S6 Geography Practice Paper

S6 | Geography | Time: 75 minutes | Total: 100 marks | 24 questions

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Part 1: River Discharge and Hydrographs

Show the formula, the substitution and the unit in every part.

1. A catchment of 48 km2 receives 85 mm of rain in one storm and has a runoff coefficient of 0.35. Find the rainfall volume, the runoff volume and the mean discharge over 24 hours in m3/s.

2. A river channel is 12 m wide with a mean depth of 1.8 m and a mean velocity of 1.25 m/s. Find the discharge in m3/s and state the effect of doubling the velocity.

3. For the same storm the pre-urbanisation peak flow is 62 m3/s with baseflow 8 m3/s and a lag time of 9 hours. After urbanisation the peak is 95 m3/s with a lag of 3 hours. Find the percentage rise in peak flow and explain it.

4. The storm yields a runoff volume of 1.43e+06 m3 and the downstream reservoir holds 3.0e+06 m3 in total. Find the percentage of capacity filled and explain its value for flood control.

Part 2: Soil Erosion and Agricultural Conservation

Universal soil loss equation A = R x K x LS x C x P, in t/ha/yr.

5. A field has R = 180, K = 0.032, LS = 1.6, C = 0.28 and P = 0.55. Find the annual soil loss and the loss if the field were completely bare (C = P = 1.0).

6. Slope length increases from 40 m to 80 m with all other factors unchanged. Given that LS is proportional to the square root of slope length, find the percentage increase in erosion.

7. Changing from conventional tillage (C = 0.28) to no-till with residue retention (C = 0.12) leaves other factors unchanged. Find the percentage reduction in soil loss.

8. The topsoil is 22 cm deep with a bulk density of 1.35 g/cm3 and, if bare, loses 9.22 t/ha/yr. Find the topsoil mass per hectare in tonnes and the years needed to remove it entirely, then comment.

Part 3: Urban Sprawl and Land Use Conflict

Show your working and use geographical concepts to explain.

9. A city has 850,000 people over 180 km2. Ten years later the population is 120,000 higher and the built-up area has grown to 205 km2. Find both population densities and explain why density barely changes.

10. Commercial rent is 24,000 per m2 at the centre, falling 3,000 per m2 per km; residential rent is 9,000 per m2, falling 600 per km. Find the distance d in km where the bid-rent curves cross and explain its land-use meaning.

11. The city converts 45 ha of farmland to urban use each year, 60% of it prime farmland. Find the prime farmland lost each year and the total over ten years.

12. After expansion the city covers 205 km2 and green plus open space rises from 18% to 25%. Find the added green area in km2 and comment on its feasibility where land is scarce.

Part 4: Industrial Location and Productivity

Costs are annual totals; show each cost item.

13. A plant makes 50,000 units a year. Site A (city centre): rent 1,500,000, transport 8 per unit, labour 32 per unit. Site B (suburb): rent 450,000, transport 19 per unit, labour 24 per unit. Find both annual totals, the better site and the percentage saved.

14. Before automation output is 36,000 units with 120 workers; afterwards 54,000 units with 90 workers. Find labour productivity in units per worker and the percentage gain.

15. A district has 160,000 jobs, 48,000 in manufacturing; nationally there are 6,000,000 jobs with 1,200,000 in manufacturing. Find the manufacturing location quotient and interpret it.

16. Each unit weighs one unit, haulage costs 0.085 per unit-km and the market is 120 km away. Find the transport cost per unit and explain how location changes if the product becomes bulky but light, such as furniture.

Part 5: Energy Mix and Generation Cost

Units: MW, kWh, cost per kWh, tonnes of CO2.

17. Peak demand is 4,800 MW against 6,000 MW of installed capacity. Find the reserve margin and explain why it is kept.

18. Annual demand is 3.2e+09 kWh. Coal costs 0.42 per kWh and gas 0.68 per kWh. Find the annual fuel cost for all-coal and all-gas generation and explain the difference.

19. A wind farm of 50 MW generates 131,400 MWh in a year. Find the capacity factor and explain why it is low.

20. Coal emits 0.82 kg CO2 per kWh and gas 0.42. With 3.2e+09 kWh a year, find the annual CO2 cut in tonnes and the percentage reduction if 40% shifts to gas.

Part 6: Glacier Mass Balance and Sea Level

Mass balance is in metres water equivalent (m w.e.).

21. A glacier shortens from 12.5 km to 10.8 km. Find the percentage retreat and name two other measurable indicators of glacier change.

22. A glacier gains 1.15 m w.e. and loses 1.72 m w.e. each year. Find the net annual balance and the cumulative change over 30 years.

23. Sea level rise comes from thermal expansion 1.8 mm/yr, glacier melt 0.9 mm/yr and ice sheets 0.7 mm/yr. Find the total rate and the rise over 50 years in mm and cm.

24. A mountain glacier covers 480 km2 with a mean thickness of 120 m and ice density 0.9 of water. If it melted entirely, find the water volume and the global mean sea level rise in mm, taking an ocean area of 3.62e+14 m2.
