

The Challenge of Weather Hazards – MARK SCHEME

Question 1a

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

One mark for correct answer:

C. High pressure occurs where the air is sinking.

No credit if two or more answers are circled.

Question 1b

Using Figure 3, describe the link between air pressure and surface winds.

Eg Winds blow from high pressure areas to low pressure areas (1).

Eg The trade winds blow from 30 degrees N and S towards the Equator (d) (1).

Winds converge in areas of low pressure (1) eg the Polar easterlies meet the westerlies at 60 degrees S (d) (1). Sinking air causes high pressure (1) which leads to winds moving away/diverging (d) (1).

Question 1c

Suggest why areas close to the Equator usually have high rainfall.

Use Figure 3 and your own understanding.

Air is heated by the sun / air rises rapidly along the Equator (1). The air cools and condensation occurs (d) (1). This leads to heavy showers and frequent (convective) thunderstorms. (d) (1)

Question 2

State what is meant by extreme weather.

One mark for an appropriate definition.

Weather that is unexpected (1), unusual (1), severe (1), unseasonal (1), significantly different from the normal pattern (1)/not normal to a particular area (1)

Weather (event) that can cause a threat to life(1)

Weather (event) that can cause damage (to property)(1)

No credit for rearranging the wording of the question or for quoting examples of extreme weather. No credit for “different weather”.

Question 3a

Using Figure 3, complete the following paragraph.

Most tropical storms happen between latitudes 5 degrees and 30 degrees north and south of the Equator. On average, three or more tropical storms per year take place in East Pacific and East Asia. In the Caribbean the main months for tropical storms are between August-October.

Question 3b

Give two reasons why tropical storms form in the areas shown in Figure 3.

Eg High sea temperatures/sea temperatures above 26/27 degrees C (1)

They form over the oceans, where water provides moisture/gives energy (1)

Water vapour is evaporated from the ocean surface, which provides “fuel” for the storm (1)

Because at the Equator there isn't enough spin from the earth's rotation (Coriolis effect). (1)

Heat makes air unstable/makes the air rise rapidly. (1)

Low wind shear (1)

2 separate reasons are required.

Question 4a

Which one of the following statements about tropical storms is true?

Shade one circle only.

D. Tropical storms form above oceans where temperatures are over 27°C

No credit if two or more answers are circled.

Question 4b

Using Figure 4, describe the track of Hurricane Irma between 6 September 2017 and 12 September 2017.

Credit use of direction, starting point, distances, dates and named locations.

Eg Hurricane had a change of direction (1) of W/WNW initially, then N/NNW (1)/

Its movement was in a W/WNW/ NW direction (1)

It passed to the north of Puerto Rico/Dominican Republic/Cuba (1)

It reached landfall over Florida and moved towards Georgia (1)

Max 1 mark for list of countries/places

No credit for changes in intensity.

Question 4c

Using Figure 4, what happened to the wind speed of Hurricane Irma between 8 and 12 September 2017?

The wind reduced (1)

It fell from a category 5 (1)

It dropped from over 252 km per hour.(1)

The wind speed halved in this time (1)

Wind speed remained very high then reduced (1)

Question 5

Give one reason why tropical storms have a seasonal pattern.

They occur (in late summer/autumn) when sea temperatures are highest (over 26/27°C)/ water temperatures of at least 26/27°C are needed down to a depth of at least 50 m/they require high sea temperatures (1).

Only occur when atmosphere is unstable (enough for convection and thunderstorms) (1).

Reference to higher temperatures on their own is insufficient-must mention sea or water temperatures

Question 6

Suggest why some tropical storms have severe primary and secondary effects.

Use Figure 3 and your own understanding.

- **Level 3 (5-6 Marks)** (detailed) responses will be developed. Some geographical terms will be applied. All aspects of the question are answered, including both primary and secondary, although the two aspects may not be balanced. Uses Figure with elaboration and own understanding. Fully explains the severity of some tropical storms

Indicative content

The command word is “suggest”, so responses should set out the likely impacts of tropical storms, making use of Figure 3.

- **Primary** effects are the direct result of a tropical storm, such as collapsed buildings. Secondary effects are the result of primary effects such as fires from broken gas lines. They also include long-term hazards like water-borne diseases.

- The initial primary effects of a storm involve destructive winds, torrential rain and storm surges.
- Primary effects may include:
 - people being killed or injured, often caused by flying debris or by drowning.
 - homes destroyed.
 - transport and communication links not working.
 - damage to infrastructure.
 - energy supplies cut off.
 - trees uprooted by strong winds.
 - storm surge raises sea level and floods over the low lying land.
- Secondary effects may include:
 - people being left homeless.
 - a lack of clean water and sanitation.
 - water-borne diseases.
 - unemployment caused by businesses being damaged.
 - if crops are destroyed and/or livestock is killed there can be a shortage of food.
 - looting and other crime.
 - local economy disrupted, including manufacturing and tourism.
 - reduced trade.
 - longer term health effects.
 - insurance claims.
 - destruction of crops.
 - disruption to coastal habitats.
 - mudslides, landslides.
- Accept some secondary effects as primary, for example homelessness and displacement of population, as there is some dispute over the precise definition

- Analysis of Figure 3. Allow any reasonable inference from the photograph, maps and text. Primary effects include strong winds, torrential rain, roofs and walls of buildings blown away, some buildings destroyed, some buildings underwater, damage to infrastructure, disruption to roads and other communications, large numbers killed or injured.
- Secondary effects include damage to local economy, longer term financial impacts, people stranded and made homeless/unemployed, pollution risk, danger of water borne diseases.
- Map shows widespread nature of destruction, partial flooding of several large settlements, and submergence of low-lying land near rivers
- Factfile indicates loss of human life, homelessness, economic effects and longer term disease risk. Economic data on Mozambique suggests that both primary and secondary effects may be worsened by low incomes and limited investment in monitoring, preparation and protection.
- Credit reference to example of tropical storm, although this is not essential to access Level 3, eg Typhoon Haiyan. Primary effects. Strong winds destroyed homes. Over 6,000 people died. Power was interrupted, the airport was badly damaged and roads were blocked by trees. Tacloban was destroyed. Secondary effects Damage to rice and seed stocks. Farmers and fishers lost their income. Huge recovery costs for agriculture and fishing. Looting problems. Increased food prices. Risk of infection and spread of disease.
- Assessment of why some tropical storms have severe effects – this may be linked to:
 - strength of storm-wind speeds, size of storm surge, amount of rain
 - extent of area flooded
 - population density in vulnerable areas.
 - wealth of country and money invested in forecasting, warning systems,
 - protection, planning and responses
 - physical geography of coastal zone
 - accessibility and communications
 - quality of infrastructure and building design
 - strength of coastal defences.The extent of both primary and secondary effects may depend on several of these factors.

Question 7

Give one reason why the wind speed of a tropical storm (hurricane) may change as it reaches land.

It loses its source of energy ie (warm) water/less moisture over land (1)

Slower movement due to winds in contact with land /rough terrain (1)

Question 8

Assess the extent to which tropical storms have effects on people and the environment.

Use Figure 5 and an example you have studied.

- **Level 3 (7-9 Marks)** (detailed) responses will be developed and include impacts affecting people and those affecting the environment (some may be interlinked). Impacts related to a named example and Figure 5, with some assessment.

Indicative content

- The command is “to what extent”, so the focus of the question is an evaluation of the degree to which a tropical storm has effects on people and on the environment eg devastating, considerable, slight, limited. Responses may also consider their relative importance.
- Credit only effects (not causes). Answers should refer to Figure 5 as well as a named example, although the two do not have to be balanced in coverage.
- Effects of storms may be categorised into people and the environment//primary and secondary effects /social and economic effects.

- Effects on people may include:
 - people being killed or injured, bereavement, shock.
 - homes being destroyed
 - transport and communication links not working
 - infrastructure destroyed, so rescue efforts more difficult
 - money needed urgently to rebuild
 - shops and businesses damaged or destroyed
 - looting and other crime
 - local economy disrupted, including manufacturing and tourism
 - reduced trade
 - longer term health effects, insurance claims
 - destruction of crops, loss of livestock(overlaps environmental effects)
 - water pipes burst and water supplies contaminated (overlaps with environmental effects). May lead to disease risk.
- Effects on the environment may include:
 - storm flooding large areas of the coast
 - damage to coastal and river defences
 - coastal habitats disrupted/disruption of ecosystems
 - removal of forest
 - changing the landscape near coastal areas heavy rainfall leading to mud/landslides
 - sewage leaks, water pollution
- Credit damage to built environment as well as natural environment
- Credit positive effects on the environment eg tropical storms can bring rain to dry areas and move heat from the tropics to poles.
- Knowledge and understanding of specific example of a tropical storm eg Typhoon Haiyan. Wind speeds of up to 300 kilometres per hour. Effects on people. Strong winds destroyed homes. Over 6,000 people died. 4 million were made homeless. Power was interrupted, the airport was badly damaged and roads were blocked by trees. Tacloban was destroyed. Damage to rice and seed stocks. Farmers and fishers lost their income. Huge recovery costs for agriculture and fishing. Looting problems. Increased food prices. Risk of infection and spread of disease.
- Effect on Haiyan on environment. Five-metre storm surge along coast, fish were killed and forests destroyed, ecosystems were damaged by leaking sewage. Poor sanitation led to water pollution. Loss of forests and widespread flooding.

- Evaluation of Figure 5. Allow any reasonable inference from the photograph. Shows effects on people: eg roofs and walls of buildings blown away, some buildings destroyed, disruption to roads and other communications, damage to local economy, containers damaged, vehicles smashed and flooded, buildings under water, people made homeless/unemployed, effects on environment include flooding, risk of landslides, vegetation destroyed, pollution risk.
- Newspaper clip shows loss of human life, disruption of local community and widespread nature of destruction
- Application of knowledge and understanding may include factors affecting effects on people and environment: eg intensity of the storm, speed of movement, distance from the sea, physical geography of coastal zone, the wealth of the country, population density, strength of coastal defences, degree of preparedness, local awareness, available technology, forecasting, storm warnings/monitoring systems, accessibility of location, quality of infrastructure and building design. The extent of impacts on people may depend on many of these factors.
- A purely generic answer without clear exemplification is limited to Level 2
- An answer that lacks consideration of extent of impacts is limited to Level 2

Spelling, punctuation and grammar (SPaG)

High performance

- Learners spell and punctuate with consistent accuracy
- Learners use rules of grammar with effective control of meaning overall
- Learners use a wide range of specialist terms as appropriate

Intermediate performance

- Learners spell and punctuate with considerable accuracy
- Learners use rules of grammar with general control of meaning overall
- Learners use a good range of specialist terms as appropriate

Threshold performance

- Learners spell and punctuate with reasonable accuracy
- Learners use rules of grammar with some control of meaning and any errors do not significantly hinder meaning overall
- Learners use a limited range of specialist terms as appropriate

No marks awarded

- The learner writes nothing
- The learner's response does not relate to the question
- The learner's achievement in SPaG does not reach the threshold performance level, for example errors in spelling, punctuation and grammar severely hinder meaning.

Question 9

Which one of the following statements does not describe an extreme weather event in the UK?

D. A wet winter in western Scotland

No credit if two or more answers are circled.

Question 10

Using Figure 1, which one of the following statements is true?

C. Cardiff has a red snow warning.

No credit if two or more answers are circled.

Question 11

Suggest how extreme weather in the UK can have economic and social impacts.

Use Figure 2 and your own understanding.

- Level 3 (detailed) (5-6 Marks) responses will be developed. Some geographical terms will be applied. All aspects of the question are answered - social and economic impacts, use of Figure and own understanding.

Indicative content

- The command word is “suggest” so responses should set out the likely impacts of extreme weather, making use of Figure 2.
- Extreme weather hazards may take place over one day or a period of time. In the UK these include storm events, flooding, severe thunderstorms and hailstorms, strong winds and tornadoes, droughts, extreme heat, extremes of cold weather including blizzards.
- Understanding of types of impact. Social - effects on people and communities. Economic - impacts on jobs, transport infrastructure, businesses and local and national economies.
- Social and economic impacts may overlap. Transport disruption can affect people’s daily lives but may have severe effect on transport of supplies and cause delays to employees.
- Credit understanding of social and economic impacts of specific weather events such as Cumbria floods (2009), St Jude storm (2013), Somerset Level floods (2014), drought/heatwave in 2003 and 2018, snow and ice in 2010 and March 2018. However reference to specific example is not needed for access to Level 3.
- Impacts depend on the nature of the event. Heatwaves may lead to pressures on water supplies (hosepipe bans, water shortages), risk to lives of frail and elderly people, danger of wildfires disrupting traffic and destroying farmland, increased food costs, buckling of railway lines and melting of roads. Credit positive social and economic effects including boost to tourism industry, sales of ice cream and cold drinks.
- Application of knowledge and understanding to Figure 2. Snow warnings indicate travel delays, road and rail closures (social and economic), power cuts (social and economic) potential risk to life and property (mainly social).
- The red warning in the photograph suggests major travel disruption which affects supplies of goods to shops and businesses (economic), possible closures of schools, increased chance of accidents and risk to life (social). Vehicles are stuck in traffic jams in both directions, including lorries carrying supplies.
- The caption suggests a cost of £1 billion per day. Credit broader implications of extreme cold including train, ferry and airline cancellations and delays (social and economic), damage to crops and losses of livestock in rural areas (economic), stoppages to certain industries such as construction (economic), loss of electricity supplies if power lines damaged (social and economic).

Question 12

'As maximum wind speeds increase, so do the number of deaths linked to tropical storms.'

Do you agree?

Use evidence from Figure 4 to support your answer.

Eg There is no (clear) relationship/there is not a direct link (1)

Some of the storms causing most deaths had lower max wind speeds / some storms causing more deaths had very high wind speeds (1) (Avoid double crediting).

Credit qualified use of data from the table e.g. the 3 storms causing the highest number of deaths all had lower wind speeds than the 4 with the least deaths (1)/The Bholra cyclone had the lowest max wind speed yet recorded the greatest number of deaths. (1)

Credit data manipulation

No credit for explanations of the data.

No credit for just disagreeing with the statement

Question 13

Suggest one way the distribution of tropical storms could change if global ocean temperatures continue to rise.

They may affect areas further from the Equator. (1)

They could affect parts of the sub tropics/the South Atlantic/NE USA. (1)

They could have a broader distribution/effect on larger parts of the world. (1)

Question 15

Give one reason why tropical storms have a seasonal pattern.

They occur (in late summer/autumn) when sea temperatures are highest (over 26/27°C)/ water temperatures of at least 26/27°C are needed down to a depth of at least 50 m/they require high sea temperatures (1).

Only occur when atmosphere is unstable (enough for convection and thunderstorms) (1).

Reference to higher temperatures on their own is insufficient-must mention sea or water temperatures

Question 16

Describe the structure of Cyclone Idai shown in Figure 2.

Credit 2 different ideas or one developed statement

The cyclone has an eye at the centre (1)

The centre/circular eye has no cloud (1)

There is a mass(swirl) of clouds surrounding the eye (1)

The vortex around the eye consists of dense cloud (1)

Clouds have a circular pattern (1)

Clouds appear to be arranged in a clockwise pattern (1)

Clouds become patchy towards the edge of the cyclone (1)

The main parts of the storm are the central eye (1) surrounded by a vortex/eye wall of clouds (d) 1

The centre or eye is cloudless (1) but dense clouds are arranged in a circular pattern around the eye (d) 1

No credit for size of storm using the scale

No credit for explanation of structure or for description of movement.