S2 Geography Practice Paper (Set 3): water cycle, coastal landforms, land-use conflict, slope hazards, energy mix and map skills

S2 Geography | Time: 60 minutes | Total: 100 marks | 22 questions

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Section A: The Water Cycle and River Processes (16 marks)

Study the data and answer the questions.

1. (a) Using the data, calculate the total annual precipitation over the catchment and the volume that becomes runoff, in cubic metres. (4 marks)

Area 2.5 km2 = 2,500,000 m2; total precipitation = 2,500,000 x 2.4 = 6,000,000 m3; runoff = 6,000,000 x 60% = 3,600,000 m3 (evaporation and transpiration take 40%, so 60% becomes runoff and infiltration).

2. (b) Name the two processes by which sea water becomes rain, and state two roles of plants in the water cycle. (4 marks)

The two processes are evaporation (sea water is heated by the sun and becomes water vapour) and condensation (the vapour rises, cools and condenses into cloud before falling as rain). Plants: transpiration returns soil moisture to the atmosphere; roots and leaf litter increase infiltration, reduce surface runoff and intercept some rain.

3. (c) After the same catchment is urbanised, the flood peak arrives earlier and is higher. Explain why. (4 marks)

Impervious concrete and asphalt surfaces cut infiltration and greatly increase surface runoff; natural channels are straightened and lined with concrete, so water travels faster and reaches the lower course sooner; vegetation is cleared, reducing interception and transpiration; drains deliver rainwater quickly to the stream. Together these make the flood peak earlier and higher.

4. (d) Describe how erosion, transportation and deposition differ between the upper and lower courses of a river. (4 marks)

Upper course: steep, fast flow; vertical erosion dominates, producing V-shaped valleys and waterfalls; larger boulders and gravel are moved by traction along the bed; little deposition. Lower course: gentle slope and slow flow; lateral erosion dominates and the valley is wide and shallow; fine sediment travels in suspension and in solution; deposition is strong, forming floodplains, meanders and deltas.

Section B: Coastal Landforms (16 marks)

Study the data and answer the questions.

5. (a) Using the data, name two coastal erosional landforms and outline how one of them is formed. (4 marks)

Two erosional landforms: sea cliff and wave-cut platform (sea cave is also accepted). Sea cliff: waves attack the base of the rock and hollow out a notch; the notch enlarges until the rock above loses support and collapses, so the cliff face retreats inland and a steep cliff with fallen debris at its foot is left.

6. (b) The sand bar at Kiu Tsui Chau is exposed only at low tide. Explain two conditions needed for such a landform to form. (4 marks)

There must be a good supply of sand and gravel (from coastal erosion or river transport); the water between the two land masses is shallow and wave energy is low there, so sediment is deposited as a bar. A tombolo also needs land at both ends to shelter the line of deposition. At low tide the water level falls and the bar emerges.

7. (c) During a typhoon the beach at Tai Long Wan becomes noticeably narrower. Explain why. (4 marks)

A typhoon brings strong winds, a long fetch and much greater wave energy; large waves wash sand off the beach face and carry it offshore to form a bar, so the beach is lowered and narrowed. After the storm, gentler normal waves gradually return some of the sand, and the beach recovers.

8. (d) With reference to the data, compare beaches and wave-cut platforms in terms of location and the processes that form them. (4 marks)

Location: beaches form in sheltered bays with lower wave energy, while wave-cut platforms form on exposed coasts directly attacked by waves, as at Tung Ping Chau. Processes: a beach is built by deposition of sand and gravel at the shore; a wave-cut platform is cut by long-continued erosion that trims the rock flat and is exposed at low tide.

Section C: Urbanisation and Land-use Conflict (16 marks)

Study the data and answer the questions.

9. (a) Calculate brownfield sites as a percentage of the total area, to one decimal place. (4 marks)

Total area = 120 + 80 + 60 + 40 + 20 = 320 hectares; brownfield percentage = 120 / 320 x 100% = 37.5%. Brownfield sites are the largest single land use in the area.

10. (b) Give two examples of land-use conflict in this area and explain why they arise. (4 marks)

Examples: container yards and open storage next to housing bring lorry noise, dust and night lighting; industry next to farmland pollutes crops with waste water and emissions. Causes: incompatible uses are mixed in a small area without proper zoning, and each activity has different environmental needs while seeking low costs, so the quality of life of nearby residents suffers.

11. (c) State two impacts of urban sprawl on the natural environment of this area. (4 marks)

Farmland and vegetation are replaced by paved surfaces and yards, so infiltration falls, runoff rises and flood risk increases; habitats are fragmented and wildlife habitat shrinks, lowering biodiversity; air and noise pollution also increase.

12. (d) Suggest two planning measures to reduce land-use conflict in this area. (4 marks)

Zoning: concentrate polluting uses in an industrial estate and separate them from housing with buffer zones such as green belts or roads. Brownfield-first development: group scattered container yards and open storage into multi-storey buildings, releasing land for housing, community facilities and open space, and use transit-oriented development to focus population near rail stations.

Section D: Slope Hazards and Their Control (16 marks)

Study the data and answer the questions.

13. (a) State three conditions that lead to a landslide. (4 marks)

A steep slope, where gravity acts strongly; loose or weathered material such as weathered granite with low strength; and abundant water, as heavy rain raises the water content and pore pressure and reduces friction. Loss of vegetation also removes root support.

14. (b) Using the data, explain how rainfall and slope angle affect the landslide risk in this case. (4 marks)

Rainfall of 500 mm in three days is torrential: infiltration saturates the weathered layer, adding weight and raising pore pressure so shear strength falls. On a 30-degree slope the downslope force is much greater than on flat ground, so once support is lost the soil slips. Cleared vegetation reduces interception and root binding, raising the risk further.

15. (c) Suggest three engineering measures to prevent another landslide on this slope. (4 marks)

Build retaining walls or gabion structures to support the toe; install soil nails, rock anchors or a reinforced surface to raise stability; cut surface drains, catchwater channels and weep holes to remove surface and groundwater and lower pore pressure; regrade and cover the slope with vegetation or shotcrete to reduce direct rain erosion.

16. (d) Apart from engineering works, state two non-engineering measures the government can take to reduce casualties. (4 marks)

Land-use planning and control: restrict building on high-risk landslide areas and require geotechnical assessment and slope strengthening before new development. Warning and evacuation: broadcast rainstorm and landslide warnings, carry out regular slope inspections and evacuation drills, and educate villagers about the risk and escape routes.

Section E: The Energy Mix and the Environment (16 marks)

Study the data and answer the questions.

17. (a) Using the data, calculate the percentage of the fuel mix that comes from fossil fuels and name the two fossil fuels listed. (4 marks)

Fossil fuels = coal 25% + natural gas 50% = 75%; the other 25% is nuclear 20% and renewables 5%. The two fossil fuels are coal and natural gas.

18. (b) Compare the effects of coal-fired and gas-fired generation on air quality. (4 marks)

Coal-fired plants emit more sulphur dioxide, nitrogen oxides, particulates and carbon dioxide and produce large amounts of ash, so their impact on air quality and the greenhouse effect is greater. Gas-fired plants release almost no sulphur dioxide or particulates and less carbon dioxide per unit of electricity, but they are still fossil fuel and emit nitrogen oxides and greenhouse gases.

19. (c) Wind and solar supply only 5% of the mix. State two reasons why these renewables are limited in large-scale generation in Hong Kong. (4 marks)

They are intermittent: wind and sunshine vary with weather and time of day, so they cannot supply steady power without backup plants or storage. Land and space are scarce: Hong Kong is small and hilly, large wind farms and solar farms need much land, and rooftop or offshore sites are limited by landscape, shipping lanes and ecology.

20. (d) Suggest two measures to reduce the environmental impact of electricity generation and outline how each works. (4 marks)

Improve energy efficiency and demand management: use efficient appliances, energy labels and smart meters to cut consumption, and so fuel use and emissions. Increase renewables and import lower-carbon electricity through regional grids, and fit desulphurisation and dust-removal equipment to coal units to cut sulphur dioxide and particulates.

Section F: Map Skills and Data Analysis (20 marks)

Study the data and answer the questions.

21. (a) (i) Calculate the real straight-line distance between A and B in kilometres; (ii) give the bearing from B to A; (iii) how many contour lines does the peak cross from sea level, and explain. (10 marks)

(i) 6.5 cm x 20,000 = 130,000 cm = 1,300 m = 1.3 km. (ii) A lies north-west of B, so the bearing from B to A is 315 degrees (000 is north, measured clockwise). (iii) 320 / 20 = 16, so the peak rises through 16 contour intervals from sea level, and the summit lies above the 16th contour line.

22. (b) The district plans to add green space in the city centre. Discuss how greening relieves the urban heat island effect and suggest two limitations in carrying it out. (10 marks)

Effects: transpiration uses heat and releases water vapour, lowering air temperature; canopies shade the ground and cut solar gain; grass and soil have lower heat capacity and higher albedo than concrete, so they warm more slowly; green corridors improve air movement and reduce heat trapped between buildings.

Limitations: land in the city centre is scarce and expensive; trees need long-term watering and maintenance and roots may damage pavements and utilities; tall buildings shade some sites so the cooling effect is limited.

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