

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

SCIENCE

2844

Science and Environmental Management

Tuesday

21 JUNE 2005

Morning

1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Electronic calculator

Candidate Name	Centre Number	Candidate Number										
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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 provided 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	13	
2	15	
3	14	
4	17	
5	14	
6	7	
7	10	
TOTAL	90	

This question paper consists of 14 printed pages and 2 blank pages.

Answer **all** the questions.

1 Pollution of waterways is a serious and growing environmental hazard. In order to assess the levels of environmental pollution, investigators may sample water from different points in a river.

(a) (i) Suggest **two** factors that should be taken into account when choosing the sites to sample the river water for pollution.

.....
.....
..... [2]

(ii) State **two** factors, other than location, which should be considered when deciding on sampling procedure.

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.....
..... [2]

(b) Suggest **one physical** observation or measurement that might be made at the chosen sites.

.....
..... [1]

(c) Scientists carrying out an investigation found that a nearby laundry was polluting a river with detergent from washing machines.

Explain the effect that phosphates from detergents have on organisms living in the river.

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..... [4]

- (d) Samples of water collected from rivers can be taken back to a laboratory to be analysed by colorimetry.

Describe the basic principles used in colorimetry.

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.....

.....

..... [4]

[Total: 13]

2 **Reverse** osmosis can be used to purify water which contains dissolved pollutants. Fig. 2.1 is a diagram to show the principle of reverse osmosis.

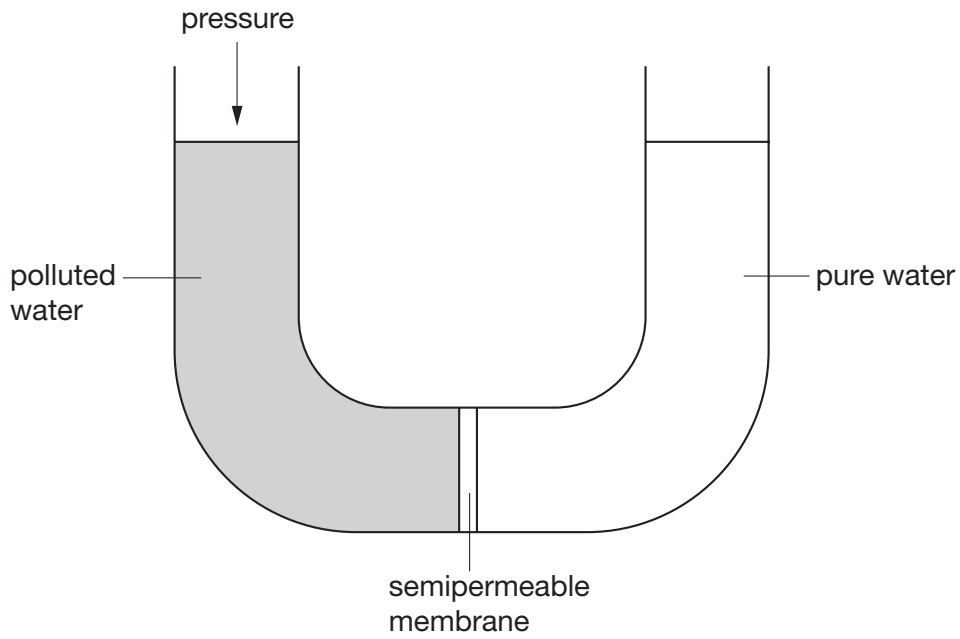


Fig. 2.1

(a) Refer to this diagram to explain how reverse osmosis purifies the polluted water.

.....
.....
.....
.....
.....
.....
..... [5]

(b) State **two** applications of reverse osmosis, other than the production of drinking water.

.....
.....
..... [2]

(c) Water moves in and out of cells in plant roots by the process of **osmosis**.

(i) Describe, using molecular kinetic theory, how water moves in and out of cells.

.....
.....
.....
..... [3]

(ii) Under what conditions would there be a net movement of water molecules into the root cell?

.....
..... [1]

(iii) What happens to the appearance of a plant if there is insufficient water in the soil?

..... [1]

(iv) State **two** adaptations of plants to overcome water stress.

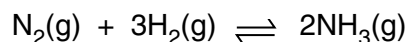
.....
.....
..... [2]

(d) Wheat is a crop that is not well adapted to grow in dry areas. Suggest why wheat is sometimes grown in hot, dry countries, instead of better-adapted crops.

..... [1]

[Total: 15]

- 3 Ammonia is used in the manufacture of synthetic fertilisers. Ammonia is made industrially from hydrogen and nitrogen using the Haber process. The Haber process is a reversible process. The equation for the reaction is shown below.



- (a) Explain the meaning of the term *reversible process*, with reference to the above reaction.

.....
..... [2]

- (b) State Le Chatelier's principle.

.....
.....
..... [2]

- (c) In the Haber process, formation of ammonia leads to a pressure decrease.

- (i) Explain the effect on the **direction** of this reversible process of an **increase** in pressure.

.....
.....
.....
..... [2]

- (ii) Suggest why a **moderately** high pressure of around 200 atmospheres is chosen for the Haber process.

.....
.....
.....
..... [3]

(d) Formation of ammonia is an exothermic process.

(i) Explain the effect on the **direction** of this reversible process of an **increase** in temperature.

.....
.....
.....
..... [3]

(ii) Suggest why a **moderately** high temperature of around 450 °C is chosen for the Haber process.

.....
.....
.....
..... [2]

[Total: 14]

4 Plants may reproduce sexually or asexually. Asexual reproduction results in genetically identical individuals because only mitotic cell divisions occur. It is used to propagate a particularly desirable plant whose characteristics would be altered by sexual reproduction.

(a) The potato plant reproduces asexually by tubers. Describe asexual reproduction using tubers.

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..... [2]

(b) Tissue culture is an example of asexual reproduction. Describe how tissue culture is carried out.

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..... [5]

(c) In asexual reproduction, new cells are made by mitosis. Describe the process of mitosis. You may use labelled diagrams if you wish.

.....
.....
.....
..... [5]

(d) Asexual reproduction is used by farmers and growers to reproduce desirable plants. There are, however, disadvantages to this method. Explain **one** disadvantage, using an example to support your answer.

.....
.....
.....
..... [3]

(e) Sexual reproduction in flowering plants uses cross-pollination or self-pollination. Self-pollination reduces genetic variation compared to cross-pollination.

(i) State the difference between cross-pollination and self-pollination.

.....
..... [1]

(ii) Explain why desirable characteristics can be altered by sexual reproduction using self-pollination, but not by asexual reproduction.

.....
.....
..... [1]

[Total: 17]

- 5 Gregor Mendel is famous for working out the rules of inheritance. He experimented with pea plants, and one of the characteristics he used was stem height. The stem height is controlled by two alleles of a gene that code for a growth hormone. T is the allele for normal growth hormone; t is the allele for non-functional growth hormone.

Mendel began his experiments by crossing pure breeding tall pea plants, with pure breeding short pea plants. His results are summarised in Fig. 5.1.

	T	T
t	Tt	Tt
t	Tt	Tt

All of the pea plants from this cross (the F1 generation) grew tall.

Fig. 5.1

- (a) (i) Suggest the meaning of the term *pure breeding*.

.....
 [1]

- (ii) State the meaning of the term *allele*.

.....
 [1]

- (b) (i) From the results shown in Fig. 5.1, what information can be deduced about the T allele?

..... [1]

- (ii) What information can be deduced about the t allele? Explain your answer.

.....

 [2]

Next, Mendel took plants from the F1 generation, and crossed them with each other. The results of this cross are shown in Fig. 5.2.

	T	t
T	TT	Tt
t	Tt	tt

Fig. 5.2

(c) What percentage of plants from the cross shown in Fig. 5.2 (the F2 generation) grew tall? Explain your answer.

.....
.....
.....
..... [3]

(d) (i) Mendel then took plants with the genotype Tt and crossed them with plants with the genotype tt. Draw a diagram to show the results of this cross.

[1]

(ii) Mendel obtained 150 plants from the above cross. How many of them would be expected to grow tall?

..... tall plants [1]

(e) (i) Often, plant breeders take two varieties of plants which exhibit desirable qualities and try to combine these qualities into a new variety. Describe how this is done, without the use of genetic engineering.

.....
.....
.....
..... [3]

(ii) State **one** possible disadvantage of this process.

.....
..... [1]

[Total: 14]

6 Fig. 6.1 provides some information about the relative risks associated with different activities.

activity	hours spent in activity to produce a 1:1000 risk of death
rock climbing	25
sky diving	50
riding a motor cycle	55
skiing	340
flying on a scheduled airline	1200

Fig. 6.1

(a) Suggest what raw data is needed to produce the information in Fig. 6.1.

.....

.....

..... [2]

(b) What is meant by a 1:1000 risk of death?

.....

..... [1]

(c) Which activity in the table carries the highest risk of death per hour spent on the activity?

..... [1]

(d) Many people perceive the risk of flying on a scheduled airline to be higher than that of skiing. Suggest reasons for this.

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..... [3]

[Total: 7]

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