AQA Examination-style questions

1 (a) State Wien's Law. *(2 marks)*

(b) The Sun radiates a total power of 4.0×10^{26} W.
Show that about 1.4 kJ of energy falls on one square metre of the Moon each second.
Sun–Moon distance = 1.5×10^{11} m *(2 marks)*

(c) One-eighth of the radiation that falls on the Moon's surface is reflected back into space.
Calculate the power absorbed by one square metre of the Moon from the Sun. *(1 mark)*

(d) **Figure 1** shows how the power radiated by a black body varies with temperature.
Use the graph to determine the equilibrium surface temperature of the Moon on the side facing the Sun. *(1 mark)*

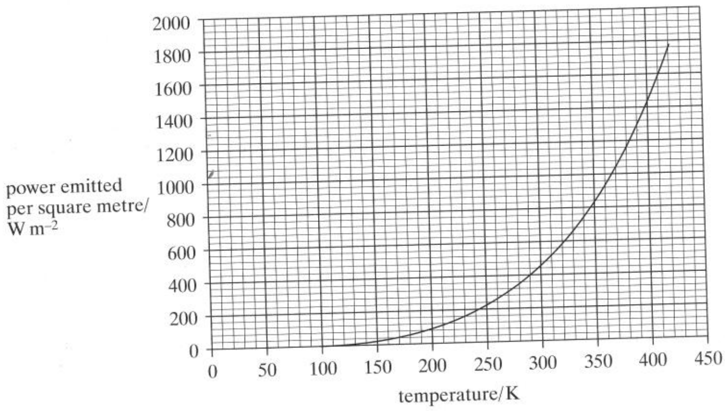

Figure 1

(e) Locations on the Moon spend 14 days in the dark and 14 days in sunlight. Suggest the factors that are likely to influence the temperature on the dark side of the Moon. *(2 marks)*

2 Arrange the following list of regions of the electromagnetic spectrum in order of increasing *wavelength*.

Radio X-ray Microwave Visible Infrared Ultraviolet

For **two** of these regions give approximate wavelengths for the radiation and indicate two uses of the radiation. *(6 marks)*

(a) Explain why the graphs are difficult to compare. *(1 mark)*

(b) One tonne of oil equivalent is equal to 4.2×10^{16} J. The mean efficiency of power stations in the UK is about 35%.

Estimate the amount of electrical energy in kW h that was generated from:

(i) coal in 1990,

(ii) renewable sources in 2005. *(4 marks)*

(c) Explain what is meant by a *renewable* fuel. *(1 mark)*

(d) (i) Give an example of a renewable energy source that is not based on the movement of water.

(ii) For your example in part (d)(i), using a diagram, explain how the energy is converted from its original form and give an account of the advantages and disadvantages of the conversion process. *(5 marks)*

4 **Figure 6** shows how the electrical energy generated in the UK from wind and wave resources has varied over a fifteen-year period. (For the years 1990–1993, 9 GWh of energy were generated.)

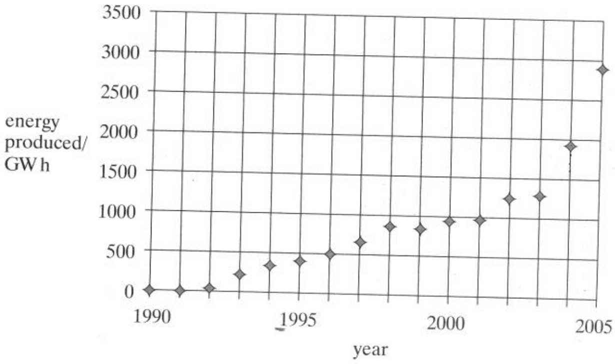

Figure 6

(a) Use the graph to give a description of the way in which the amount of electrical energy produced from waves and wind changed during the period shown on the graph. *(3 marks)*

(b) Calculate the energy in joules generated in the year 2004. *(2 marks)*

(c) The area of the UK is roughly 240 000 km^2 and the Sun delivers roughly 1.4 kW of energy per second to each square metre at the distance of the Earth from the Sun.

Estimate the length of time required for the Sun to deliver the amount of energy you calculated in part (b) to the UK. *(3 marks)*

(d) State and explain whether your estimate in part (c) is a maximum or a minimum. *(3 marks)*

5 Calculate the energy in joules that is converted in the following:

(i) a 1.2 kW heater running for 5.0 h,

(ii) burning 10 000 cm^3 of petrol, if 1 kg of petrol releases 4.8×10^7 J and the density of petrol is 740 kg m^{-3}. *(5 marks)*

6 Read the following and then construct a Sankey diagram to illustrate the energy usage in the motor car described below.

A car uses 7 dm^3 of petrol when it drives 100 km in 1 h. 1 dm^3 of petrol releases 4.8×10^7 J of energy. The engine of the car is 20% efficient. The energy from the engine travels to the transmission losing 3 kW on the way due to resistance and other losses; the transmission system is 75% efficient. The energy reaching the wheels is transferred to air friction and road (rolling) friction in equal amounts. *(7 marks)*

2 **Figure 3** below shows the electrical energy generated in the UK from large-scale hydroelectric resources.

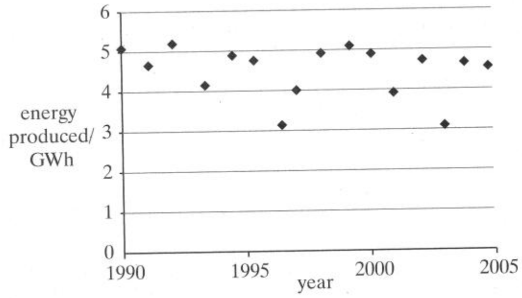

Figure 3

(a) Calculate the maximum energy that can be provided by 1.0 kg of water falling through 100 m. *(2 marks)*

(b) Use the graph to estimate the mean energy in joules produced every year in the UK by large-scale hydroelectric resources. *(1 mark)*

(c) Estimate the minimum mass of water that must fall through 100 m in order to generate this energy. *(3 marks)*

3 **Figures 4 and 5** show data relating to the generation of electricity in the UK for periods up to 2006.

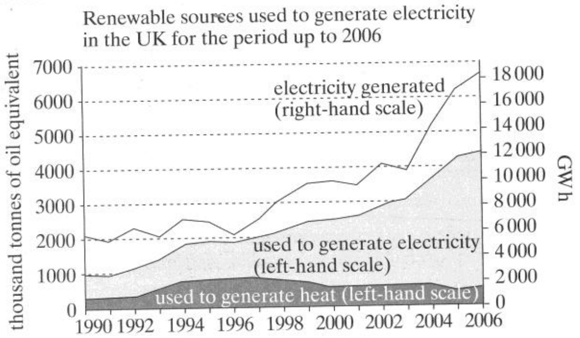

Figure 4

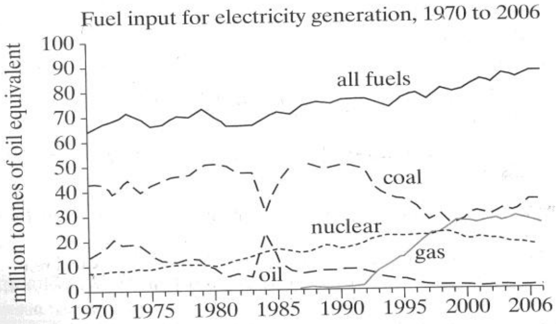

Figure 5

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