1.6 Reducing Tectonic Hazard Risk: Monitoring, Prediction, Protection, Planning: 30-minute Pack

AQA 8035 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Explain why the effectiveness of hazard-reduction strategies such as monitoring, prediction, protection and planning varies between countries with different levels of development.

(Total for Question 1 is 6 marks)

2 Give two features of an effective tsunami early warning system that help to reduce the risk to coastal communities.

(Total for Question 2 is 2 marks)

3 Evaluate the effectiveness of planning strategies, such as building regulations, land-use zoning and insurance, compared with monitoring, prediction and protective building design, in reducing the risk from tectonic hazards.

(Total for Question 3 is 6 marks)

© Revision Library | revisionlibrary.co.uk

4 Describe how a tiltmeter helps scientists monitor a volcano and how this reduces hazard risk.

(Total for Question 4 is 3 marks)

---

5 Describe how a seismometer helps in earthquake monitoring and how that monitoring reduces the effects of an earthquake for people in affected areas.

(Total for Question 5 is 3 marks)

---

6 Give TWO reasons why a low-income country may have less access to monitoring, prediction and protection strategies for tectonic hazards than a higher-income country.

(Total for Question 6 is 4 marks)

---

7 Explain how automated gas-emission sensors (measuring gases such as sulphur dioxide) can be used to predict volcanic eruptions. Give TWO linked points.

(Total for Question 7 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 1.6 Reducing Tectonic Hazard Risk: Monitoring, Prediction, Protection, Planning: 30-minute Pack

Question 1

Level 3 A clear, well-developed explanation that links differences in resources, technology, governance and public awareness to variation in the effectiveness of monitoring, prediction, protection and planning, with supporting examples or reasoning and a clear overall judgement. **5-6**

Level 2 A reasonable explanation that describes several relevant factors, such as money, expertise or enforcement, and makes some links to how they affect effectiveness, with limited supporting detail. **3-4**

Level 1 One or two simple points about why strategies vary in effectiveness, stated without development or clear links to outcomes. **1-2**

Indicative content:

- Availability of finance, since monitoring networks, protective technologies and resilient infrastructure require investment; wealthier countries can usually afford denser monitoring networks and better-protected buildings.
- Technical expertise and trained personnel, because instruments need skilled staff to operate, maintain and interpret data, and building designs require engineers and inspectors to implement and enforce standards.
- Institutional capacity and governance, as effective planning and enforcement of building codes, land-use zoning and evacuation plans depend on functioning institutions and low corruption.
- Public awareness and education, since regular drills, community knowledge of evacuation routes and willingness to evacuate depend on public engagement and trust in authorities.
- Access to technology and supply chains, because some protective measures need specialised materials and manufacturing (e.g. base isolators) which may be unavailable or unaffordable in poorer countries.
- Trade-offs and priorities, where low-income countries may prioritise immediate needs such as healthcare and food over long-term hazard investment, reducing application of some strategies.
- A balanced conclusion might judge that development level is a major factor but that political will, international aid, local knowledge and low-cost measures can still improve effectiveness in less wealthy countries.

Question 2

any one valid feature, e.g. seismic monitoring stations that detect undersea earthquakes; ocean buoys or seabed pressure sensors that detect the wave; tide gauges; a warning centre that analyses the data and issues warnings; sirens, radio, TV or mobile alerts; signed evacuation routes to higher ground; public education and evacuation drills, oe **B1**

a second, different valid feature from the same list, oe **B1**

Answer: Any two valid features, e.g. a network of seismic stations and ocean buoys that detects undersea earthquakes and tsunami waves, and a communication system such as sirens, radio or mobile alerts that warns coastal communities in time to evacuate to higher ground.

Question 3

Level 3 A detailed, balanced evaluation that weighs planning strategies against monitoring, prediction and protective design, considers cost, coverage and the level of development of the affected country, and reaches a clear, supported judgement. **5-6**

Level 2 A reasonable evaluation that describes several relevant strategies from both categories and makes some comparison between them, with limited supporting detail or a partly developed judgement. **3-4**

Level 1 One or two simple points about planning, monitoring or protection are made, with little comparison or development, and any judgement is unsupported. **1-2**

Indicative content:

- Planning strategies such as building regulations and land-use zoning can be relatively low cost once established and apply to a whole country or region, but they rely on strong government institutions to enforce them, which some countries lack.
- Insurance and international aid provide funding for recovery after a disaster but do not, on their own, prevent damage or loss of life happening in the first place.
- Monitoring and prediction give early warning that can save lives through evacuation, but they cannot stop a hazard occurring and some events (especially earthquakes) remain very difficult to predict precisely.
- Protective building design, such as base isolators or reinforced frames, is highly effective at reducing damage but is expensive, so it is applied less widely in lower-income countries.
- In practice the strategies work best together: monitoring and prediction buy time for evacuation under a planning framework, while protective design and enforced building codes reduce damage to buildings that remain occupied.
- A country's level of development strongly affects which strategies are realistic: wealthier countries can combine all four, while lower-income countries may have to prioritise the cheapest, most widely applicable measures such as basic land-use zoning and community education.
- A balanced conclusion might judge that no single strategy is most effective on its own, and that planning strategies are essential because they make the other, more technical strategies possible to apply and enforce.

Question 4

it measures small changes in the slope or tilt of the ground around a volcano, oe **B1**

ground tilt often indicates magma moving underground and the volcano inflating, oe **B1**

detecting inflation early gives time for warnings/evacuations, reducing risk to people, oe **B1**

Answer: A tiltmeter measures small changes in the slope or tilt of the ground around a volcano; ground tilt often indicates magma movement and inflation beneath the surface, so detecting this early allows authorities to issue warnings and organise evacuations, reducing risk to people.

© Revision Library | revisionlibrary.co.uk

Question 5

it detects and records ground vibrations and seismic waves, giving data on when and where small quakes occur, oe **B1**

networked seismometers can show increasing seismic activity or foreshocks, indicating a higher chance of a larger quake, oe **B1**

this monitoring gives early warning of increased risk so authorities can raise alert levels, shut down transport or gas systems and implement emergency plans, reducing harm, oe **B1**

Answer: A seismometer detects and records ground vibrations and seismic waves, providing data on when and where small quakes occur; networks of seismometers can reveal increasing activity or foreshocks, indicating higher risk, and this allows authorities to raise alerts, shut down vulnerable services and activate emergency plans, reducing harm to people.

Question 6

reason 1, e.g. limited financial resources to buy and maintain instruments, high-tech equipment and trained staff, oe **B1**

linked detail for reason 1, e.g. without funding and maintenance, monitoring networks may be sparse or unreliable, reducing prediction ability, oe **B1**

reason 2, e.g. weaker institutional capacity and technical expertise to plan and enforce protective building codes, oe **B1**

linked detail for reason 2, e.g. even if designs exist, lack of enforcement and affordable construction means many buildings remain vulnerable, oe **B1**

Answer: Limited financial resources to buy, maintain and staff monitoring equipment, which can leave networks sparse or unreliable; and weaker institutional capacity and technical expertise to plan, enforce and fund protective building codes, so many buildings remain vulnerable.

Question 7

gas sensors measure increases or changes in volcanic gases such as SO2, CO2, oe **B1**

a rise in gas emissions can indicate magma is nearing the surface or rock is fracturing, oe **B1**

this information can be combined with other monitoring data to forecast an eruption, oe **B1**

a forecast allows officials to prepare or evacuate people, reducing casualties and disruption, oe **B1**

Answer: Gas-emission sensors record increases or changes in gases such as SO2 and CO2; a rise in emissions can indicate magma is rising or rock is fracturing, and combined with other monitoring data this helps scientists forecast an eruption so officials can prepare or evacuate people, reducing casualties.

© Revision Library | revisionlibrary.co.uk