S4 Geography Practice Paper: Plate Tectonics and Earthquakes, River Processes and Basins, Population Structure and Migration, Agriculture and Food Supply, Urbanisation and Land Use, Manufacturing and Industrial Location

S4 | Geography | Time: 75 minutes | Total: 100 marks | 24 questions

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Part A - Plate Tectonics and Earthquakes (20 marks)

Show working with units and give answers to a sensible number of decimal places.

1. A station records P waves at 6.0 km/s arriving 30 seconds before S waves at 3.5 km/s. Find the distance from the station to the epicentre. [5]

Answer: Let d be the distance: d / 3.5 - d / 6.0 = 30, so d x (0.2857 - 0.1667) = 30 and d is about 252 km.

2. A plate moves 6 cm per year on average. Find the distance moved in 2.5 million years, in km. [5]

Answer: 6 cm is 0.00006 km; 0.00006 x 2,500,000 = 150 km.

3. Each step up the magnitude scale releases about 31.6 times more energy. Find the energy ratio from magnitude 6.0 to 7.0, to three significant figures. [5]

Answer: The gap is one magnitude step, so the ratio is 31.6^1 = 31.6, about 32 times; two steps would give 31.6^2, about 999 times.

4. A tsunami travels over water 4,000 m deep with speed about the square root of (g x depth), where g is 9.8. Find the speed, and the time to reach a coast 500 km away in minutes. [5]

Answer: Speed = square root of (9.8 x 4,000) = 198 m/s; 500,000 / 198 is about 2,525 s, or 42.1 minutes.

Part B - River Processes and Drainage Basins (18 marks)

Give runoff in cubic metres and show every step with units.

5. A basin covers 480 km2 with 2,200 mm of rain a year and a runoff coefficient of 0.35. Find the annual runoff in cubic metres. [5]

Answer: Volume = 480 x 10^6 m2 x 2.2 m x 0.35 = 3.696 x 10^8 m3, i.e. 369.6 million cubic metres.

6. A river falls 900 m between the 60 km and 120 km points. Find the average gradient of that reach as a decimal and as a percentage. [4]

Answer: Horizontal distance is 60 km, that is 60,000 m; gradient = 900 / 60,000 = 0.015, or 1.5 percent, about 1 in 67.

7. A reach is 25 m wide with a mean depth of 1.8 m and a velocity of 1.2 m/s. Find the discharge in m3/s and the daily flow in m3. [5]

Answer: Discharge = 25 x 1.8 x 1.2 = 54 m3/s; per day 54 x 86,400 = 4,665,600 m3, about 4.67 million m3.

8. A reservoir holds 24 million m3. With inflow at 54 m3/s and no outflow, find the number of days to fill it from empty, to two decimal places. [4]

Answer: 24,000,000 / 54 is about 444,444 s; dividing by 86,400 gives about 5.14 days.

Part C - Population Structure and Migration (17 marks)

State units clearly, either persons per km2 or per thousand.

9. A district has 684,000 people over 12.5 km2. Find the population density. [5]

Answer: 684,000 / 12.5 = 54,720 persons per km2.

10. A place has a mid-year population of 620,000, with 4,200 births and 3,100 deaths in a year. Find the rate of natural increase per thousand, to two decimal places. [4]

Answer: Natural increase = 4,200 - 3,100 = 1,100 people; 1,100 / 620,000 x 1,000 is about 1.77 per thousand.

11. In a place there are 96,000 people aged 0-14, 84,000 aged 65 or above and 480,000 aged 15-64. Find the total dependency ratio. [5]

Answer: Dependants = 96,000 + 84,000 = 180,000; 180,000 / 480,000 x 100 percent = 37.5 percent.

12. In the same place 12,400 people moved in and 9,600 moved out in a year. Find the net migration rate per thousand, to two decimal places. [3]

Answer: Net migration = 12,400 - 9,600 = 2,800 people; 2,800 / 620,000 x 1,000 is about 4.52 per thousand.

Part D - Agriculture and Food Supply (16 marks)

Give self-sufficiency and water share as percentages and explain what they mean.

13. A place has 2,400 ha of paddy field yielding 6.5 t per ha; 96,000 people each eat 130 kg of rice a year. Find total output, demand and the self-sufficiency rate. [5]

Answer: Output = 2,400 x 6.5 = 15,600 t; demand = 96,000 x 0.13 = 12,480 t; self-sufficiency = 15,600 / 12,480 x 100 percent = 125 percent.

14. Fertiliser is applied at 180 kg per ha and costs 4,500 dollars per tonne. Find the tonnage and total cost for 2,400 ha. [4]

Answer: Use = 180 x 2,400 = 432,000 kg = 432 t; cost = 432 x 4,500 = 1,944,000 dollars.

15. Irrigation needs 9,000 m3 per ha and the reservoir supplies 30 million m3 a year. Find the total irrigation need for 2,400 ha and its share of the reservoir supply. [4]

Answer: Need = 9,000 x 2,400 = 21,600,000 m3; share = 21,600,000 / 30,000,000 x 100 percent = 72 percent.

16. A place has a labour force of 380,000 with 1.8 percent in farming. Find the farm labour force and the average cropland per farmer in ha, to two decimal places. [3]

Answer: Farm labour = 380,000 x 1.8 percent = 6,840 people; per farmer 2,400 / 6,840 is about 0.35 ha.

Part E - Urbanisation and Land Use (15 marks)

Give urbanisation rates as percentages and commuting time in person-hours.

17. A place has 5.6 million people; its urban population rises from 3.2 to 4.48 million. Find the urbanisation rate before and after and the rise in percentage points. [4]

Answer: Before 320 / 560 x 100 percent = 57.1 percent; after 448 / 560 x 100 percent = 80.0 percent; the rise is 22.9 percentage points.

18. A town has 45,000 people over 1.5 km2. Find its density, and the density if 6,000 people leave and the area stays the same. [4]

Answer: Density 45,000 / 1.5 = 30,000 per km2; after out-migration 39,000 / 1.5 = 26,000 per km2.

19. A city area of 240 km2 is used for housing 38 percent, commerce 9 percent, industry 6 percent, roads 14 percent and open space 10 percent, with the rest other uses. Find the other-use share and the housing area. [4]

Answer: Other uses = 100 - (38 + 9 + 6 + 14 + 10) = 23 percent; housing = 240 x 38 percent = 91.2 km2.

20. In that town 60 percent of people are employed and 70 percent of them commute across districts, 35 minutes each way. Find the daily cross-district commuters and total commuting person-hours. [3]

Answer: Commuters = 45,000 x 60 percent x 70 percent = 18,900; each a 70-minute return trip, so 18,900 x 70 / 60 = 22,050 person-hours.

Part F - Manufacturing and Industrial Location (14 marks)

Give unit cost per item and list each cost item.

21. A factory makes 60,000 units a year: raw material freight 12 dollars a unit, labour 18 dollars a unit and rent 2.4 million dollars a year. Find rent per unit, unit cost and annual total cost. [4]

Answer: Rent per unit = 2,400,000 / 60,000 = 40 dollars; unit cost = 12 + 18 + 40 = 70 dollars; total 70 x 60,000 = 4.2 million dollars.

22. Moving to a new district raises freight by 3 dollars and cuts labour by 4 dollars a unit, with rent down to 1.8 million dollars a year. Find the new unit cost and the annual saving. [4]

Answer: New unit cost = 15 + 14 + 30 = 59 dollars; annual saving (70 - 59) x 60,000 = 660,000 dollars.

23. An industrial estate covers 3.2 km2 with 160 factories. Find the average site area per factory in km2, in ha and in m2. [3]

Answer: 3.2 / 160 = 0.02 km2, which is 2 ha or 20,000 m2.

24. Manufacturing output is 84 million dollars with 58.8 million exported. Find the export share; if exports then rise 12 percent, find the new export value. [3]

Answer: Export share = 58.8 / 84 x 100 percent = 70 percent; after a 12 percent rise 58.8 x 1.12 = 65.856 million dollars.