



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2019

Centre Number

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Candidate Number

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Environmental Technology

Assessment Unit AS 1

assessing

The Earth's Capacity to Support
Human Activity



SET11

[SET11]

WEDNESDAY 15 MAY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question 7.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	

Total Marks	
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1 (a) Explain the concept of fuel security.

[2]

(b) Outline **two** ways that a country can enhance its fuel security.

1. _____

_____ [1]

2. _____

_____ [1]

(c) Discuss the global economic impact of key emerging economies in relation to demand for fossil fuel supplies. Your discussion must include **three** different points.

1. _____

_____ [2]

2. _____

_____ [2]

3. _____

_____ [2]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

(d) Biomass can be converted into syngas.

Name the **two** main gases present in syngas.

1. _____ [1]

2. _____ [1]

Examiner Only	
Marks	Remark

3 (a) Crude oil is the main source of feedstock for the plastics industry.

(i) Explain how the feedstock is obtained from crude oil.

_____ [2]

(ii) Explain how and why the feedstock is prepared for storage before use.

_____ [2]

(b) Plastics derived from crude oil are building up in the Earth's oceans causing significant pollution problems.

(i) Explain why plastics cause pollution problems in the oceans.

_____ [2]

(ii) Describe a modern manufacturing process used to address the polluting effect of plastics.

_____ [2]

Examiner Only	
Marks	Remark

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(Questions continue overleaf)

4 (a) Complete the following statement:

- Energy cannot be created or destroyed, it can only

_____ [1]

- The above statement forms part of the Law

_____ [1]

(b) Fig. 1 shows a schematic diagram of a hydroelectric power installation. Identify the forms of energy which have been labelled **A** and **B** in the diagram.

A: _____
B: _____ [2]

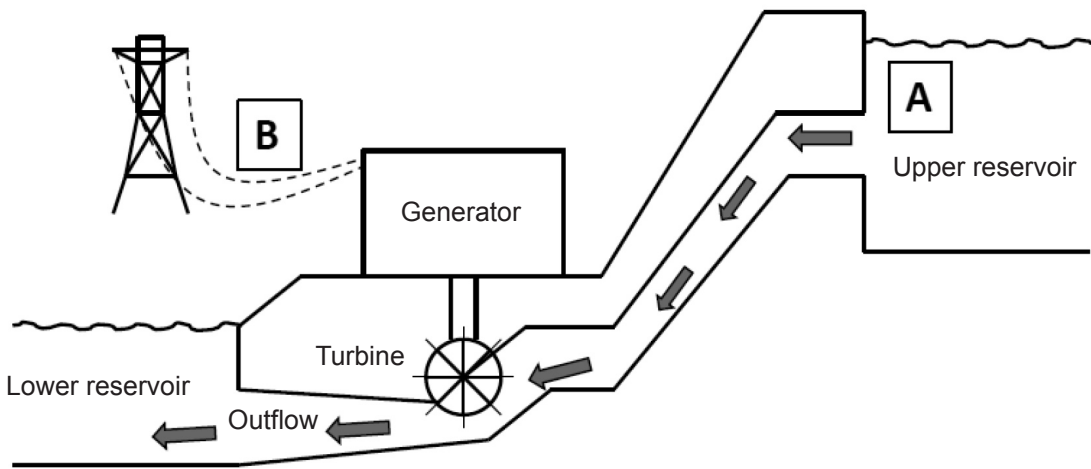


Fig. 1

Source: © Principal Examiner

Examiner Only	
Marks	Remark

(c) State another name by which Combined Heat and Power (CHP) is also known.

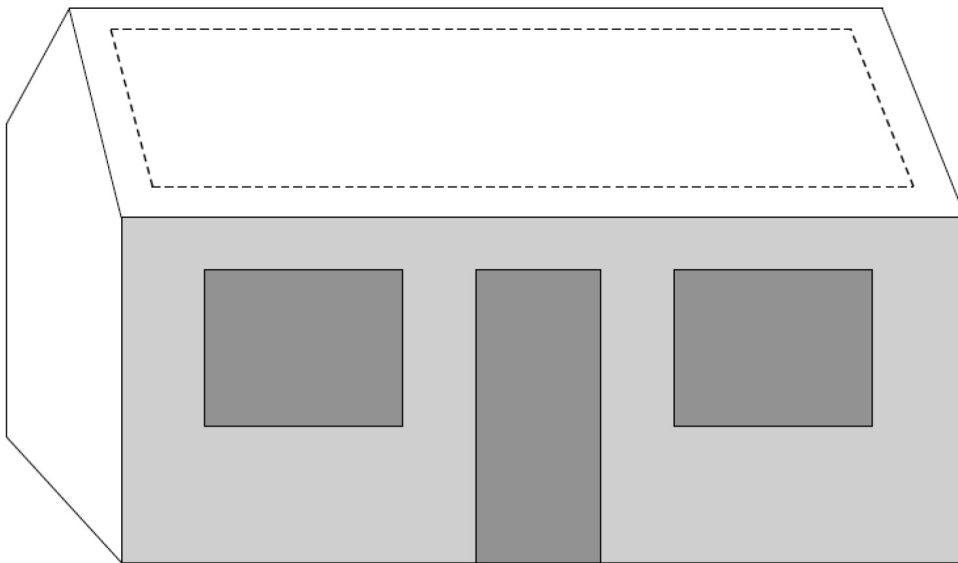
_____ [1]

(d) Discuss how CHP can improve energy efficiencies in the production of heat and power and contrast this with the processes in traditional power plants.

_____ [4]

Examiner Only	
Marks	Remark

5 Fig. 2 shows the roof of a typical house which could be utilised for a solar thermal collector installation.



Source: © Principal Examiner

Fig. 2

- (a) The occupants of the house in Fig. 2 wish to install a solar thermal hot water system to meet part of their annual hot water needs of 7200 kWh per year. If they only have enough roof space for 7 flat plate panels, what percentage of their annual hot water needs would be met by the installation?
(Assume each panel provides 650 kWh of useful heat per year.)
Show your working out in the space below.

Examiner Only	
Marks	Remark

[3]

(b) (i) State **one** benefit that the occupants would get from installing the flat plate solar collector.

_____ [1]

(ii) Identify **two** factors, other than cost, that should be taken into consideration by the occupants when deciding whether to install the solar collector.

1. _____

2. _____
_____ [2]

(c) Outline **two** methods by which automatic solar tracking maximises the energy output from solar collectors.

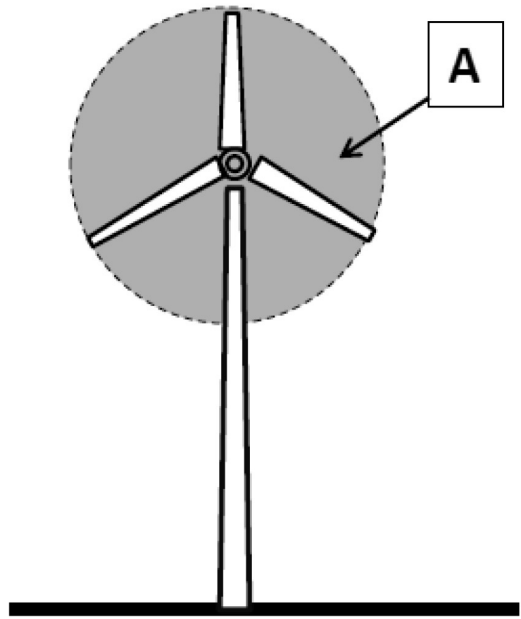
1. _____

2. _____
_____ [2]

Examiner Only	
Marks	Remark

6 (a) **Fig. 3** shows a typical horizontal axis wind turbine. Identify the shaded area which has been labelled **A** in **Fig. 3**.

_____ [1]



Source: © Principal Examiner

Fig. 3

(b) (i) If the length of the rotor blades in **Fig. 3** is doubled, explain by what factor the shaded area will increase.

 _____ [2]

(ii) If the length of the rotor blades in **Fig. 3** increases, how will the power output of the turbine change (assuming the wind speed remains constant)?

_____ [1]

Examiner Only	
Marks	Remark

(c) For the turbine in **Fig. 3** calculate the maximum theoretical energy available from 580 kg of air passing through the turbine with a speed of 11 m/s. Show your working out in the space below.

[2]

(d) (i) Define what is meant by the term **Betz Limit** when applied to a wind turbine.

[2]

(ii) Explain how the Betz Limit is related to power efficiencies achievable by wind turbines in the real world.

[2]

(e) State what is meant by the **wind survival speed** of a wind turbine.

[1]

(f) Explain the function of **yawing** in the context of a wind turbine.

[2]

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Marks	Remark

7 In November 2016 the Department for Business, Energy and Industrial Strategy and Ofgem published proposals for the development of a smarter, more flexible energy system in the UK. The proposals include a specific focus on energy storage and aim to remove the regulatory and commercial barriers to the further deployment of energy storage in the UK.

Discuss the storage of energy from renewable energy sources and outline how this can contribute to the development of a smarter, more flexible energy system.

Your answer should address each of the following:

- The problems associated with delivering energy from renewable energy sources and the need to develop energy storage facilities that can store energy produced by renewable sources.
- The basic operational systems of the **two** main grid-scale renewable energy storage systems and the types of locations where each of these could be installed cost effectively.
- How energy storage can contribute to the development of a smarter, more flexible energy system.

The quality of written communication will be assessed in this question.

Examiner Only	
Marks	Remark

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