1 The table gives information about some ways to generate electrical power.

Type of power station	Maximum power output in MW	Time to reach maximum power	Relative fuel cost
wind farm	20	variable	none
gas turbine	600	15 minutes	medium
tidal scheme	6000	variable	none
nuclear power station	1200	2 days	low
coal-fired power station	1800	3 hours	high

An electricity supply company has enough power stations to cover the normal demand for electricity but not enough for cold conditions.

On cold days the demand for electrical power can suddenly increase by 20 000 MW.

The company needs to build new power stations to meet this increased demand.

Using **only** information in the table, evaluate which types of power station would be the most suitable to meet this increased demand. **(separate only)**

(5)

(Total for Question 1 = 5 marks)

2 An electric kettle is connected to the 230 V mains supply.

The power of the kettle is 960 W.

(a) (i) A power of 960 watts is the same as

(1)

☒ **A** 960 joules per coulomb

☒ **B** 960 joules per second

☒ **C** 960 newtons per metre

☒ **D** 960 newtons per second

(ii) State the equation linking power, current and voltage.

(1)

(iii) Show that the current in the kettle is about 4 A.

(2)

(b) The 960 W kettle is earthed and fitted with a fuse.

(i) Explain how this can protect the person using the kettle if there is a fault.

(3)

(ii) Another kettle has twice as much power.

It is connected to the same mains supply.

Which of these fuse ratings should be used for this kettle?

(1)

☒ **A** 1 A

☒ **B** 3 A

☒ **C** 5 A

☒ **D** 13 A

(c) A student has a pack of fuses labelled 2 A.

Explain how she could use one of these fuses to check that the label is correct.

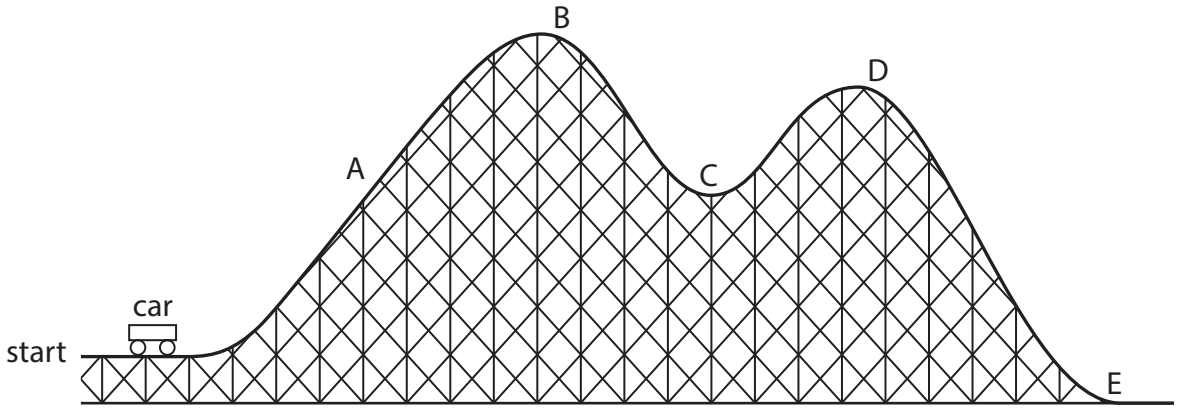
You may draw a circuit diagram to help your answer.

(3)

(Total for Question 2 = 11 marks)

3 The diagram shows a roller-coaster ride.

The car is pulled slowly from the start to point B and then released.



(a) Choose letters from the diagram to complete this sentence.

(2)

The car has the most gravitational potential energy at point .....

and it goes fastest at point ..... .

(b) The mass of the car is 900 kg.

The maximum speed of the car is 15 m/s.

(i) State the relationship between momentum, mass and velocity. **(separate only)**

(1)

(ii) Calculate the maximum momentum of the car.

Give the unit. **(separate only)**

(3)

maximum momentum = ... unit .....

(iii) State the equation linking kinetic energy (KE), mass and speed.

(1)

(iv) Calculate the maximum KE of the car.

(2)

maximum KE = ... J

(Total for Question 3 = 9 marks)

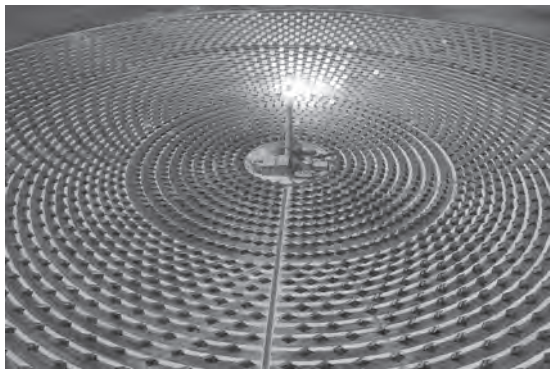
4 An energy company plans to build a new power station.

The company must decide between two renewable energy projects, a geothermal power station or a solar power station.

Geothermal power station

(Author: Gretar Ívarsson, geologist at Nesjavellir, 2006)

Solar power station



(Author: Torresol Energy, 2011)

Explain how the location and the climate might affect the type of power station that the company chooses. **(separate only)**

(4)

location .....

.....

.....

.....

.....

.....

climate .....

.....

.....

.....

.....

.....

(Total for Question 4 = 4 marks)

5 A coal-fired power station and a wind turbine both produce electrical power.

The power station produces 1200 MW and the wind turbine produces 1.5 MW.

(a) Give **one** advantage of using wind turbines instead of a coal-fired power station to produce electricity. **(separate only)**

(1)

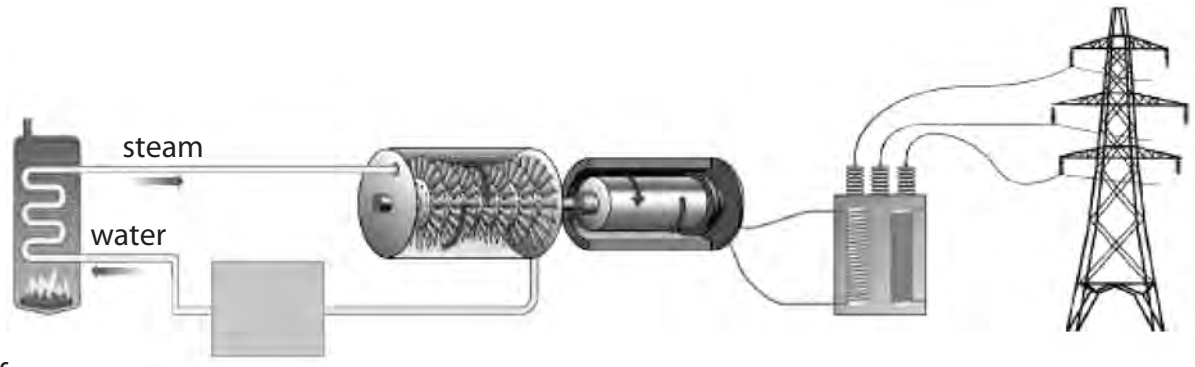
(b) Coal-fired power stations are still in general use.

Explain why wind turbines have not replaced them. **(separate only)**

(4)

(Total for Question 5 5 marks)

6 The diagram shows a coal-fired power station.



(a) (i) In which part of the power station is heat energy usefully converted to kinetic energy?

(1)

☒ **A** boiler

☒ **B** turbine

☒ **C** generator

☒ **D** wires

(ii) In which part of the power station is kinetic energy usefully converted to electrical energy?

(1)

☒ **A** boiler

☒ **B** turbine

☒ **C** generator

☒ **D** wires

(b) A transformer is used to convert the 25 kV output from the power station to 115 kV.

(i) State the equation linking power, voltage and current.

(1)

(ii) Compare the input current and the output current of the transformer.

Assume there are no energy losses in the transformer. **(separate only)**

(3)

(iii) State one advantage of transmitting electricity at high voltages.

(1)

(c) Some power stations use uranium as a fuel.

Describe the problems that arise from the disposal of waste from this type of power station. **(separate only)**

(4)

(Total for Question 6 = 11 marks)