OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

SCIENCE 2845

Synthesis of Scientific Concepts

Thursday **23 JUNE 2005** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	10	
2	10	
3	10	
4	10	
5	28	
6	22	
TOTAL	90	

This question paper consists of 13 printed pages and 3 blank pages.

Registered Charity Number: 1066969
[Turn over

Answer **all** the questions.

1 Wind power provides a renewable source of energy. Wind turbines (electricity-generating windmills) already supply some electricity to the national grids of some countries. There are plans to increase the proportion of electrical power generated in this way.

(a) The total generating capacity of a country is 205 GW.
The generating capacity for wind turbines is 560 MW.

(i) Write down these values in watts in standard form.

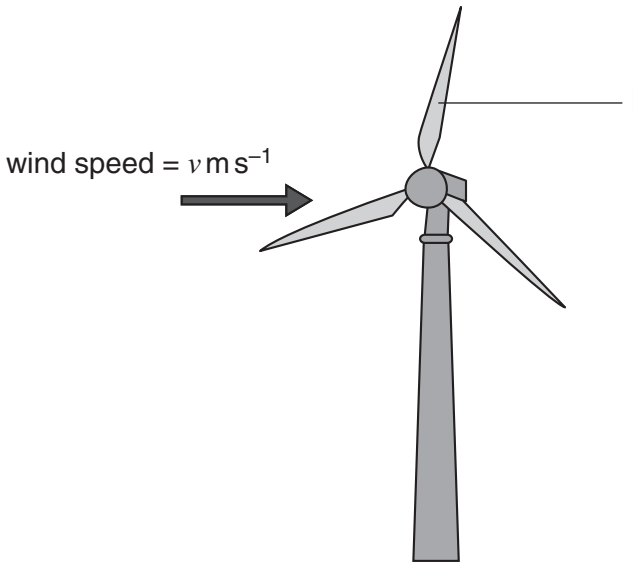
205 GW = ... W

560 MW = ... W [2]

(ii) Calculate the percentage of generating capacity supplied by wind power.
Show your working. Give your answer to 2 significant figures.

percentage supplied by wind power = ... % [2]

Information about one design of wind turbine is contained in Fig. 1.1.



The power, P, in watts, generated by the wind turbine is given by the equation

$$P = 0.43\ v^3\ l^2$$

$(v^3 = v \times v \times v)$

Fig. 1.1

(b) By what factor will the power output of the wind turbine increase when the blade length is doubled at constant wind speed?

.....[1]

(c) Wind speed is often measured in knots.
A wind with a speed of 14 knots is described as a moderate breeze.

(i) Calculate the speed of such a wind in units of $m\,s^{-1}$.
(1 knot = $0.5144\,m\,s^{-1}$)

wind speed = ... $m\,s^{-1}$ [1]

(ii) Calculate the power generated by a wind turbine of the type shown in Fig. 1.1 with a blade length of 24 m in a 14 knot wind.

power = ... W [3]

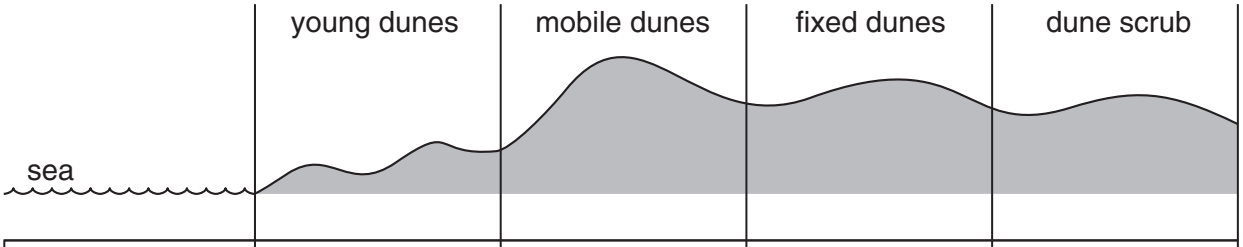
(d) When wind speed exceeds 27 knots, the movement of a wind turbine is often prevented by locking the blades. Suggest why this is done.

.....

.....[1]

[Total: 10]

2 Fig. 2.1 shows a cross-section through some sand dunes and contains information about them.

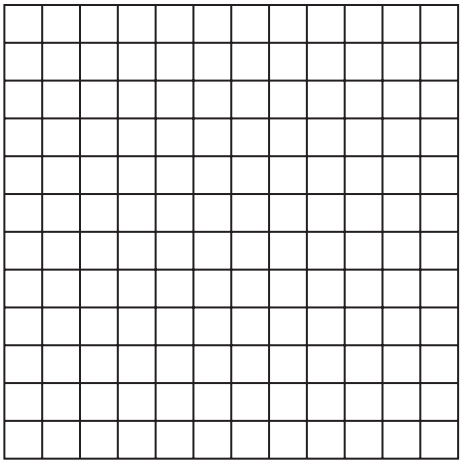


stage	1	2	3	4
age / years	50–90	90–130	130–240	240–370
humus content of soil / %	0.5	2.5	5.0	11.0
plant biomass per m^2 / kg	0.5	3.5	8.0	11.5
number of plant species per km^2	16	75	129	140
soil pH	6.6	6.0	5.8	5.6

Fig. 2.1

(a) Plant biomass and humus (organic matter) content of soil are two variables shown in Fig. 2.1.

(i) Use the grid below to construct a scatter plot to show that there is a relationship between these two variables.



[3]

(ii) The scatter plot shows a correlation between the two variables.
Why would you expect there to be a link between plant biomass and humus content of soil?

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.....[2]

(b) The definition of pH is

$$pH = -\log_{10}[H^+]$$

where $[H^+]$ is an abbreviation for 'concentration of hydrogen ions'.

(i) The pH falls by 1 unit between stage 1 and stage 4.
By what factor does $[H^+]$ increase?

.....[1]

(ii) Suggest why $[H^+]$ increases between stage 1 and stage 4.

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.....[1]

(c) **(i)** Describe **one** relationship between the variables shown in Fig. 2.1, other than the relationships in **(a)** and **(b)**.

.....

.....[1]

(ii) Suggest an explanation for the relationship you have described.

.....

.....[1]

(d) Name **one** variable not shown in Fig. 2.1, and suggest how it would change across the sand dunes.

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.....[1]

[Total: 10]

3 Fig. 3.1 shows the scientific model that can be used to explain the emission of electromagnetic radiation by a lithium atom.

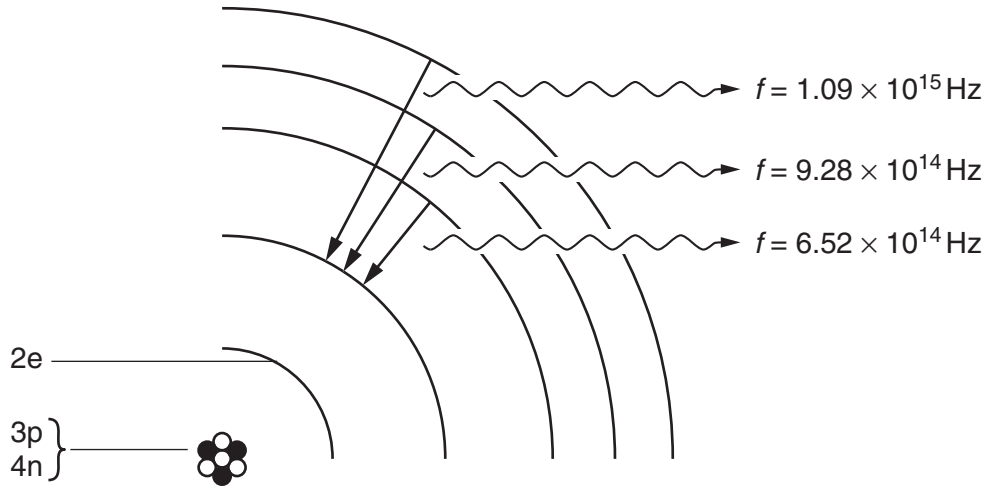

Fig. 3.1

Discuss the information summarised in Fig. 3.1.

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[Total: 10]

4 Water is the most abundant compound on the Earth's surface. Water plays a part in many natural processes.

State the names of **two** such processes. For each, explain how water plays a part.

process 1. .....

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process 2. .....

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[Total: 10]

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Question 5 starts on page 10

5 In this question, four marks are available for the quality of written communication.

Read the extract that follows about marsupial wolves.

Marsupials are mammals whose.....

An extract has been removed due to third party copyright restrictions

Details:

An extract about the marsupial wolf, which is now extinct and is related to other australian marsupials

.....comparison of external characteristics.

Discuss the scientific principles that are described in the extract above.

For Examiner's Use

....[24]

Quality of written communication [4]

[Total: 28]

[Turn over

6 In this question, four marks are available for the quality of written communication.

Read the extract that follows about Mars – the frozen planet.

Millions of years ago.....

An extract has been removed due to third party copyright restrictions

Details:

An extract about the reasons behind mars freezing during it's development

.....the surface of Mars.

Write an account of the processes that have influenced the temperature of Mars.

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.....[18]

Quality of written communication [4]

[Total: 22]

END OF QUESTION PAPER

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