S5 Geography Practice Paper: Weather and Climate, River Processes and Discharge, Industrial Location, Urbanisation and Urban Renewal, Farming Systems, Energy and Pollution Management (100 marks)

Level: S5 | Subject: Geography | 75 minutes | 100 marks | 24 questions | question paper

Section A Weather and Climate (18 marks)

Show all working. Give units in every answer.

#	Question	Marks
1	On a morning the ground-level air temperature is 28.5 °C. A hill-top station lies at 958 m above sea level and the regional lapse rate is 6.5 °C per km. (a) Calculate the temperature at the hill top. (b) State the lapse rate that an air parcel would follow after rising above its condensation level, and explain why it changes.	4
2	Air temperature in the city is 30 °C, the saturation vapour pressure is 42.4 hPa and the measured vapour pressure is 21.2 hPa. (a) Calculate the relative humidity. (b) State what would be observed if the temperature fell to 15 °C with the same vapour content. (c) Give one way the urban heat island affects these values.	5
3	A catchment of 35 km2 receives 2,400 mm of rain a year and yields 1,680 mm of runoff. (a) Calculate the runoff coefficient. (b) Calculate the annual runoff volume in cubic metres. (c) Explain why the coefficient is not equal to 1.	4
4	Station data: hottest month 31.2 °C, coldest month 10.4 °C; rainfall is concentrated in summer (May-September) with 1,200 mm in summer and 250 mm in winter. (a) Calculate the annual temperature range. (b) State which hemisphere the station is in and give a reason. (c) Identify the climate type and one agricultural implication.	5

Section B River Processes and Discharge (18 marks)

Write the formula, substitute the values and give units.

#	Question	Marks
5	A river cross-section has an area of 45 m2 and a mean velocity of 1.2 m/s. (a) Calculate the discharge in m3/s. (b) Calculate the volume discharged in one day. (c) If the area triples at the same velocity, how does discharge change?	5
6	During a storm the water level rises 1.8 m in a 60 m wide rectangular channel and the mean velocity becomes 1.5 m/s. (a) Calculate the extra cross-sectional area. (b) Calculate the extra discharge. (c) Explain why natural banks give a less abrupt flood peak than concrete channels.	4
7	Bed sand has a median grain size D50 = 0.10 mm with a critical erosion velocity of about 0.20 m/s. (a) Name the sediment class of 0.10 mm material. (b) Describe what happens if velocity rises from 0.15 to 0.35 m/s. (c) Give one engineering use of D50 data.	4
8	A catchment of 120 km2 receives 80 mm of rain in 3 hours with a runoff coefficient of 0.65. (a) Calculate the runoff volume. (b) Calculate the mean peak discharge in m3/s. (c) Explain how urbanisation changes these values.	5

Section C Industrial Location (16 marks)

Show your calculations and name the type of location factor involved.

#	Question	Marks
9	A factory needs 4 tonnes of raw materials to make 1 tonne of product. (a) Calculate the material index. (b) Decide whether it should locate near the raw material or the market, and explain. (c) Give one example of such an industry.	4
10	Freight costs 0.8 dollars per tonne-km. Option 1: plant at the raw material, shipping 1 tonne of product 400 km. Option 2: plant at the market, shipping 4 tonnes of raw material 150 km. (a) Calculate the freight cost per tonne of product for each option. (b) State the better option. (c) Would the answer change at 1.5 dollars per tonne-km?	4
11	A factory pays 24 million dollars in wages against total costs of 80 million dollars. (a) Calculate wages as a percentage of total cost. (b) If wages rise 15% with other costs unchanged, by what percentage does total cost rise? (c) Name the location orientation of this industry and give an example.	4
12	After an industrial estate attracts similar plants, the average supplier distance falls from 300 km to 40 km, with 1,000 lorry trips a year costing 12 dollars per km per trip. (a) Calculate the annual freight saving. (b) Name this phenomenon and give two other benefits.	4

Section D Urbanisation and Urban Renewal (17 marks)

Give units in all calculations and explain the concepts.

#	Question	Marks
13	A city region has 5.6 million people, of whom 4.2 million live in urban areas. (a) Calculate the urbanisation rate. (b) If ten years later the population is 6.0 million and the rate reaches 85%, calculate the urban population. (c) Relate the urbanisation rate to economic development.	4
14	An urban district covers 2.4 km2 with 180,000 residents. (a) Calculate the population density in persons per km2. (b) Given a rural district density of 1,500 persons per km2, calculate how many times denser the urban district is. (c) State two effects of high density on transport and public services.	4
15	A redevelopment site covers 0.6 ha. The plot ratio is 4 before and is allowed to rise to 9 after renewal. (a) Calculate the gross floor area before and after in m2. (b) Calculate the percentage increase. (c) Give two benefits and one cost of the higher plot ratio.	5
16	After renewal, average residential rent in an old district rises from 240 dollars to 396 dollars per m2. (a) Calculate the percentage rise in rent. (b) Name the phenomenon. (c) State one effect on original residents.	4

Section E Farming Systems (16 marks)

Answer using systems concepts; give units in calculations.

#	Question	Marks
17	A farm uses 12 units of energy input (fuel, fertiliser, feed) and produces 30 units of food energy. (a) Calculate the energy output to input ratio. (b) State whether this is commercial or subsistence farming and why. (c) Give two ways to raise the ratio.	4
18	A farm of 0.8 ha employs 6 full-time workers. (a) Calculate workers per hectare. (b) Decide whether the farm is intensive or extensive. (c) Contrast labour inputs in Asian rice farming and North American wheat farming.	4
19	A rice farmer harvests 5.2 tonnes per hectare at 3,600 dollars per tonne, with production costs of 14,000 dollars per hectare. (a) Calculate revenue per hectare. (b) Calculate profit per hectare. (c) Calculate the profit margin.	4

20	Rice needs 900 mm of water over the growing season and receives 420 mm of effective rainfall. (a) Calculate the irrigation depth needed in mm. (b) Calculate the volume of water needed per hectare in m3. (c) Explain the effect of a water shortage on yield and give one water-saving method.	4

Section F Energy and Pollution Management (15 marks)

Give units in calculations and name management measures.

#	Question	Marks
21	A power mix is 40% coal, 30% natural gas, 20% nuclear and 10% renewables, with carbon intensities of 0.90, 0.40, 0 and 0 kg CO2 per kWh. (a) Calculate the average carbon intensity. (b) Explain why nuclear is low-carbon but not renewable.	4
22	A household uses 4,800 kWh a year and the grid carbon intensity is 0.48 kg CO2 per kWh. (a) Calculate the annual emissions in kg. (b) Express this in tonnes. (c) Give two practical actions to cut emissions and estimate the saving for one of them.	4
23	A chimney emits 60 g/s of sulphur dioxide. Wind speed is 3 m/s, mixing height 200 m and the plume width 5 km downwind is 300 m. (a) Use a box model to calculate ground-level concentration in micrograms per m3. (b) Explain why concentrations are higher at night. (c) Give one emission control measure.	4
24	A factory flue gas carries 200 mg/m3 of dust and the electrostatic precipitator is 95% efficient. (a) Calculate the emission concentration. (b) Compare it with a 99% efficient unit.	3