

## The Challenge of Climate Change – MARK SCHEME

### Question 1

Using Figure 3, which one of the following statements is true?

One mark for the correct answer:

**C.** The 15 hottest years were all recorded between 1995 and 2015

No credit if two or more statements are shaded

### Question 2

Explain how alternative energy production and planting trees may help to reduce the rate of climate change.

- **Level 2 (clear)(3-4)** responses will be clear explanation(s) or linked statements. Some accurate use of geographical terms.

#### Indicative content

- The command word is “explain” which requires an account of how and why mitigation strategies of alternative energy production and planting trees are helpful in reducing the rate of climate change.
- Knowledge and understanding of how these strategies work. Both attempt to deal with the source of the problem i.e. to prevent or reduce the release of greenhouse gases which cause climate change.
- Alternative energy production. Renewable energy sources such as HEP, solar, wind and tides do not emit large amounts of CO<sub>2</sub>. Some are renewable and last into the future. Nuclear is another source with little or no release of CO<sub>2</sub>.
- Planting trees. Trees act as carbon sinks, removing CO<sub>2</sub> from the atmosphere during photosynthesis. They also release moisture into the air, producing more cloud and reducing incoming solar radiation.

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### Question 3

Using Figure 5, which one of the following statements is true?

Shade one circle only.

D Areas north of 60°N will have the greatest increase in temperature.

No credit if two or more answers are circled.

### Question 4

To what extent is climate change the result of human actions?

Use Figure 4 and your own understanding.

- **Level 3 (7-9)(detailed)** responses will be developed. Appropriate use of Figure 4 (direct or inferred) and specific own understanding, with some evaluation.

#### Indicative content

- The command is “to what extent”, so the focus of the question is an evaluation of the degree to which human factors are responsible for climate change. eg Fully agree, disagree, partially agree. Many may feel that human factors are largely to blame for the rapid rise in temperatures (global warming) in recent times. Answers should consider their relative importance, supported by evidence.
- Knowledge of long term changes in climate since start of Quaternary period. Patterns of alternating cold periods (glacials) and warm periods (interglacials). Up to 10 glacial periods in past million years. Ice age continued until 12 000 years before present.
- Knowledge of the enhanced greenhouse effect and the role of greenhouse gases such as CO<sub>2</sub>, methane and nitrous oxides. Evidence of recent temperature change, with predictions of rises of up to 5o C by 2100.
- Knowledge of the evidence for climate change eg ice and sediment cores, tree rings, pollen analysis, temperature records, rising sea levels, loss of ice volumes.

- Understanding the contribution of increased use of fossil fuels, inferred in Figure 4. Fossil fuels account for over 50% of global greenhouse gas emissions. Burning these releases carbon dioxide into the atmosphere. Fossil fuels are used in transportation, building, heating homes, manufacturing industry, and generating electricity.
- Understanding of other human factors affecting climate change:
  - eg Changes in agriculture. Producing food uses fossil fuels in the production of fertiliser and pesticides, and in transporting. Changing forest cover to farmland also releases greenhouses gases. Increases in meat, dairy and rice production create more methane. Deforestation. Plants remove CO<sub>2</sub> from the atmosphere and convert it to organic matter using photosynthesis. When trees are cut down this is reduced. CO<sub>2</sub> is also released when trees are burnt.
  - Cement production. Cement is made from limestone, which contains carbon. When cement is manufactured, much CO<sub>2</sub> is released.
- Understanding of the effects of volcanic activity, inferred from Figure 4. Volcanoes can release large amounts of ash. This can reflect the Sun's rays causing the planet to cool. Over time however, eruptions can release large quantities of greenhouse gases eg. Carbon dioxide. These gases can trap the Sun's rays causing the planet to warm.
- Understanding of other natural factors affecting climate change, eg Effects of orbital changes. Changes from a circular to an oval orbit can affect the amount of sunlight the earth receives. It takes 100 000 years for the Earth's orbit to change from being more circular to an ellipse and back again. This eccentricity cycle coincides closely with the alternating cold (glacial) and warm (inter-glacial) periods in the Quaternary period. These changes are called Milankovitch Cycles. The Earth wobbles on its axis leading to changes in its tilt. When the Earth is more upright, it receives a greater amount of energy from the sun and experiences higher temperatures. Solar output. The output is measured by observing sunspots, which are not constant. They increase and decrease over an 11 year cycle, and possible longer cycles of several hundred years.
- Evaluation of the importance of human factors in climate change. Much evidence that since the start of the industrial era (about 1750) the overall effect of human activities on climate has been a warming influence. The human impact on climate during this period greatly exceeds that due to changes in natural processes, such as solar changes and volcanic eruptions. However in the longer term scientists have measured and proved that natural causes are fundamentally responsible for climate change.

## Question 5

**Give one natural cause of changes in global temperatures.**

One natural cause should be identified.

The specification includes:

(Changes to the ) earth's orbit/ (1)

(Changes in) volcanic activity (1)

(Variations in) solar output/ sunspot activity (1).

Accept other valid natural causes such as movement of tectonic plates, shifts in ocean currents/El Nino effects.

Reject human causes such as the enhanced greenhouse effect.

## Question 6

**Give two pieces of evidence, other than the change in global temperature, that show climate change has taken place.**

Eg

Shrinking ice sheets/glaciers/reduced Arctic or sea ice/less snowfall (1)

Sea level rise (1)

Extreme weather events/more droughts/ more tropical storms (1)

Ocean acidification (1)

Desertification (1)

Increased concentration of greenhouse gases/higher CO<sub>2</sub> concentration

Accept longer term evidence such as ice cores, tree rings, ocean sediments, rocks and fossils, pollen analysis.

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## Question 7

**Explain how the increasing use of fossil fuels and changes in agriculture may have contributed to global changes in temperature.**

- **Level 2 (3-4 Marks)** (clear) responses will be clear explanation(s) or linked statements. Some accurate use of geographical terms

### Indicative content

- The command word is “explain” which requires an account as to how and why the human factors of use of fossil fuels and changes in agriculture may contribute to climate change
- Knowledge and understanding of the greenhouse effect.
- Understanding the contribution of increased use of fossil fuels. Fossil fuels account for over 50% of global greenhouse gas emissions. Burning these releases carbon dioxide into the atmosphere. Fossil fuels are used in transportation, building, heating homes, manufacturing industry, and generating electricity.
- Understanding of the contribution of changes in agriculture. Producing food uses fossil fuels in the production of fertiliser and pesticides, and in transporting. Changing forest cover to farmland also releases greenhouse gases. Increases in meat, dairy and rice production create more methane.
- Expect both factors to be explained for top of Level 2, but a clear explanation of one factor gains access to low Level 2.

## Question 8

**State one source of evidence for long-term climate change during the Quaternary period.**

Ice cores (which show CO<sub>2</sub> and methane concentrations) (1).

Evidence from ocean sediments/rocks/ fossils/plankton (helps to show temperature changes) (1).

Pollen analysis.(1)

Credit other valid answers

No credit for evidence of recent short-term temperature change

### Question 9a

One mark for idea of steady increase followed by rapid rise in CO<sub>2</sub> levels/exponential rise.

Second mark for use of data shown on graph or for data manipulation, eg CO<sub>2</sub> concentration increased by almost 100 ppm in 150 years.

No credit for increase in CO<sub>2</sub> levels without qualification.

### Question 9b

Credit **one** reason only. Valid developed point awarded 2 marks.

One mark for appropriate reason, eg

- burning of fossil fuels (1)
- manufacturing of products like cement (1)
- deforestation (1).

Allow natural factors such as volcanic activity (1).

Second mark for developed reason, eg

- thermal power stations burn fossil fuels which release gases including carbon dioxide which build up in the atmosphere (2).

### Question 9c

One mark for each correct answer:

**C** Temperatures over most of the sea areas north of 60° N are expected to increase by 4 °C

**D** Temperatures over the whole of Africa are likely to rise by 3 °C or 4 °C.

No credit if three or more statements are shaded.