3.8 Energy Resources and Electricity Generation: 10-minute Pack

EDEXCEL 4PH1 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 An illustrative electricity log records the energy generated during one hour: hydroelectric: 42 MWh; solar: 18 MWh; gas: 35 MWh. State which resource generated the greatest electrical energy in that hour.

(Total for Question 1 is 1 mark)

2 State one example of renewable energy resources named on the Edexcel 4PH1 specification, suitable for electricity generation.

(Total for Question 2 is 1 mark)

3 An illustrative village needs 5 MW throughout the night. A proposed hydroelectric station can supply 6 MW throughout that night but its reservoir would flood a meadow. A proposed solar farm supplies 0 MW at night and would use an existing roof. No storage or other generators are available. Recommend one of these resources for meeting the night demand, using its output as a reason, and state one environmental disadvantage of your choice.

(Total for Question 3 is 2 marks)

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4 Two illustrative proposals each meet a town's electricity demand. Proposal A is a wind farm with storage, requiring 80 cost units to build and 3 cost units per year to operate. Proposal B is a gas station, requiring 45 cost units to build and 9 cost units per year to operate. These are invented cost units, not prices. The town has at most 60 cost units for construction and wants low annual operating costs. State which proposal meets the construction budget and compare the annual operating costs.

(Total for Question 4 is 2 marks)

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5 An illustrative wind farm supplies 9 MW at noon and 2 MW in the evening. Demand is 7 MW at both times. A reserve gas generator can supply up to 8 MW on demand. There is no storage. Identify the time when wind alone cannot meet demand, using the output data, and explain how the reserve generator can prevent a shortfall at that time.

(Total for Question 5 is 2 marks)

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6 Describe, in the context of a thermal power station that burns coal, how burning the fuel leads to electricity generation. Include the main energy transfers.

(Total for Question 6 is 2 marks)

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Mark scheme · 3.8 Energy Resources and Electricity Generation: 10-minute Pack

Question 1

hydroelectric **B1**

Answer: hydroelectric

Question 2

any one valid renewable resource named, e.g. solar, wind, hydroelectric, tidal, geothermal, biofuel **B1**

Answer: Any one of: solar, wind, hydroelectric, tidal, geothermal, biofuel

Question 3

recommends hydroelectric because its 6 MW meets the 5 MW night demand **B1**

states that the reservoir floods the meadow, damaging or removing its habitat **B1**

Answer: Choose hydroelectric: its 6 MW meets the 5 MW night demand. Flooding the meadow would damage its habitat.

Question 4

B meets the construction budget: 45 is within 60, whereas A needs 80 **B1**

A has lower annual operating costs: 3 cost units per year compared with 9 for B; accept B costs 6 more cost units per year **B1**

Answer: B meets the construction budget because 45 ≤ 60, while A requires 80. A has lower annual operating costs: 3 cost units per year compared with 9 for B.

Question 5

identifies evening, since 2 MW is less than the 7 MW demand **B1**

gas can provide the missing 5 MW on demand, within its 8 MW maximum; accept any gas output from 5 to 8 MW with excess generation curtailed **B1**

Answer: In the evening, wind supplies only 2 MW against demand of 7 MW. The gas generator can supply the missing 5 MW on demand because this is within its 8 MW maximum.

Question 6

states that burning coal releases thermal energy heating water to make steam **B1**

states that steam drives a turbine connected to a generator that produces electricity **B1**

Answer: Burning coal releases heat that boils water to make steam; the steam drives a turbine which turns a generator to produce electricity

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