



GEO.PH2 Weather Hazards

AQA 8035 · Calculator allowed · about 65 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 This question is about the global atmospheric circulation.

(a) State what is meant by the global atmospheric circulation. (1)

(b) State whether air pressure at the Equator is typically high or low, and give one resulting weather effect. (2)

(Total for Question 1 is 3 marks)

2 This question is about the formation and structure of tropical storms.

(a) State THREE conditions needed for a tropical storm to form. (3)

(b) Describe the structure of a mature tropical storm, including the eye and the eyewall. (3)

(Total for Question 2 is 6 marks)

3 For each statement below about tropical storms, state whether it is TRUE or FALSE.

(a) Tropical storms lose strength (weaken) once they move over land. (1)

(b) Tropical storms form directly on the Equator, at 0 degrees latitude. (1)

(c) Storm surges (a rise in sea level pushed onshore by a storm) are a secondary hazard associated with tropical storms. (1)

(Total for Question 3 is 3 marks)

4 Explain how climate change may be affecting the distribution and intensity of tropical storms.

(Total for Question 4 is 4 marks)

5 This question is about extreme weather in the UK.

(a) Give THREE types of extreme weather that can affect the UK. (3)

(b) Explain why the UK can experience such a wide range of extreme weather types, despite its generally mild, temperate climate. (3)

(Total for Question 5 is 6 marks)

6 In early December 2015, Storm Desmond brought exceptionally heavy rainfall to north-west England, particularly Cumbria.

(a) State the name of the storm and the region of the UK most affected. (2)

(b) Describe TWO effects of Storm Desmond. (4)

(Total for Question 6 is 6 marks)

7 Explain TWO ways the UK responded to the flooding caused by Storm Desmond.

(Total for Question 7 is 4 marks)

8 In August 2005, Hurricane Katrina made landfall near New Orleans, USA, a high-income country (HIC).

(a) State the name, year and country of this tropical storm. (2)

(b) Describe TWO effects of Hurricane Katrina. (4)

(Total for Question 8 is 6 marks)

- 9** Suggest TWO reasons why the effects of Hurricane Katrina were so severe, even though the USA is a high-income country.

(Total for Question 9 is 4 marks)

- 10** Explain TWO ways that primary effects of a tropical storm differ from secondary effects, using an example of each.

(Total for Question 10 is 4 marks)

- 11** Table 1 shows the estimated hourly rainfall recorded at a UK weather station during a six-hour period of a storm.

Hour	1	2	3	4	5	6
Rainfall (mm)	8	14	22	26	19	11

- (a) Calculate the total rainfall recorded over the six hours. (2)

- (b) Calculate the mean (average) hourly rainfall over the six-hour period. (2)

(Total for Question 11 is 4 marks)

12 Describe how the UK monitors and prepares for extreme weather.

(Total for Question 12 is 4 marks)

13 Explain how improved building design can reduce the risk to people from strong winds during a tropical storm.

(Total for Question 13 is 3 marks)

14 Use the case studies of Storm Desmond (UK, 2015) and Hurricane Katrina (USA, 2005) that you have studied in this pack, and any others you know, to answer this question.
'Even high-income countries cannot fully prevent the impacts of extreme weather.' Assess the extent to which you agree with this statement.

(Total for Question 14 is 9 marks)

Mark scheme · GEO.PH2 Weather Hazards

Question 1

- (a) **B1** the worldwide system of air movement that transfers heat energy from the Equator towards the poles, oe
- (a) **Answer: The worldwide system of air movement that transfers heat energy from the Equator towards the poles.**
- (b) **B1** low pressure
- (b) **B1** warm air rises, cools and condenses, causing high rainfall/frequent thunderstorms, oe
- (b) **Answer: Low pressure; warm air rises, cools and condenses, causing high rainfall and frequent thunderstorms.**

Question 2

- (a) **B1** sea surface temperature of at least 26-27 degrees C, to a depth of around 50 m, oe
- (a) **B1** the location must be at least 5 degrees latitude from the Equator, so the Coriolis effect can make the storm spin, oe
- (a) **B1** low wind shear (little change in wind speed/direction with height), so the storm structure is not torn apart, oe
- (a) **Answer: Sea temperature of at least 26-27 degrees C to a depth of around 50 m; a location at least 5 degrees of latitude from the Equator, so the Coriolis effect makes the storm spin; and low wind shear, so the developing storm is not torn apart.**
- (b) **B1** the eye is a calm, roughly circular area at the centre, with light winds, little cloud and no rain, oe
- (b) **B1** the eyewall surrounds the eye and is a ring of very tall cumulonimbus cloud with the storm's strongest winds and heaviest rainfall, oe
- (b) **B1** spiral rainbands of cloud and heavy rain extend outward from the eyewall, oe
- (b) **Answer: The eye is a calm central area with light winds and little rain; it is surrounded by the eyewall, a ring of tall cumulonimbus cloud with the storm's strongest winds and heaviest rain; spiral rainbands of cloud and rain extend outward from the eyewall.**

Question 3

- (a) **B1** true
- (a) **Answer: True.**
- (b) **B1** false
- (b) **Answer: False.**
- (c) **B1** true
- (c) **Answer: True.**

Question 4

- **B1** rising global temperatures are warming the ocean surface, oe
- **B1** since tropical storms draw their energy from warm ocean water, warmer seas can provide more energy, which climate scientists link to the potential for more intense storms (though not necessarily more storms overall), oe
- **B1** warmer seas may also allow storms to form and remain intense over a wider area than in the past, oe
- **B1** the exact scale of these changes, and how much of any single storm's intensity is due to climate change rather than natural variation, remains an area of ongoing scientific research, oe
- **Answer: Warmer sea surface temperatures, linked to rising global temperatures, can supply more energy to tropical storms, which climate scientists associate with the potential for more intense storms over a wider area; however, the exact scale of this effect, and how much any single storm owes to climate change rather than natural variation, remains an area of ongoing research.**

Question 5

- (a) **B1** any valid type, e.g. heavy rainfall/flooding, oe
- (a) **B1** any second valid type, e.g. drought, oe
- (a) **B1** any third valid type, e.g. strong winds/storms, extreme cold/snow, or heatwaves, oe
- **(a) Answer: For example: heavy rainfall/flooding, drought, and strong winds/storms.**
- (b) **B1** the UK sits at the boundary of several different air masses (e.g. warm tropical maritime air, cold polar maritime/continental air), oe
- (b) **B1** which air mass is dominant can change over just a few days, bringing rapidly changing conditions, oe
- (b) **B1** the UK is also affected by the jet stream, whose position influences whether low-pressure systems (bringing wind and rain) or high-pressure systems (bringing settled weather) dominate, oe
- **(b) Answer: The UK sits at the boundary of several different air masses, and which one dominates can change within days, bringing rapidly changing conditions; the position of the jet stream also influences whether low-pressure systems (wind and rain) or high-pressure systems (settled weather) affect the UK at any given time.**

Question 6

- (a) **B1** Storm Desmond
- (a) **B1** Cumbria (north-west England), including towns such as Cockermouth, Carlisle and Appleby
- **(a) Answer: Storm Desmond; Cumbria, in north-west England, including towns such as Cockermouth, Carlisle and Appleby.**
- (b) **B1** effect 1 named, e.g. a UK 24-hour rainfall record was set, oe
- (b) **B1** detail on effect 1, e.g. Honister Pass in Cumbria recorded over 340 mm of rain in 24 hours, oe
- (b) **B1** effect 2 named, e.g. widespread flooding across Cumbria and Lancashire, oe
- (b) **B1** detail on effect 2, e.g. several thousand homes and businesses were flooded, and thousands of properties lost power, oe
- **(b) Answer: For example: a UK 24-hour rainfall record was set, with Honister Pass in Cumbria recording over 340 mm of rain in 24 hours; and widespread flooding across Cumbria and Lancashire left several thousand homes and businesses flooded, with thousands more losing power.**

Question 7

- **B1** response 1, e.g. the emergency services and Environment Agency issued flood warnings and helped evacuate and rescue residents from flooded homes, oe
- **B1** linked detail, e.g. reducing the risk to life during the immediate flooding, oe
- **B1** response 2, e.g. the army was deployed to help with flood defences and clean-up, and emergency funding was made available to affected households and businesses, oe
- **B1** linked detail, e.g. speeding up recovery and repair after the flood, oe
- **Answer: For example: emergency services and the Environment Agency issued flood warnings and helped evacuate and rescue residents, reducing the risk to life; and the army was deployed to help with flood defences and clean-up, while emergency funding was made available to affected households and businesses, speeding up recovery.**

Question 8

- (a) **B1** Hurricane Katrina, 2005
- (a) **B1** United States of America (Gulf Coast, near New Orleans, Louisiana)
- **(a) Answer: Hurricane Katrina, 2005, United States of America (Gulf Coast, near New Orleans, Louisiana).**
- (b) **B1** effect 1 named, e.g. an estimated 1,800 or more people were killed, oe
- (b) **B1** detail on effect 1, e.g. many deaths occurred in New Orleans after flood defences failed, oe
- (b) **B1** effect 2 named, e.g. the city's levees (flood defence walls) failed in several places, oe
- (b) **B1** detail on effect 2, e.g. flooding around 80% of New Orleans, in some places for weeks, and causing tens of billions of dollars of damage, oe
- **(b) Answer: For example: an estimated 1,800 or more people were killed, many in New Orleans after the city's levees (flood defence walls) failed in several places; the resulting flooding covered around 80% of the city, in places for weeks, and caused tens of billions of dollars of damage.**

Question 9

- **B1** reason 1, e.g. New Orleans lies mostly below sea level, protected by levees, so when the levees failed, water could not drain away and flooding was prolonged, oe
- **B1** linked detail, e.g. this made the flooding far more severe and long-lasting than in a city on higher ground, oe
- **B1** reason 2, e.g. the evacuation and emergency response were widely criticised as too slow, leaving many, particularly poorer residents without cars, unable to leave in time, oe
- **B1** linked detail, e.g. showing that even a high-income country's disaster impact depends on local planning, infrastructure and response, not wealth alone, oe
- **Answer: New Orleans lies mostly below sea level and relies on levees for protection, so when the levees failed the water could not drain away, prolonging the flooding; the evacuation and emergency response were also widely criticised as too slow, leaving many residents, particularly poorer people without cars, unable to leave in time, showing that impact depends on local planning and response, not wealth alone.**

Question 10

- **B1** a primary effect is caused directly by the storm itself, e.g. strong winds damaging or destroying buildings and trees, oe
- **B1** it happens at the time the storm strikes, oe
- **B1** a secondary effect is a knock-on consequence that happens afterwards, e.g. disease spreading due to contaminated flood water and damaged sanitation, oe
- **B1** it happens over the following days, weeks or months, oe
- **Answer: A primary effect is caused directly by the storm at the time it strikes, e.g. strong winds damaging buildings and trees; a secondary effect is a knock-on consequence that develops over the following days, weeks or months, e.g. disease spreading due to contaminated flood water and damaged sanitation.**

Question 11

- (a) **M1** $8 + 14 + 22 + 26 + 19 + 11$ seen, oe
- (a) **A1** 100 mm cao
- (a) **Answer: 100 mm.**
- (b) **M1** $100 / 6$ seen, oe
- (b) **A1** 16.7 mm (accept 16.6-16.7 mm) cao
- (b) **Answer: 16.7 mm per hour.**

Question 12

- **B1** the Met Office monitors weather using satellites, radar and weather stations, oe
- **B1** it issues a colour-coded weather warning system (yellow, amber, red) for the public and emergency services, oe
- **B1** the Environment Agency issues separate flood warnings and flood alerts for specific rivers and areas, oe
- **B1** local authorities and emergency services use these warnings to prepare resources, such as sandbags, evacuation plans and emergency shelters, in advance, oe
- **Answer: The Met Office monitors weather using satellites, radar and weather stations, and issues colour-coded warnings (yellow, amber, red); the Environment Agency issues separate flood warnings and alerts; local authorities and emergency services use these warnings to prepare resources such as sandbags, evacuation plans and shelters in advance.**

Question 13

- **B1** buildings can be designed with reinforced roofs and hurricane straps/shutters, which are less likely to be torn off or broken by strong winds, oe
- **B1** buildings can be raised on stilts/elevated foundations in flood-prone coastal areas, oe
- **B1** this reduces flood damage from a storm surge and reduces the chance of structural collapse, protecting the people inside, oe
- **Answer: Buildings can be designed with reinforced roofs, hurricane straps or shutters, which are less likely to be torn off by strong winds, and can be raised on stilts in flood-prone coastal areas, reducing storm-surge damage and the chance of structural collapse.**

Question 14

- **Level 4** (7-9): A detailed, well-balanced assessment that uses accurate, detailed reference to named examples (e.g. Storm Desmond and/or Hurricane Katrina); weighs the extent to which development level reduces impact against factors that remain outside a country's control, and reaches a clear, justified conclusion.
- **Level 3** (5-6): A clear assessment that uses accurate reference to at least one named example in some detail; a conclusion is reached, though the balance of the argument may be less developed.
- **Level 2** (3-4): Some relevant comparison is made, with limited or generalised use of named examples; a simple conclusion is given with little justification.
- **Level 1** (1-2): One or two isolated relevant points about extreme weather are made, with little or no use of named examples or comparison.
- **Level 0** (0): No relevant content.
- **Indicative content:**
 - Storm Desmond (UK, 2015, HIC): a UK 24-hour rainfall record was set at Honister Pass; despite the UK's wealth and flood-warning systems, several thousand homes and businesses were still flooded across Cumbria and Lancashire.
 - Hurricane Katrina (USA, 2005, HIC): an estimated 1,800 or more deaths and around 80% of New Orleans flooded after levee failures, despite the USA being a high-income country with significant hazard-management resources.
 - Supports the statement: both examples show that even well-resourced, high-income countries cannot fully prevent damage and disruption from an unusually extreme or rare weather event; physical factors (exceptional rainfall totals, a city built below sea level) can overwhelm existing defences.
 - Challenges the statement: development level still clearly reduces the SCALE of impact; the UK's death toll from Storm Desmond was far lower than Katrina's, and both events caused far fewer deaths than comparable disasters in lower-income countries, showing prevention/mitigation is far more effective in wealthier countries even if not perfect.
 - Katrina in particular showed that poor local decisions (delayed evacuation, under-maintained levees) worsened the impact beyond what wealth alone would predict, suggesting governance and planning matter as much as income.
 - A well-supported conclusion should distinguish between fully preventing impacts (which the evidence suggests is not realistic for extreme events even in HICs) and substantially reducing them (which development level and preparedness clearly achieve), reaching a balanced judgement on the statement.