**Paper 1: Living with the physical environment**

**Section A: The challenge of natural hazards**

**Tectonic hazards**

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| **1a.** A **natural hazard** is a **natural event** that has a social impact. Natural hazards include: | | | | **1b. Hazard risk** is the chance or probability of being affected by a natural event. | | **2.** The **structure of the earth** comprises:  **Crust:**   * Thin, outermost layer up to 60km thick. * Solid; which is split into ‘slabs’ called plates which move due to convection currents. * 2 types of crust:   + Oceanic – thin, dense   + Continental – thick, less dense * 3 types of plate margin:   + Constructive   + Destructive   + Conservative   **Mantle:**   * Widest section – approximately 2900km. * Made of semi-molten rock called magma. * Convection currents are present. * Made of iron and magnesium. * Can reach temperatures of 3800°C   **Core:**   * Innermost part of the earth. * Very hot – up to 5500°C * Made of iron and nickel. * Sometimes split into inner core and outer core. * Inner core is solid, outer core is liquid. |
| **Atmospheric** | **Geological** | **Flooding** | | **3a.** Earthquakes and volcanoes are the result of tectonic activity at plate margins.   * **Earthquakes** occur * **Volcanoes** occur when * They may also occur at **hot spots** where the crust is thin. Hawaii is a good example. | |
| **1c.** More people are at risk of natural events because of:  - Urbanisation – Poverty – Farming – Climate change | | | |
| **3b.** Three main types of **plate margin:**  **Constructive:**  **Destructive:**    **Conservative:** | | | |
| **4a. Primary effect** of an earthquake – caused directly  **Secondary effects** occur as a result of the primary effect. Includes tsunamis, fires & landslides. | | | **4b.** There are two different responses to natural disasters such as earthquakes:  **Immediate responses** –  **Long term responses** – | | | **5.** People live in tectonically active areas due to the following reasons:   * Poverty – people lack choice * Awareness (lack of) * Benefits in volcanic areas (Iceland):   + Fertile soils   + Rocks for building   + Mineral deposits   + Hot water * Favourable areas   + Ports * Water – reaches surface; important in desert areas * Monitoring – reduces the threat * Building design – reduces the threat * Timescale (happen rarely)   Iceland is a good example to use:  - Geothermal energy – volcanic rocks for construction – tourism – hot water for heating homes & greenhouses for agriculture. |
| **6a.** The 4 main **management strategies** for reducing the risk from tectonic hazards. | | | **6b.** Earthquake proof building design includes: | | |
| Effects and responses to tectonic hazards vary between areas of contrasting levels of wealth | | | | | | |
| **Chile earthquake**, 27 Feb 2010, richer country.  **Richter scale** 8.8  Destructive plate margin – Nazca & South American Plate, off the coast of Central Chile in the Pacific.  **Cost of earthquake** US$30 billion. | | | | | **Nepal earthquake**, 25 April 2015, poorer country.  **Richter scale** 7.9  Destructive plate margin (collision) – Indo-Australian & Eurasian Plate, 80km north-west of capital Kathmandu.  **Cost of earthquake** US$5 billion. | |
| **Chile primary effects** | | | | | **Nepal primary effects** | |
| **Chile secondary effects** | | | | | **Nepal secondary effects** | |
| **Chile immediate responses** | | | | | **Nepal immediate response** | |
| **Chile long term responses** | | | | | **Nepal long term response** | |

**Weather Hazards**

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| **1a. Key terms:**  **Storm surge**: abnormal rise of the sea along a shore as the result of low pressure and high winds. The storm surge of Typhoon Haiyan (2013) was 5m at Tacloban.  **Coriolis Effect**: Causes the spin of a tropical storm due to the earth’s rotation.  **Mandatory evacuation**: Commanded by the authorities.  **El Nino**: a warming of the ocean surface of the western coast of South America.  **Natural cycle**: series of events in nature that are repeated.  **Latitude** is used to identify how far a location is north or south of the equator.  **Longitude** is used to identify how far a location is east or west of the Prime Meridian.  When quoting latitude and longitude, latitude always comes first (it’s alphabetical).  The UK is located about 55N. | | | | | | | | * **1b. Global atmospheric circulation** transfers heat from the Tropics to the Poles. Think of it as a conveyor belt. * In each hemisphere north and south of the equator there are three cells. From the equator to the Poles these are the **Hadley cell, Ferrel cell** and **Polar cell**. * In these cells air circulates through the entire depth of the **troposphere**. * The **troposphere** is the name given to the vertical extent of the atmosphere from the surface, right up to between 10 and 15 km high. It is the part of the atmosphere where most of the weather takes place. * The UK at about 55°N is between the Ferrel cell bringing warm wet winds from the south west and the Polar cell bringing cold polar winds from the north. | | | | | | |
| **1c. High pressure** areas are formed where the air is sinking – Poles, sub-tropics (desert areas).  **Low pressure** areas are formed where the air is rising – Equator (tropics), sub-polar low.  Winds on the ground are formed by air moving from areas of high pressure to low pressure.  Winds on the ground are distorted by the rotation of the earth. This is the **Coriolis Effect**. Winds appear to be deflected to the right in the northern hemisphere. | | | | | | |
| **2a.** Three ingredients needed for a tropical storm to form:  Tropical storms do not extend (with much intensity) inland into continental land masses as they need warm water to fuel them. | | | | | | | | **2b.** Sequence of tropical storm formation: | | | | | | |
| **3a. Primary effects** of a tropical storm are the impacts of the strong winds, heavy rain and storm surge. They include:   * Fatalities * Damage to buildings and infrastructure * Destruction of crops. | | | | **3b. Secondary effects** of a tropical storm are the longer term impacts that are a consequence of the primary effects. They include:   * Homelessness * Unemployment * Spread of disease * Looting * Insurance costs | | | | | | | | **3c.** Effects of a tropical storm can be further divided into:   * **Physical and environmental** – damage to buildings, loss of animal habitats. * **Social** – disease, looting, unemployment. * **Economic** – Businesses closed, loss of income, insurance claims. | | |
| **3d.** Tropical storms cause damage due to:   * High winds * Torrential rain which causes flooding * Storm surge which can cause the highest loss of life. | | | | | | **3e.** Hurricanes are measured using the Saffir-Simpson scale.   * Category 1 status is reached when wind speeds exceed 119km/h. * Category 5 (strongest) is reached when wind speeds exceed 252km/h | | | | | | | | |
| **4a. ‘Super’ Typhoon Haiyan, November 2013, Philippines**   * Saffir-Simpson category 5, wind speeds up to 275km/h * 15m high waves * 5m high storm surge | | | | | | | | | | | | | | |
| **4b. What happened – why the storm was so powerful**  Wind speeds peaked as it hit the Philippines coast, particularly in the province of Leyte & city of Tacloban.  Tacloban destroyed by a 5m high storm surge  Coincidence of favourable circumstances for a super typhoon. | | | | | | | | | **4c. Why the Philippines are vulnerable tropical storms and their effects.**  Over 7000 islands situated in some of the warmest waters on the planet.  High population density.  Newly emerging economy with millions of people living in poverty. | | | | | |
| **4d. Monitoring, prediction and preparation**  Did not predict level of storm surge.  Many Filipinos were not concerned as they are used to typhoons.  Preparations were not adequate. | | | | | | | | | | | | | | |
| **4e. Primary effects** | | | | | | | | **4f. Secondary effects** | | | | | | |
| **4g. Immediate response** | | | | | | | | **4h. Long term response** | | | | | | |
| **5a.** The effects of tropical storms can be reduced by: **+** Monitoring **+** Prediction **+** Protection **+** Planning | | | | | | | | | | | | | | |
| **5b. Monitor**  Monitoring tropical storms allows predictions to be made. Satellites, aircraft & drones are used. | **5c. Predict**  This is still an inexact science. Supercomputers will be used to produce forecast maps with a track cone predicting the path and intensity. The **cone of uncertainty** represents the probable track of the centre of a tropical storm. Historically the centre of a tropical storm stays inside the cone of uncertainty 66% of the time. | | | | | | **5d. Protection**  In the USA the Federal Emergency Management Agency (FEMA) advises homeowners to:   * Install hurricane straps (galvanised metal) between the roof and wall. * Install storm shutters on windows. * Install an emergency generator. * Tie down windborne objects such as garden furniture. * Reinforce garage doors. * Remove trees close to buildings. | | | | | | | **5e. Planning**  Involves raising individual and community awareness. In the USA the National Hurricane Preparedness Week educates people about the dangers of the next hurricane season.   * Prepare disaster supply kits. * Have fuel in vehicles. * Know where the official evacuation shelter is located. * Store loose objects. * Plan with family members what to do. |
| **5f. Change in the future**   * Opinion is divided as to whether the frequency, distribution, intensity and duration of tropical storms will change as a result of climate change. * **Distribution** * **Frequency** and **intensity**      * **Duration**. | | | | | | | | | | **6a. Weather** is the description of the day-to-day conditions of the atmosphere. This includes temperature, amount of cloud, the strength and direction of the wind and the amount of precipitation.  **Climate** is the average weather over a long period of time. Data collected over a 30-year period is used to describe the climate of a place. | | | | |
| **6b.**   * The UK is at a meeting point of different air masses which can each bring different weather conditions. * These air masses largely dictate the changeable nature of our weather. * Although the UK has a moderate climate it can still experience extreme weather events. | | **6c.** When extreme weather causes damage to societies this then become a weather hazard. The UK is subjected to: | | | | | | | | | | | **6d.** Four different types of flood associated with extreme weather in the UK. These include:   * Coastal flooding * River flash flooding * Slow-onset river flooding * Surface water flooding (pluvial). | |
| **7a. Somerset Levels floods 2014**  Somerset Levels are an extensive area of low-lying farmland drained by several river including the River Tone and River Parrett. Flooding has occurred here for centuries. | | | **7b. Causes of the 2014 Somerset Levels floods (human & physical)**   * Wettest January since records began in 1910 (physical * Series of depressions form the Atlantic brought the prolonged rainfall (physical) * 350mm of rain fell in January & February – 100mm above average (physical) * High tides and storm surges from the Bristol Channel prevented outflow of river water (physical) * Rivers had not been dredged for 20 years and were clogged with sediment (human). | | | | | | | | | | | |
| **7c.** Impacts of flooding can be categorised as social, economic or environmental | | | | | | | | | | | | | | |
| **7d. Social impacts** | | | | | **7e. Economic impacts** | | | | | | | | **7f. Environmental** | |
| **7g. Immediate responses** | | | | | | | | | | | **7h. Longer-term responses** | | | |

**Climate Change**

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| **1a.** The Earth was formed approximately 4600 million years ago (4.6 billion years).  Earth scientists describe the history of the earth using the geological time scale which has stratified divisions of time.  Geologically speaking we are currently in:   * Cenozoic era: 65 million years (age of mammals) * Quaternary period: 2.6 million years ago (age of ice ages). The Quaternary has not only been colder, it has also been a time of big climate variation compared with earlier geological periods. The Quaternary period is split into two epochs, the Pleistocene and the Holocene. * We are currently in the Holocene epoch which started approximately 12000 years ago. | **1b.** It is believed that there has been five major ice ages in the earth’s history. Technically speaking, we’re living during an ‘Ice Age’ today – in the sense that we have a world with glaciers and ice sheets. However, the present time is a relatively warm phase within a period of geological time when glaciers and ice sheets have typically been larger and more extensive than now.  Today the major ice sheets are the Antarctic Ice Sheet and the Greenland Ice Sheet. However, during the Last Glacial Maximum (LGM) ice sheets covered a far greater area than they do today.  **Glacial periods** – cold spikes  **Inter-glacial periods** – warmer periods within an ice age. We are currently in an inter-glacial period | | |
| **1c.** The **Holocene epoch** is the relatively warmer phase (interglacial) we are in now. The invention of farming and civilisation has happened during the Holocene. Before the Holocene epoch was the **Pleistocene epoch**. Our species (Homo sapiens) was evolved during the Pleistocene epoch. During the Pleistocene huge glaciers and ice sheets covered huge parts of planet earth. | | |
| **2a. Evidence for climate change**  **Observations**:  **Reliable instrument records**    To know what the climate was like before these instrument records we must use **Proxy recordings**:   * Historical recordings - Diary entries, observations, pictures, prices. * Geomorphology - the interpretation of features in the landscape. * Sedimentology - the characteristics of rocks, sands and soils. * Ecology - the study of fossil or sub-fossil organisms. Fossilised pollen is useful. * Dendrochronology - Each ring marks a complete cycle of seasons, or one year, in the tree's life. A wider ring in a favourable year and a narrower ring in an unfavourable year. * Ice cores - records go back 800000 years. | | | **2b.** Since 1880 the average global temperature has increased by 0.85°C. Most of this has occurred since the mid-1970s  **Global effects of climate change**:   * Glaciers & ice caps shrinking * Arctic sea ice is reducing * Sea levels may rise by 1m by 2100 flooding coastal areas * Low-lying islands under threat from sea level rise (Maldives).   The effects can be positive as well as negative. We can further subdivide them into social, economic and environmental effects. |
| **3.** The **greenhouse effect** is a naturally occurring phenomenon that keeps the Earth warm enough for life to exist. It is thought that without the greenhouse effect, the Earth would be approximately 33°C colder and therefore life would not exist as we know it today. Short-wave (high energy) solar radiation enters the Earth’s atmosphere. The heat is reflected from the Earth’s surface as long-wave radiation (low energy). The natural layer of greenhouse gases allows some heat to pass out of the Earth’s atmosphere, but some of the Earth’s infrared heat is trapped, which keeps the Earth warm enough. The **enhanced greenhouse** **effect**, sometimes referred to as climate change or global warming, is the impact on the climate from the additional heat retained due to the increased amounts of carbon dioxide and other greenhouse gases that humans have released into the Earth’s atmosphere since the industrial revolution. | | | |
| **4. Natural causes of climate change**:  Geological records stretching back millions of years indicate a number of large variations in Earth’s past climate. In particular the Quaternary period involved dramatic changes of climate which occurred before humans could have any environmental impact.   * **Orbital changes** * **Solar activity** * **Volcanic activity** | | **5. Human causes of climate change**:  Many scientists believe humans have caused climate change (global warming) by releasing additional greenhouse gases into the atmosphere. This has led to the **enhanced greenhouse effect**. Humans have added to the different greenhouse gases in the following ways:   * **Carbon dioxide** * **Nitrous oxides** * **Methane** | |
| **6a.** Managing the impacts of climate change can be done by two different methods – mitigation or adaptation. | | | |
| **6b. Mitigation** is the action of reducing the severity, seriousness, or painfulness of something. Climate change can be **mitigated** by:   1. Using **alternative energy sources** 2. **Carbon capture and storage technology**. 3. **Planting trees** 4. **International agreements** | | **6c. Adaptation** responds to the impacts of climate change and tries to make populations less vulnerable. Adaptation strategies are local rather than global. We can **adapt** to climate change by:   1. **Changing agricultural techniques** 2. **Managing water supply** 3. **Managing sea level rise** | |