, increasing empowerment of disadvantaged groups, providing infrastructure and increasing trade links.
- There are also huge numbers of smaller, specialised NGOs, e.g. Tourism Concern, Farm Africa, Water Aid, which operate projects on a more local scale across SSA. They provide aid to areas identified in National Development Plans. There are also many small semi-formal links, e.g. between schools
- All SSA countries have a National Development Plan on paper, covering infrastructure, trade, water, health and education etc with identified priorities for development, but many have not been fully implemented and rely on international help. An example is the Ethiopian Growth and Transformation Plan (GTP). In the first five years (2010-2015) Ethiopia's economy recorded, albeit form a low base, 10% growth rates of GNI, but due to war, the country is now in decline and increasingly reliant on international aid.
- Some countries, spearheaded by China, Brasil and India, are providing huge quantities of FDI and aid largely for economic development described by some sources as Neo-colonialism. Some students may mention the impact of OBOR.
- Some candidates may mention MNCs as international organisations provide FDI largely for economic development of minerals and other resources, as well as agricultural exports.

Credit factual exemplification and detailed examples for the chosen countries.

© WJEC CBAC Ltd.

AO2

Application of knowledge and understanding is deployed to evaluate the effectiveness of the various international organisations and aid agencies in promoting development of the selected SSA countries.

- Effectiveness can be measured in a number of ways:
  - Whether the strategies contribute to solutions of the problems identified
  - Whether the strategies improve the lives of the disadvantaged communities they target.
  - The nature and management of the organisations themselves
  - Whether they are effective spatially across the country or temporally over a period of time, with measurable improvements.
  - What the national or local situation is within the chosen country will affect the effectiveness e.g. war in Sudan (2023).
- International organisations and aid agencies cover a huge range of differing issues, and their deployment varies widely across SSAs, dependent on their income status (MICs, LICs, LDCs), their needs for emergency, short- or long-term support, the quality of governance (some countries are too dangerous to operate in. In poverty-stricken countries, or those at war (DRC), progress is incremental.
- They are increasingly deployed as many of the problems, such as increasing impacts of climate warming are too complex for governments to solve by themselves as many suffer from extreme levels of poverty with very low GNIs.
- Many of the UN agencies work in close cooperation with the National Development Plans which all SSAs have developed, albeit with much fewer at an operational stage, and therefore they work with the National Governments (interdependence) so developing a better understanding of what needs to be done. This may be in contrast to some BINGOs which may have stereotypical views of what needs to be done with top-down strategies which fail to take account of a country's political complexities. However, both groups provide vital finance for a huge range of important projects in environmental, economic and social development.
- Many of the smaller NGOs have very focused, sustainable projects, for example, increasing resilience and adapting to climate emergencies, developing safe water supplies or using appropriate technology to develop improved farming strategies, all of which involve bottom-up participation of local communities. Admirable as these small-scale projects are, it is often very difficult to upscale them, so effectiveness is very localised, but avoids politicisation of aid.
- The effectiveness of the agencies may vary spatially, with many clustered in certain regions of a country, some imbalance may occur with physically isolated areas frequently disadvantaged.
- The effectiveness of strategies introduced may vary by interest group. In most SSA countries, women are often at a disadvantage because financial institutions of the country do not empower women to develop as entrepreneurs (contrast Rwanda where women are well supported with the Islamic countries of Sahel). Microfinance schemes, often by NGOs, can be extremely effective as micro-loans, cooperative and enterprise loans can revolutionise development at a village scale, especially in rural areas, by allowing them to engage in income generating activities. If a number of linked, small-scale projects are developed, this can have a cumulative impact, for example, micro hydro schemes, small scale irrigation schemes, agroforestry and other farm improvements, ecotourism, can combat famine and drag the community out of poverty., e.g. Udzungwa in Tanzania.
- The effectiveness of international governments such as the investment by China in most countries in Africa, or Brasil in Lusophone countries or India in east and south Africa, can have huge impacts on the economies of these countries with

© WJEC CBAC Ltd.

improved infrastructure (e.g. hospitals) and transport development as well as development of energy and mineral resources. However, some western media perceive these developments as neo-colonialism. As OBOR spreads globally, many countries benefit and really welcome the efficiency of China even though there are costs. Opinions on effectiveness can be very divided.

- MNCs, often from USA or EU, also play a major role with FDI, by not only providing employment via agriculture and industrial development, but in some cases, investing in major health and education projects within their area, but sometimes, as in DRC or Sierra Leone, causing environmental damage in the resource exploitation, (e.g. Shell in Nigeria) and causing much wealth to leave the country (leakage).
- The influence of international institutions such as the IMF and World bank may in some cases hamper development by national governments. The IMF structural adjustment plans impose strict fiscal/financial limits, requiring governments to cut back on social programmes such as health care, education, sanitation, when indebted countries apply for help. The loans come with a demand for recipients to agree to operate free market economies which do not protect their fledgling industries, exposing them to outside investment.
- As a result, subsequent debt relief programmes such as HIPC have been more collaborative and therefore more effective and national governments are consulted to develop PPPs as opposed to SAPs.
- The role of all international organisations and agencies has undoubtedly increased as a result of the COVID pandemic (which led to a health crisis), for example, in vaccine provision.
- The war in Ukraine (which had huge impacts on the cost of food supplies) and the climate emergency (which has had such a disastrous impact on countries such as South Sudan, Malawi, Eritrea who have been hit hard by multiple climate extreme events) have also led to huge needs in the countries in SSA.

Note:

1. Answers based on a two-country approach may evaluate effectiveness scheme by scheme.

A possible conclusion would be that a huge variety of activity by a range of organisations and agencies has been effective in some SSA countries, but less so in others for a variety of reasons including the nature of the country and the strategy developed by the agency as well as the organisation or agency itself. There are both spatial and temporal variations in the effectiveness and the choice of countries will impact on the conclusions made. There are also marked variations within each country.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments evaluating the range of strategies introduced by a variety of international organisations and aid agencies and the extent to which they promote development.
- The skill in constructing relevant diagrams (e.g. showing types of aid) and tables, (e.g. showing improvements) which can be annotated to meet the requirements of the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion about the degree of effectiveness in promoting development of the range of strategies developed by international organisations and aid agencies.

© WJEC CBAC Ltd.

11. 'The most important factors influencing the changing demand for energy resources are economic.' Discuss.

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.4.3

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of factors influencing the changing demand for energy resources (economic, social, demographic, political, technological and environmental.
Energy resources include fossil fuels (coal, oil, gas) and alternatives – recyclable (nuclear and biomass) and renewable (wind, solar, hydro, geothermal, oceans).

- Changing demand occurs at a variety of scales (from global to local – spatial variations) and can vary over time.
- Overall demand
  - All scenarios predict a steadily rising global consumption of energy in spite of periodic downturns brought about by global events (recession 2008-9, Covid pandemic 2020-23 or Ukraine war), largely driven by emergent economies, especially China but also India, Brasil, Mexico and Middle Eastern countries (i.e.. NICs, BRICs, MINTs etc). Energy demand in advanced economies is expected to stabilise or in some cases, decrease (greater efficiencies etc).
  - A combination of increasing population growth, rising living standards and rapid industrial expansion (global shift) in the emerging countries leads to an enormous increase in demand.
  - As any nation develops economically, both its primary energy consumption and its use of petroleum and electricity (secondary sources) rise with a strong correlation between GNI per capita and total energy consumption per capita, although averages mask inequalities amongst populations.
- Composition of energy resources (energy mix) also changes considerably as countries develop. Not only does the demand increase, but the actual sources of energy change over time as shown on the energy transition model.
- The recent drive towards more sustainable energy use has an impact on both overall demand and the increasing diversity of resources used as countries develop – with a greater emphasis on 'green growth'.

© WJEC CBAC Ltd.

AO2
Application of knowledge and understanding is deployed to discuss whether economic factors are the most significant influence on changing demand.

Economic factors
- The strong positive correlation between GNI per capita and energy consumption emphasises the importance of economic development as a factor. The demand for energy for manufacturing is vital as a driver of economic growth. India and China have on average experienced annual economic growth rates of around 8-10% with industries such as steel, chemicals, cement and plastics dependent on large supplies of energy.
- Growing international trade (globalisation) has led to high demands for energy from transport by sea and air.
- The cost of energy has influenced the choice of resource, with coal and other fossil fuels traditionally being low cost compared to many of the newer renewables which have only recently become competitive (improved technology).
- Fossil fuels are finite with oil in particular expected to reach peak oil by 2030 depending on discoveries. Gas, the cleanest of the fossil fuels, is also expected to reach a peak, possibly by 2060 depending on supply/demand ratios.

Demographic and Social factors
- Increased wealth acquisition and an expanding middle class in countries such as India and China lead to higher living standards and an increasing demand for electricity to power white goods and appliances such as air conditioning, cooking and lighting and rising car ownership all of which place increasing demands on energy.
- As the global population continues to grow, with a higher proportion of people living in cities (urban areas generally using more electricity than rural areas), this again will increase power consumption and energy demand. These factors reinforce the economic factors and huge demands of the BRICs could be replicated across most of the world, including the continent of Africa in the future.

Technological factors
- For many of the above economic and social factors, a growing, more affluent population, use of technological equipment has proliferated, for example, electricity to support the massive servers belonging to the 'tech' giants such as Microsoft and Google. Servers need electricity to run and to keep from overheating. Cloud services, sophisticated social media all take electricity to operate.
- Technology has a major impact on cost of energy resources. Many of the renewables are steadily decreasing in cost per unit and efficiency because of technological developments (for example, solar/wind power and battery storage)
- Technology also emphasises the development gap as many of the LICs rely on technology transfer from NICs, ECs to develop their energy supplies.
- Technology makes the exploitation of resources, e.g. of unconventional oil and gas possible.

Political factors
- Political factors play an increasing role in influencing the changing demand for energy. Countries aim to be increasingly energy secure to avoid the dangers of interruption of supplies and distribution, especially of vital oil and gas supplies which, as in the Ukraine, have been used as 'geopolitical weapons' with the blowing up of pipelines and interruption of supplies.

© WJEC CBAC Ltd.

- Whilst coal is ubiquitous, many locations for oil and gas are politically dangerous areas (e.g. S. Sudan) and are concentrated in OPEC countries with the cartel having a very dominant political influence on pricing.

Environmental factors

- Environmental factors are becoming increasingly crucial with a drive to more sustainable 'green growth' emphasising both the importance of efficiency of use, so 'levelling' out demand and the need to phase out fossil fuels, especially the dirtiest – coal, in order to cut down on GHG emissions to mitigate the impacts of climate warming. Impacts are increasing in scale and pace. Many would argue that all energy sources have environmental impacts and only by cutting demand can growth be truly 'green' with nuclear options very controversial. Sustainable use of energy is often not feasible for LICs and these countries rely on HICs to take the lead financially to achieve this aim (interdependence).

As to whether economic factors are the most important, the 'case' could be argued both for and against the question. Many of the factors are actually interlinked (e.g. Economic development and the affluence of a growing population). Their relative importance varies spatially and over time. Some may argue that environmental factors are of increasing importance in changing demand, both total and by resource type over time as the need to manage 'the world's most wicked problem – climate warming' has become of paramount importance.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments about the vital need to transition to alternative energy sources.
- The skill in constructing relevant diagrams (e.g. energy transition models or Kuznets curve) and using relevant statistics to meet the requirements of the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion as to how important economic factors are in influencing changing demand.

© WJEC CBAC Ltd.

12. 'Balancing supply and demand is the greatest challenge facing organisations involved in the global management of oil and gas resources. To what extent do you agree?

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.4.4

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of the major organisations and challenges faced in the global management of oil and gas: -

The major players include:

- OPEC (a cartel of key oil producing countries – 43% of production, 80% of proven reserves) and GECF (Gas Exporting Countries – a partially formed cartel of gas producers who manage the imbalance between supply and demand, e.g. By pricing and storage control)
- Governments, especially of oil producing countries, with increasing numbers outside of OPEC, some with good stewardship, e.g. Norway, others not.
- MNCs- the major transnationals who exploit and produce the oil and have importance at most stages as they have a high degree of expertise.
- Gazprom, the Russian state-owned company which functions as an MNC and has control over Russian oil and gas.
- Consumers which include groups of countries, e.g. EU and single countries, as well as agricultural, industrial and domestic users who buy the gas and oil.
- Increasingly, environmental groups opposed to the use of fossil fuels for climate warming reasons (Greenpeace BINGO, Stop Oil and local groups etc)

Management of oil and gas occurs in three stages:

- Upstream (exploitation and production) to obtain supplies.
- Mid-stream (Storage, transporting and marketing)
- Downstream (refining, distribution and retailing) to meet demand.

Challenges associated with balancing supply and demand include economic, political, technological and environmental issues in a global situation where there is limited correlation between the global supplies of oil and gas and the more important areas of demand/consumption (space) and also the changing situation both long term and short term (time).

© WJEC CBAC Ltd.

AO2

Application of knowledge and understanding is deployed to evaluate the range of challenges facing organisations managing the global oil and gas industry.

- A number of organisations are involved in the supply and demand of national gas resources, each with different priorities and roles and degrees of influence.
- MNCs are frequently involved in all three stages of global oil and gas management (upstream supply, midstream and downstream fulfilling demand).
- MNCs (e.g. Esso/Shell) need to be profitable for their shareholders. Oil exploitation is a long-term investment and constant fluctuations in oil prices (over US$150 a barrel in 2008 or recently and below US$50 a barrel in 2010) are difficult for oil companies to manage, especially as oil exploitation is a long-term investment in a highly dynamic situation and much of the future available oil is technologically difficult and therefore higher cost to produce (e.g. unconventional oil – tar sands)
- The MNCs are increasingly in conflict with environmentalists with potential added costs of paying for all the damage and clean-up costs from exploitation (tankers, oil rig and pipeline explosions, e.g. in Niger Delta) often in increasingly difficult and extreme environments such as the Arctic and also long term over predicted falls in exploitation as oil and gas are phased down in order to deliver the slowing of the rate of global warming.
- Crude oil and gas are the world's most actively traded commodities in financial markets and are highly susceptible to shocks, including geopolitical (Ukraine gas) and environmental (Deep Water Horizon oil spill) which increases the challenge of managing the imbalance between supply and demand (risk and resilience). If oil prices rise sky high, many governments seek opportunities to force oil companies to pay high tax as they make enormous profits (windfall tax UK 2022)
- Oil companies have to manage political instability as frequently oil and gas resources are concentrated in areas such as Nigeria, South Sudan, Libya and Venezuela, which create challenges for managing transfer and oil storage. Stable areas such as Norway (oil) and the North Sea (oil and gas) are currently in high demand.
- As a result of the high demand for oil and gas from emerging economies of China and India, there is increasing pressure placed on the management of future global oil and gas supplies for which MNCs are largely responsible. With Peak Oil estimated around 2030 this puts long term pressure on exploring for new supplies, with easy to produce supplies running out.
- OPEC, and to a lesser extent GECF, play a key, very powerful role in the global management of oil and gas as the cartel has controlled the supplies of oil pumped out of the ground in order to prevent a fall of oil prices to a level which would bring a drop in profits for members. Russia has joined OPEC and this has influenced many of the decisions made by the largely traditional members who are predominantly Middle Eastern countries.
- Both oil and gas can have supply issues. Supplies are very concentrated in the strategic ellipse that stretches from the Middle East to the Caspian Sea to North West Siberia. This reinforces their strategic value as geopolitical weapons and causes fears of a lack of energy security in many countries, which is further exacerbated by pinch points in the global supply networks of pipelines and super tankers (dangers include pirates, accidental explosions, terrorist activity, wars or weather events).
- Many countries, including LICs for whom it is barely affordable, have to rely on imported oil and gas, which poses economic difficulties. Moreover, they need technological support from MNCs in developed countries should oil be discovered within their territory. Much of the current demand has come from members of the BRICs group whose emerging economies have driven rising global demand for

© WJEC CBAC Ltd.

oil and gas. The recent war in Ukraine has enhanced the key role of OPEC, although there are many oil producing countries outside OPEC, notably Norway.

- National governments have a duty to their people (voters) to provide secure supplies of affordable, sustainable energy supplies. They are concerned to manage secure supplies and yet to fulfil their commitments to mitigate their contribution to global greenhouse gases. At the same time, they aim to reduce, or control rising demand by a variety of energy efficiency strategies. The situation in the current Ukraine war, with supplies of Russian gas cut off to many EU centres, such as Germany, has shown the importance of national governments in managing issues such as developing enhanced storage capacity and controlling demand and developing both stop gap and long-term alternatives to Russian gas, and to some extent, oil.
- GASPROM a state owned Russian MNC is very much influenced by the Russian government.
- Many global environmental groups involved in combatting climate change (Stop Oil) have used powerful protests to highlight key environmental issues by disruption of the national supply chains.

Overall, a conclusion might suggest that spatial imbalance between supply sources and maximum demand from consumers which requires organisations to manage supply and demand through transfers, storage and pricing is the major long-term issues. There are many short-term challenges, political, environmental, technological and economic which add to the complexity of the management of what are finite resources.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments about the relative importance of the balancing of supply and demand.
- The skill in constructing relevant diagrams (e.g. of management chain) and using supporting statistics (e.g. for role of OPEC) to support the argument.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion about the challenge of manging supply and demand in the global management of oil and gas by the various organisations involved.

© WJEC CBAC Ltd.

13. 'The seasonal movement of the Inter Tropical Convergence Zone (ITCZ) is the main reason why characteristics of tropical climates vary'. Discuss.

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.5.2

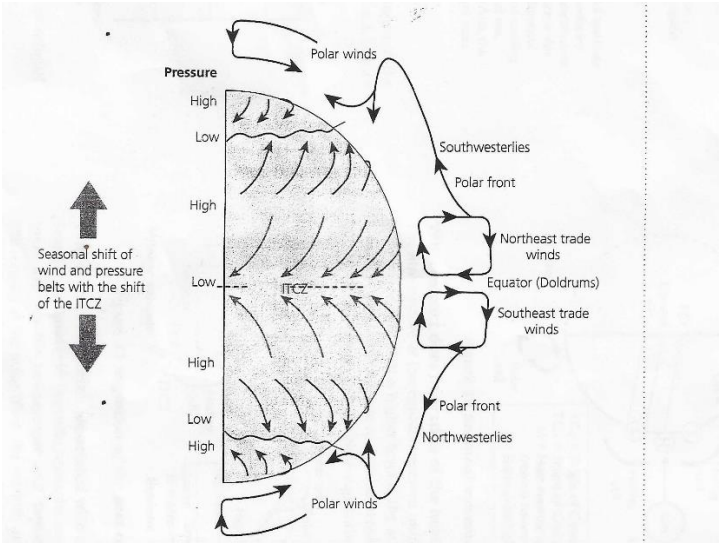
This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of the position of the ITCZ and how it leads to seasonal variations in tropical climate types: -

- The climate types found in tropical zones are equatorial, savanna (tropical wet dry), monsoon and hot desert.
- The Inter Tropical Convergence zone (ITCZ) or discontinuity, results from the rising air within the Hadley cell which leads to a surface lower pressure zone (doldrums). The Trade winds from the tropics are drawn towards this low-pressure zone which leads to convergence. The rising tropical air gives rise to convectional rain (Figure 1).
- The seasons result from the combined effects of the Earth's axial tilt and its orbit around the sun.
- The sun's overhead position shifts during the year from the equator (where it is overhead at the Equinox (March 21st) to the Tropic of Cancer summer solstice (21st June) and returns southward to the equator (Equinox 21st September) and to the Tropic of Capricorn (winter solstice – December 21st) – see Figure 2. This is known as the migration of the heat equator, i.e., a shift in maximum insolation.

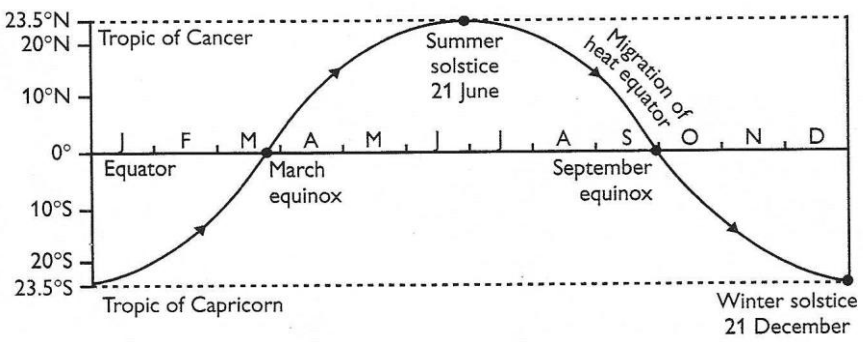
Figure 1: Global circulation - pressure belts and associated wind systems



© WJEC CBAC Ltd.

- The migration of the heat equator triggers changes in the global circulation and its accompanying pressure and air mass belts which in turn influences the distribution of rainfall – see Figure 2.
- These changes are most marked over land, especially in Asia where they play an important part in the monsoon climate's characteristics.

Figure 2: Migration of the heat equator



Credit supporting exemplification of located statistics for the various tropical climate types.

AO2

Application of knowledge and understanding is deployed to evaluate the importance of the seasonal variation of the ITCZ in influencing the characteristics of climate types within the tropics. In support of the argument, the seasonal variations play an extremely important role in explaining the variations in the main climate types.

- The migration of the heat equator has a major impact on global circulation, in that it leads to a shift in the pressure belts and air masses.

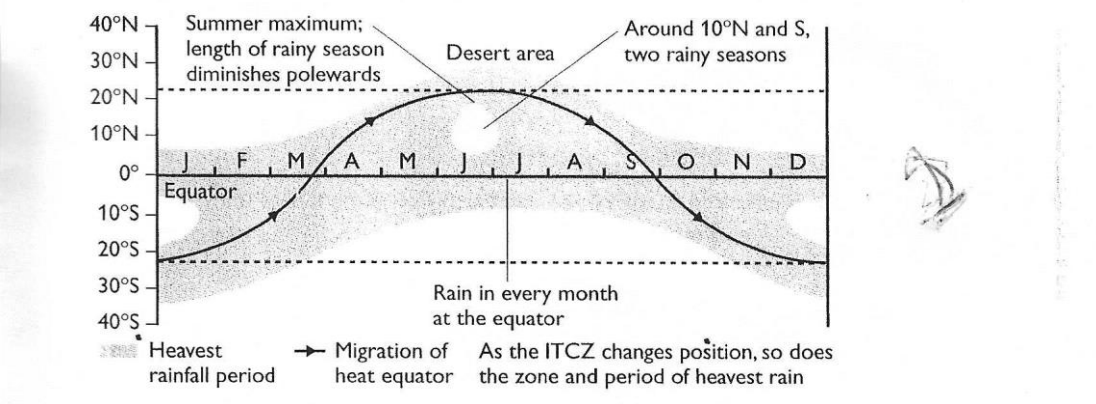
Within the Hadley cells.

- The atmosphere at the heat equator receives more concentrated heat, expands and rises. It then spreads out at a high level with the heavier air sinking back to the surface to form sub-tropical high pressures which are the source of air masses such as tropical maritime.
- Even though there are no temperature and density differences found in the converging air masses this leads to potential turbulence, and this triggers the strong convectional uplift leading to heavy rainfall.

© WJEC CBAC Ltd.

This migration explains the seasonal variations and characteristics of the climate type (see Figure 3).

Figure 3: The effect of the heat equator on the distribution of rainfall



- At the equator there is heavy rainfall and humidity all the year round with only limited variation in temperatures (equatorial climate)
- Just after the equinox in April and October the heaviest rainfall occurs, but with rainfall in every month.
- At around 10° N and S there are two main rainy seasons associated with the movement of the ITCZ and the migration of the heat equator. With increasing distance from the equator, the winter rainfall period diminishes completely.
- Moving poleward around 20° N and S the summer maximum length of the rainy season diminishes poleward and is limited to around 3 – 4 months (Tropical wet-dry climate – Savanna). This is associated with the solstices.
- At 30° N and S the savanna climate gradually changes to a desert climate, declining to very brief summer convectional showers with no rainy season, and increasingly high summer temperatures.
- Monsoon climate (typically on the eastern side of continental land masses) extending from 5 - 20° of latitude is marked by a distinct hot wet season and a cooling dry season, again determined by the annual movement of the ITCZ between the tropics, exacerbated by continentality and relief in the Indian sub-continent. The wet monsoon season occurs with the movement of the ITCZ into the region as it brings an area of low pressure and draws in hot, moist winds from the ocean SW monsoon, with increased orographic uplift over the Western Ghats. In the cooler, dry season, the continental high pressure is extended as the ITCZ moves back towards the equator towards the Tropic of Capricorn. With high pressure dominating, out blowing winds are dry as they come from the land.
- Inevitably, there are other influences of the tropical climate, including the influence in the upper air of the sub-tropical Jetstream at a macro scale which influences the paths of the low-pressure system.
- Short-term climate change e.g. climate warming and cyclical change (ENSO) may be mentioned as other influences.
- At a regional scale, continentality, altitude and influence of ocean temperature and currents can lead to significant variations.

A likely conclusion would be that the seasonal variations in the position of the ITCZ and the underlying influence of the migration of the heat equator are by far the most important factor in explaining the characteristics and variations in the tropical climates, especially marked over land areas.

Credit answers which evaluate the influence of the factors with located examples.

© WJEC CBAC Ltd.

AO3

Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments about the importance of variations in the ITCZ.
- The skill in constructing relevant diagrams (e.g. of migrating heat equator, global atmospheric circulation), or graphs (statistics of climate types) which are annotated to meet the requirements of the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion about the importance of the ITCZ variations in relation to other factors such as the link to upper air movements or oceanic circulation e.g. Indian dipole, as well as local factors.

© WJEC CBAC Ltd.

14. 'Air masses are the most important influence on the UK's weather.' To what extent do you agree?

AO1 [20] AO2.1c [20] AO3.3 [5] [45 marks]

Focus 3.5.3

This question requires candidates to demonstrate their ability to develop a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.

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.

AO1
Knowledge and understanding of the characteristics of different air masses influencing UK weather could include:

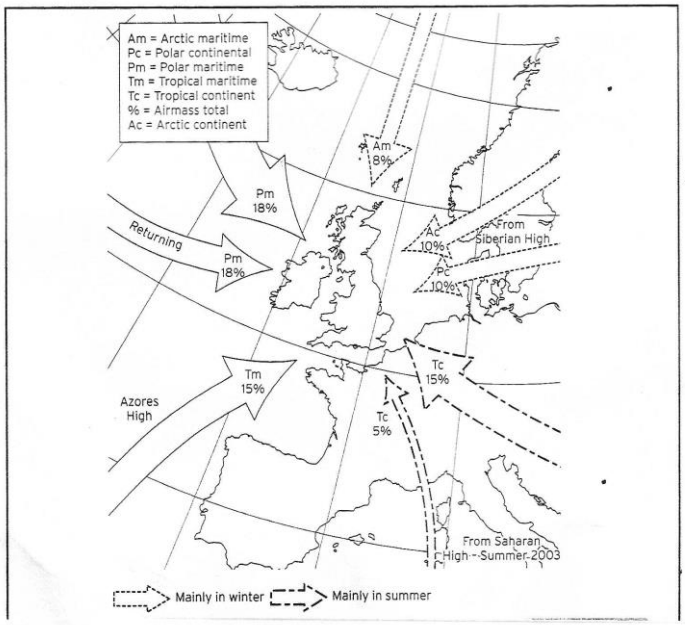
- An air mass is a large body of air that has similar temperature and moisture properties.
- Air masses originate at source regions e.g. extensive areas of water or land where air can be significantly stagnant long enough to take up the characteristics of the surface below.
- Air masses move over long distances from their sources and the tracks they take modify their characteristics.
- Tropical air masses will bring warm weather; their low layers are cooled as they travel north leading to stability.
- Polar and Arctic air masses will bring cold weather, but their lowest layers are warmed as they move southwards leading to instability.
- Continental air masses are those which travel over land, with only short distances of sea to cross, so will bring dry weather as they have not picked up much moisture on the way.
- Maritime air masses travel over the sea, so will pick up moisture leading to wet weather (causality).
- As Figure 1 shows, there are six major air masses that influence the UK's weather and climate at varying frequencies and at different times of the year.

Note:
1. Air masses should be the main focus of the answer.

© WJEC CBAC Ltd.

Figure 1: Summary of the main characteristics of air masses

Air mass	Origins and track	Characteristics over UK
Arctic maritime (Am)	Polar cell over the cold, frozen Arctic Ocean – tracks south across Arctic Ocean and North Sea	Very cold – some moisture picked up which may fall as snow over east and north-facing coasts and hills. Blizzards in Scotland. Mainly occurs in winter months.
Polar continental (Pc)	Polar cell over land especially Northern and Eastern Europe. Moves west across . North Sea	Cold dry air but some moisture picked up across North Sea giving rise to some snow in eastern districts. Mainly occurs in winter months
Polar maritime (Pm)	Originating over North America as Pc but picking up characteristics of the North Atlantic. Tracks south-eastwards to Western Europe.	Moisture picked up over North Atlantic, so therefore unstable. Cumulus clouds and heavy showers. Cool weather to north and west. Affects all seasons.
Returning Polar maritime	Pc air that has moved south into the Atlantic before approaching UK from west or south-west.	Variant of above where air has tracked to warmer south before tracking to UK from south west. Sea fog in summer. Can be similar to Tm below.
Tropical maritime (Tm)	From Azores High. Tracks north east.	Warm moist air is being cooled and therefore stable. Rainfall may be heavy and accentuated by relief (orographic) and summer convection. Mild in winter. Warm and humid in summer.
Tropical continental (Tc)	Originates over Sahara, North Africa. Tracks north and north west.	Brings hot, dry, stable heatwave conditions mainly in summer. Sometimes originates in Eastern Mediterranean and is more humid and prone to convectional storms. Heatwave often ended by violent storms – moisture from seas to south.



- The UK's location on the Polar front is important as this is the point polar and tropical air masses converge and weather systems form along the front, according to the pattern, position and amplitude of the jet stream.

© WJEC CBAC Ltd.

AO2
Application of knowledge and understanding is deployed to evaluate whether the air masses are the most important factor influencing the UK's weather.

- Reference to air mass type (see figure 1) is an important indication of expected weather, and many candidates will include details to support their importance, for example, of short-term changes.

There are, however, numerous other factors:

- At a macro scale, the marked temperature contrasts at the polar front between tropical and polar air at the surface and marked pressure gradients in the upper air, which leads to very strong westerly winds following a meandering path (Rossby waves) with varying patterns and positions seasonally within the Rossby waves and jet streams.
- The varying pattern of the jet stream is associated with the formation of depressions and anticyclones. Convergence of upper air causes a downflow to the ground creating high pressures. Divergence of upper air causes low pressure systems at ground level.
- The upper air movement can lead to blocking high pressures or a series of depressions formed of Pm and Tm air.
- At a more local scale, factors such as altitude, latitude and the proximity to the influence of the Atlantic Ocean are important.
- The weather of a particular area is influenced by a combination of factors including air masses (interdependence), for example of a Tm air mass from the Azores may bring rain to westerly windward coasts and hills, but to the lee of the high mountains (rain shadow effect), the clouds break up, leading to fine, sunny weather, especially in summer.
- At a local scale, built up areas modify or intensify weather characteristics.
- At a continental scale, climate change is having an increasing influence on the UK's weather, mainly associated with extremes of temperature and precipitation.

A possible conclusion would emphasise the importance of air masses but may argue that the underlying factors result from upper air movements of the jet stream, which in turn control weather systems of anticyclones and depressions. This may be considered more important as these are fundamental to influencing UK weather. Other smaller scale factors could usefully be discussed. Some students may use information from their NEA to reinforce their arguments at a local scale.

AO3
Skills evidenced in the question context include:

- The skill in presenting well-constructed, coherent, evidenced and logical arguments about the importance of air masses in relation to other factors at a variety of scales.
- The skill in constructing relevant diagrams and tables (e.g. see Figure 1 map and table) which are annotated to meet the requirements of the question.
- The skills in covering both the breadth and depth of the question.
- The skill in reaching an evidenced conclusion about the importance of air masses in relation to other factors such as importance of weather systems and the fact that they are controlled by upper air patterns and position of the jet stream.

© WJEC CBAC Ltd.