

UNIT 3 HAZARDOUS ENVIRONMENTS

Recommended Prior Knowledge: As is the case for all the Advanced Geography options completion of the core modules is expected. This option builds on knowledge gained in the compulsory core units of *Atmosphere and weather* and *Rocks and Weathering*.

Context –This option is focused and dependent upon an understanding of the physical - human interface of the subject, i.e. the relationship and interaction between the physical events and the human response to those events.

Outline- Three major groups of hazards should be studied. In section 3.2 the activity and resultant landforms has been separated from the hazardous nature of the activity. Exemplar material is essential to an understanding of the ways in which the impacts of these hazards vary according to location and scale of the impact. Therefore the final unit which focuses upon a case study may already have been covered as the rest of the syllabus for this option is covered. The questions may focus on a specific hazard or require knowledge of a range of hazards.

3.1	<p>General introduction to Hazards</p>	<p>Definitions of the terms hazard and disaster</p> <p>Relationship between the physical event and human population. Where the two overlap-that is the hazard/disaster. Usefully shown by means of a Venn diagram See Fig. 1</p> <p>Classification of Hazards:Tectonic; Volcanic activity and earthquakes(3.1); atmospheric: tropical storms and tornadoes(3.2); geomorphological: landslides,mudflows and avalanches.(3.3).</p> <p>Factors which influence the impact of hazards such as: Economic-including level of development; social(ethnic groups,education) physical(magnitude and frequency) , political (aid, international relations), psychological(perception of risk)(These are just a selection)</p> <p>Location-start with a world map showing relationship between hazards and population distribution and densities. Annotate, highlight multi-hazardous zones. Discuss level of economic development and likely variations in impact and response. November 2003 Q6(a) is about tectonic hazards.</p>	<p>www.geography@btinternet.co.uk has excellent links to volcanoes</p>	<p>Introductory chapters in Skinner, Ross and Bishop</p> <p>Bishop p.5 (Venn diagram) Fig. 1</p> <p>Nagle p.329(classification table) Waugh p.31</p> <p>Bishop p.10-11</p> <p>Bishop p.17</p>
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3.1	Volcanic activity and landforms.	<p>risk and vulnerability. Risk-exposure of people to a hazardous event Vulnerability-‘ability of a person or group to anticipate, cope with and recover from the impact of a natural hazard’ (Blaikie et al 1994)</p> <p>It may be that these ideas are best conveyed in the course of case study material rather than as general principles-this will be a matter of individual choice and resources. However they form the guidelines which can be followed in each of the units of this option.</p> <p>Activity related to tectonic plates Definition/description: ie lithospheric plates</p> <p>Global distribution: Relate to plate boundaries-global distribution of tectonic plates. Definition of a tectonic plate; activity related specifically to plate margins. Add reminder about relationship to population distribution.</p> <p>November 2003 Q6 (a)</p> <p>Types of plate margin-convergent/destructive; divergent/constructive; conservative/passive.</p> <p>Causes of plate movement-convection currents relate to direction of movement-slab pull at the destructive margins and slab push at the mid-oceanic ridges. Relation between crustal creation(divergent margin) and destruction(convergent margin). Rates of movement. Clear well annotated diagrams are ideal here-ones that can be reproduced easily in response to exam questions.</p>		<p>Good diagram of model of plate tectonics Bishop p.37</p> <p>Maps Bishop p.37 types of plate boundary;p.38 earthquake location;p.60 active volcanoes;p.16 hazard zones Witherick p.12 clear map easy to photocopy; Waugh p.15</p> <p>Cook, Hordern et al 304 – 314 is excellent</p> <p>Guinness and Nagle p.94-95 Nagle p.9 Witherick p.12 Waugh p.16-21 Excellent block diagrams. Ideal for understanding via visual aids. Bishop p.36-39</p> <p>Ross p. 36-7 Causes-good diagram includes ‘hot spots’</p>
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	<p>Tectonic hazards</p>	<p>Activity associated with tectonic movements. Relationship between plate margin and type of activity Destructive margins- explosive activity pyroclastic flows/nuees ardentes, ash fallout, acid viscous lava flows, lahars, mudflows as result of stream damming and ash-laden precipitation. Resultant landforms: Dome volcanoes-high steep sided, narrow cones Constructive margins: less explosive activity-fluid, basic, basalt lava flows, fire fountaining, lava bombs eg Iceland. Mudflows as result of under-glacier melting Resultant landforms: shield cones-low gently sloping wide cones Conservative margins. Little vertical displacement largely horizontal movement, produces earthquakes. Link to next section on earthquakes. Emphasise hazardous nature of the activity: pyroclastic flows, lava flows and bombs, fire fountaining and lahars. Location especially 'Pacific Ring of Fire' Hot spots. e.g Pacific plate. These are 'plumes' of molten material from the mantle which are ejected on the surface far from a plate boundary. They tend to produce isolated activity and can occur on continents as well. Secondary Activity Lahars-mudflows. Link to 3.2. It is a type of mass movement. Best example Nevado Del Ruiz in Colombia 1985 Climate Change-addition of dust to the atmosphere results in temporary cooling e.g. Mt Pinatubo June 2002 Q6 (b) Nature and causes of tectonic hazards June 2003 Q6(b) Well annotated diagrams can be used to answer questions</p>	<p>Use key words for search engine. Eg <i>Montserrat Volcanic observatory</i> Geofactsheet 164 Volcanoes: Why are some more hazardous than others?</p>	<p>Cook, Hordern et al 322-335 is excellent Nagle p.14-15 Good on landforms and type of eruption Waugh p.24 Very good on lava. Bishop p.68 Bishop p.68-9 Bishop p.65-6 Good detail on lava flows, pyroclastic flows Ross 29-30 very good on ash fallout Ross p30-1 for products of activity Guinness and Nagle p.104 excellent series of diagrams of pyroclastic flows Excellent map of Ring of Fire Guinness and Nagle AS p.103. Guinness and Nagle AS p.103- excellent diagram of the Hawaiian hot spots. G and N AS p.106 Nevado del Ruiz includes map. Ross p.33-4 G and N p.395 excellent section on the effect of a pyroclastic flow on global temperatures Mt Pinatubo Ross p.37-9</p>
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	<p>Earthquakes – causes and hazardous nature of seismic activity</p>	<p>which require description.</p> <p>Prediction - monitoring indications of imminent activity such as: harmonic tremors, bulges in the cone, geochemical changes; gravitational changes; satellite monitoring. Reduction- control, hazard mapping, building structures.</p> <p>Human response to volcanic activity Case studies best exemplify this section. Highlight the physical causes and nature of the activity. The example should be closely tied to the relevant plate boundaries so that the causes and nature of the eruption is clearly known and understood. The links can be made to the impact on the population. Two case studies which contrast the type of activity and level of economic development of the country would be ideal. June 2002 Q6 (b)</p> <p>Earthquakes: Definition of terms: Focus, epicentre, seismic waves.</p> <p>Measurement of earthquakes: Richter(magnitude) and Mercalli(intensity)scales. Seismograph (instrument) seismogram (print out of magnitude of seismic waves)</p> <p>Causes- Link to conservative plate boundaries fault lines. Appreciate that the effects extend beyond the immediate plate boundary. Ground movement, landslides, Other physical factors may compound the impact: Geological conditions. Liquefaction.</p> <p>November 2002 Q5 (a) Nature and causes of earthquakes</p>	<p>www.earthquakes.bgs.ac.uk</p> <p>Use Key words of location of the</p>	<p>Bishop p.74-80-very comprehensive section Skinner p.29-30</p> <p>Ross p.39-41 Bishop p.71-80</p> <p>All the textbooks have case studies eg. Waugh Mt Pinatubo p. Bishop Mont Pelee p.67-8 and Pinatubo p.81-2; Ross Pinatubo p.34-5 and Montserrat 1995 p.42-5 Skinner p.27-8 Congo 2002</p> <p>Bishop p.42 Good diagram Nagle p.19 Skinner p.16-7</p> <p>Ross p.10-11 measurement Ross p.12 and G and N p.336 Mercalli scale Bishop p.44 Waugh p.9-10</p> <p>Ross p. 12-14 Bishop p. 44-46</p> <p>Bishop p.46 Nagle p.21 G and N p.336 Ross p.14</p>
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	<p>Tsunamis-causes and formation. Nature of hazardous activity associated with tsunamis</p> <p>Hazardous</p>	<p>Management of the hazard</p> <p>Prediction-seismic gap theory. Monitoring of earthquake zones-use of instruments Hazard mapping, community preparedness eg. Earthquake Awareness Day Japan; Hard engineering: earthquake proof building structures are an example of technological fix..</p> <p>Human Response to Earthquakes</p> <p>Two contrasting case studies. Earthquakes of similar magnitude one in an LEDC and one in an MEDC. Good examples: Iran 2003 and California 2003 Kobe 1995 is an excellent example of an earthquake which had a huge impact on a country seemingly prepared. Provides many issues for discussion and is well documented. Examples should relate to the particular plate boundary and contain factual detail. Issues of the causes, hazardous nature and impact of the event should be at the core of the study. Scale is a useful framework too:area affected; long and short term impacts.</p> <p>Awareness of secondary events eg. Mass movements: landslides and mudflows. Link with 3.2-geomorphic hazards. These activities can compound the hazard. November 2002 Q5(b)</p> <p>Tsunamis. Definition: tidal waves but not linked to tides. Formation and link to earthquakes A short case study eg Papua New Guinea 1998 is the best documented example.</p> <p>Slope Processes</p>	<p>earthquake to locate factual information on the internet. In the case of a recent event CNN and the BBC are useful sources of up-to-date information</p> <p>www.curriculumpress.co.uk Geo factfile Earthquakes-September 2002 Number 133</p> <p>Geo Factsheet 133 Earthquakes: Why do some places suffer more than others?</p>	<p>Ross p.20-24; Nagle p.20-1 Both texts have good diagrams on earthquake proof buildings Bishop p.47-51 Very good diagram of instrumentation p.49;Skinner p.23-4-good on Japan</p> <p>Ross p16-20 Kobe p.24-27 G and N AS p.100-102 Nagle p.22-3 Japan Loma Prieta California 1989 Bishop p.27-8; 45; 51; 52-4 Kobe p.55-8 Gujarat 2001 Skinner p.20-1</p> <p>Waugh p.52-3</p> <p>Skinner p.88-91 Nagle p.24-5 Ross 31-2</p>
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3.2	Environments resulting from Mass Movements	<p>Revision of theoretical work covered in AS Unit 3.3 Focus for this unit should be on hazardous nature of the activity- especially management. This section may be short because foundations have been laid in the AS course and case study material already covered.</p> <p>Causes; 1. Physical: Idea of downslope movement of material under the influence of gravity. Relationship between internal strength and external stress on weathered material on a slope. 2. Human mismanagement</p> <p>June 2002 Q5(a) asks about the causes of mass movement.</p> <p>Nature and speed of the movement: classification of processes: flows, slides and heaves. Speed of flows; mixed lithology-rotational slip.</p> <p>Landslides and mudflows June 2003 Q6 (a) Lahars link to previous section-volcanic activity</p> <p>Avalanches: will be new material. Nature of avalanches: Slab-dry and snow-wet Causes: conditions for avalanche formation. Precaution, prevention, control Avalanches as hazards: Human Responses</p> <p>Case Studies will illustrate these principal points: Vaiont Dam Italy; Aberfan S Wales 1966; Holbeck Hall Scarborough</p>	<p>www.geohazards.cr.uq.edu.au</p> <p>www.sgs.gov</p> <p>www.marauder.miller.sv</p> <p>www.csac.org</p> <p>www.curriculumpress.com</p>	<p>Waugh p.46-9 Waugh p.52-3 Natural causes Nagle p.48-52 Good on theory Bishop p.123-5 Ross p.46-48 Waugh p.54-5 Excellent section on human mismanagement</p> <p>G and N AS p.110 excellent diagrams of types of mass movement Skinner p.80-1 Holbeck Hall Bishop p.129-30 Ross p.50-52 Waugh p.52-53</p> <p>Bishop p129-132 Waugh p.124-7 Good case studies Nagle p.52;130-excellent classification and diagrams</p> <p>Alps 1999 in Bishop p.133-4; Waugh p.124-7 Italy 1998 in Nagle p.54 and Waugh p.49 UK landslides in Nagle p.55 Hong Kong 1992 in Ross p.48-50;</p>
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3.3	Hazard resulting from Atmospheric Disturbances	<p>This section may appear short. This is for two reasons. 1. The theoretical side of the section on processes may have been covered in the AS physical core <i>Rocks and Weathering</i> 3.3 and 3.4 (to some extent). 2. The case study material may also be linked closely to section 3.4 in this syllabus-i.e sustainable management of mass movement as hazardous activity.</p> <p>Tropical Storms: Definition Classification: Hurricanes, cyclones, typhoons and 'Willy willies' Location: Map to show global location. June 2002 Q6(a) June 2003 Q5 (a)</p> <p>Formation: Conditions for formation. Understanding of processes of instability, adiabatic changes of temperature, release of latent heat. Link to AS Unit Atmosphere and Weather. 2.1 and 2.2.</p> <p>Weather conditions: High winds, heavy rainfall and storm surges may result in flooding. Link to hazardous nature of the physical event.</p> <p>Cross section of a tropical storm-fully labelled and annotated. November 2002 Q6(a)</p> <p>Magnitude and frequency- these hazards have</p>	<p>co.uk Geo Factsheet Avalanches January 2003 Number 143 Geofile online – useful detail and case studies</p> <p>September 2002 Number 435- Avalanche Management</p> <p>www.nhc.noaa.gov</p> <p>www.regolith.com</p>	<p>Maps of location Skinner p.39;Bishop p.97; Nagle p.170; Ross p.56; G and N p.421 Cook, Hordern et al 519-526</p> <p>Ross p.57;Skinner p.38;Bishop p.95-7;Nagle p.170-1; Warburton p.156-163-very good on impact</p> <p>Skinner p.40;Bishop p.99-100;Ross p.57-8;</p> <p>Skinner p.40 Digby, p.18</p> <p>Skinner p.43;Ross p.59 Money p.39-43 Skinner p.44</p> <p>Cook, Hordern et al 314-321</p>
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		<p>considerable potential to damage life and property. Location may be an important factor- e.g barrier islands of the E. seaboard of the US.</p> <p>Prediction: Arguably most predictable of all these physical events. Forecasting technology, seasonal pattern of the storms. However notoriously difficult to guarantee track and speed of movement. Reminder about distinction between forecasting and prediction.</p> <p>Precaution: evacuation, Protection: coastal and river defences against flooding, drills, land use planning/zoning. Insurance, perception of the risk.</p> <p>Two contrasting case Studies one in an MEDC one in an LEDC. Hurricane Isabel Autumn 2003-eastern seaboard of the USA (Other well documented ones are Gilbert and Andrew) and Hurricane Mitch 1998 –Central America. The causes and secondary effects e.g. storm surges, high winds, flooding should be highlighted as these are specifically mentioned in the syllabus. The impact of the storm and the response to the event should be emphasised. Population densities, perception of the risk, contrasting levels of empowerment to control the environment can be highlighted in the contrasting choices.</p> <p>November 2003 Q5 (b)</p> <p>Tornadoes: Definition- a short-lived, violently rotating, narrow, funnel-like column of cloud that reaches the ground from a cumulo-nimbus cloud. They are associated with intense low pressure conditions.</p> <p>Formation; measurement of magnitude: Fujita Tornado scale</p> <p>Case Study to demonstrate hazardous nature.</p> <p>November 2003 Q5(a)-formation of tropical storms and tornadoes.</p>	<p>www.curriculumpress.co.uk Geo Factsheet Hurricanes: A Predictable Hazard? Number 162</p> <p>Geo Factsheet 62 Hazards: Hurricane Mitch</p> <p>www.chaseday.com/tornadoes.htm This site has good images</p> <p>www.spc.noaa.gov/faq/tornado Has frequently asked questions-accessible</p> <p>www.zetnet.co.uk/iogs/torro</p>	<p>Cyclones Bishop p.17-21;Ross p.60-1,62;G and N p.423; Waugh p.238; 'Orissa' Warburton p165-6 Hurricanes-'Mitch' Bishop p.103-4;Waugh p.238;Skinner p.41-2. Digby,(GC) p.16-17'Andrew'-Warburton p.163-5.</p> <p>Bishop p.105-6-very good detail maps diagrams; Fujita scale- Ross p.60-2, Warburton p.168; Warburton, p.166-7</p> <p>Cook, Hordern et al 528 – Fujita scale</p> <p>Ross p.61-2; Warburton Oklahoma 1999, p.167-8, 9</p> <p>Cook, Hordern et al 529-530 case study tornadoes in USA</p>
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3.4	Sustainable Management in Hazardous Environments	<p>Case Studies incorporated at each stage will fulfil the requirements for this section of work. Therefore a separate section may not be needed.</p> <p>General guidance on case Studies:</p> <ol style="list-style-type: none"> 1. Knowledge of the cause and nature of the event and its location is fundamental. In the case of tectonic hazards nature and location of plate boundary is essential. 2. The information should be focused under side headings. 3. Annotated maps and diagrams which are reproducible in examination conditions are ideal 4. Factors that influence the impact of the hazard-physical, economic, social, political Discussion and awareness of causes and factors that influence magnitude and response are important. E.g. Nature of the underlying material in an earthquake can magnify the event. Political tensions may potentially influence availability of aid. e.g. Iran 2003. 5. Time scale i.e. short and long term view of factors and impacts should be considered. <p>Link made between the physical event and the human response.</p> <ol style="list-style-type: none"> 1. Case Studies which contrast an MEDC with an LEDC provides useful material for discussion of human response to the physical event <p>Evaluation of the impact in terms of magnitude and timing of the physical event, preparedness, precautionary measures, prevention, control measures need consideration. I.e. Hard engineering schemes. More sustainable precautionary measures, impact on the landscape/environment</p> <p>Reality of accurate prediction in the future. Importance of technological fix.</p> <p>Management of the hazard after the event and preparation</p>	<p>www.solar.ifa.hawaii.edu/tropical/tropical.html</p> <p>www.wmo.ch</p>	<p>See attached case study- Bam Earthquake Iran December 2003</p> <p>Ross p42-5 Good case study and questions on Montserrat. Ross p.34-5</p>
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		<p>for the next hazardous event. E.g. Montserrat 1995 Impact of Mt Pinatubo on global climate</p> <p>Multiple Hazard Zones could provide a useful vehicle for this section. e.g. California; Iceland; New Zealand. Local examples are always preferable if applicable.</p> <p>.</p> <p>Candidates are expected to cover a range of hazards and be able to appreciate the human responses and management strategies as well as the impact of the physical event itself. Eg timing, location and scale of the event. Kobe 1995 would be a useful example. They should also appreciate that the effects may not be obvious at the time, but have a long-term influence on peoples' lives – psychological trauma, loss of family members, possessions, livelihood, economic effects.</p> <p>June 2002 Q5 (b) June 2003 Q5(b); November 2003 Q6(b); November 2003 Q5(b). These questions focus on the prediction and management of hazards/hazardous environments. Case studies of contrasting environments and levels of economic development serve to illustrate the answer very well.</p>	<p>www.curriculumpress.co.uk Geo Factsheet West Sussex: A Multiple Hazard Zone? September 2002 Number 137</p>	<p>G and N p.395</p> <p>Skinner has a chapter on multi-hazard urban environments-Los Angeles and Mexico City-some useful information</p>
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Fig. 1 Venn Diagrams to illustrate a hazard

