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FIRST**

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Award

Sample Assessment Material

PRINCIPLES OF
APPLIED SCIENCE

From September 2012

Edexcel BTEC Level 1/Level 2 First Award in
Principles of Applied Science

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Introduction

The Sample Assessment Materials (SAMs) have been prepared to support the qualification.

The aim of these materials is to provide learners and centres with a general impression and flavour of the actual question papers and mark schemes in advance of the first operational examinations.

Write your name here

Surname

Other names

Edexcel BTEC

Level 1/Level 2 First Award

Centre Number

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Candidate Number

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Principles of Applied Science

Unit 1: Principles of Science

Sample Assessment Material

Time: 1 hour

Paper Reference

2046/0E

You will need a scientific calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*

Information

- The total mark for this paper is 54.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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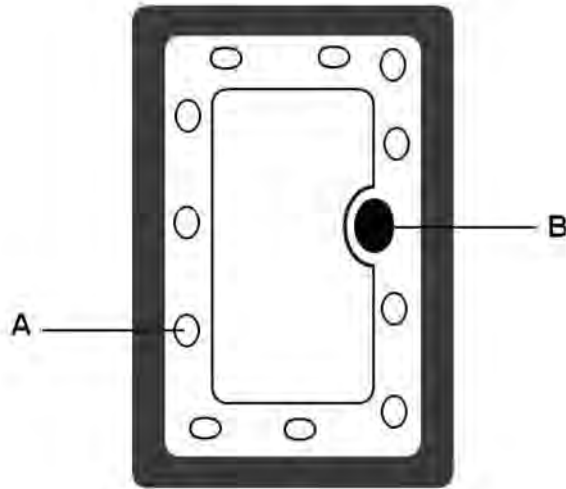


PEARSON

SECTION A: BIOLOGY

Answer all of the questions in this section

1 The diagram shows a cell from the leaf of a plant.



(a) (i) Name the process that happens in the chloroplasts, labelled A.

(1)

(ii) Explain the function of the part of the cell labelled B.

(2)

(b) Water travels from the roots of the plant to the leaf.

(i) Name the process that causes this to happen.

(1)

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(ii) Explain how this process works.

(2)

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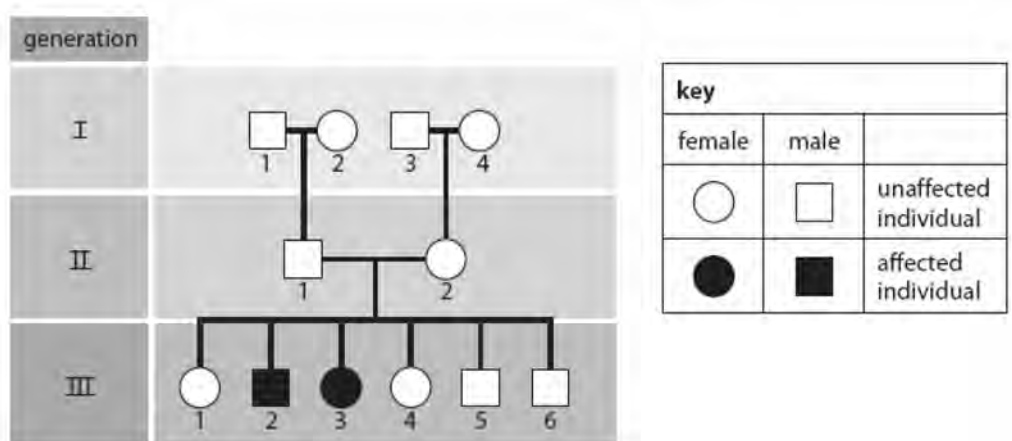
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(Total for Question 1 = 6 marks)

- 2 Cystic fibrosis is a genetic disorder caused by recessive alleles. The diagram shows the inheritance of cystic fibrosis in a family.



- (a) Complete the sentence by putting a cross in the box next to your answer.

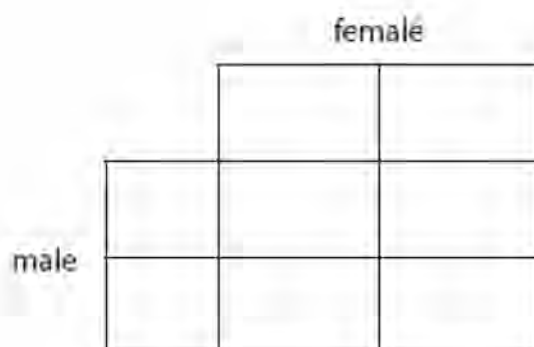
In generation III, individual 3 is:

(1)

- A** a carrier of cystic fibrosis allele
- B** heterozygous for cystic fibrosis
- C** homozygous dominant for cystic fibrosis
- D** homozygous recessive for cystic fibrosis

- (b) Complete the Punnett square to illustrate the inheritance of cystic fibrosis from the two heterozygous parents in generation II. Use B for the dominant allele and b for the recessive allele.

(2)



(c) The unaffected children in generation III are concerned that they may have children with cystic fibrosis. They visit their doctor in a local clinic to get advice.

Explain how pedigree analysis would help to inform the doctor's advice to them.

Use percentages or ratios to help illustrate this.

(2)

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(Total for Question 2 = 5 marks)

- 3 The nervous system and the endocrine system allow different parts of the body to communicate with each other.

The diagram shows a nerve pathway that helps to keep body temperature constant.



(a) Name neurone X in the diagram.

(1)

(b) When an athlete runs her body temperature starts to rise.



Explain **three** ways her body responds to regulate this rise in temperature.

(6)

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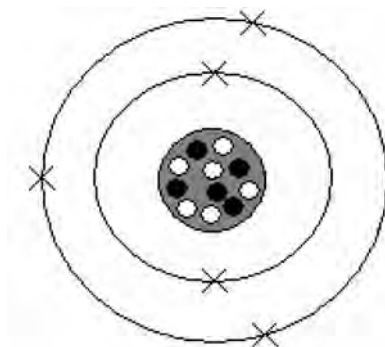
(Total for Question 3 = 7 marks)

TOTAL FOR SECTION A = 18 MARKS

SECTION B: CHEMISTRY

Answer all of the questions in this section

4 The diagram shows the structure of a boron atom.



Key:

Neutron ○
Proton ●
Electron ×

(a) Give the atomic number of boron.

(1)

(b) Below are four statements about the mass of an electron.
Put a cross in the box next to the correct statement.

(1)

- An electron has no mass.
- An electron has a much smaller mass than a proton.
- An electron has the same mass as a proton.
- An electron has a much larger mass than a proton.

(c) Boron occurs naturally as two isotopes, boron-10 and boron-11. Boron contains 20% boron-10 and 80% boron-11.

Calculate the Relative Atomic Mass of boron.

(2)

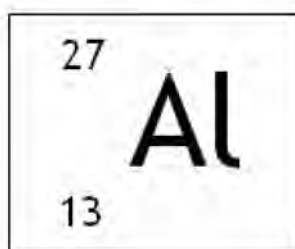
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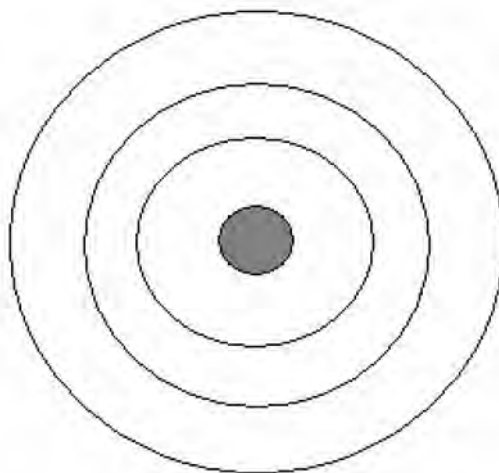
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(d) This is how aluminium is shown in the periodic table.



The diagram below shows the electron shells of an aluminium atom. Complete the diagram to show the electron configuration of the aluminium atom. Use X to represent an electron.

(2)



(Total for Question 4 = 6 marks)

6 Some indigestion tablets contain calcium carbonate.
The calcium carbonate reacts with hydrochloric acid in the stomach.
Carbon dioxide is one of the products of this reaction.

(a) Describe the chemical test for carbon dioxide.

(2)

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(b) The reaction in the stomach between hydrochloric acid and calcium carbonate is a neutralisation reaction.
Name the salt formed in the reaction.

(1)

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(c) Indigestion tablets are coated to stop them reacting before they reach the stomach.
Explain **two** reasons why calcium carbonate is still used to neutralise stomach acid rather than sodium hydroxide.

(4)

1

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2

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(d) When sodium hydroxide is added to dilute sulfuric acid, one of the products is sodium sulfate, Na_2SO_4 .

Write the balanced chemical equation for this reaction.

(2)

(Total for Question 6 = 9 marks)

TOTAL FOR SECTION B = 18 MARKS

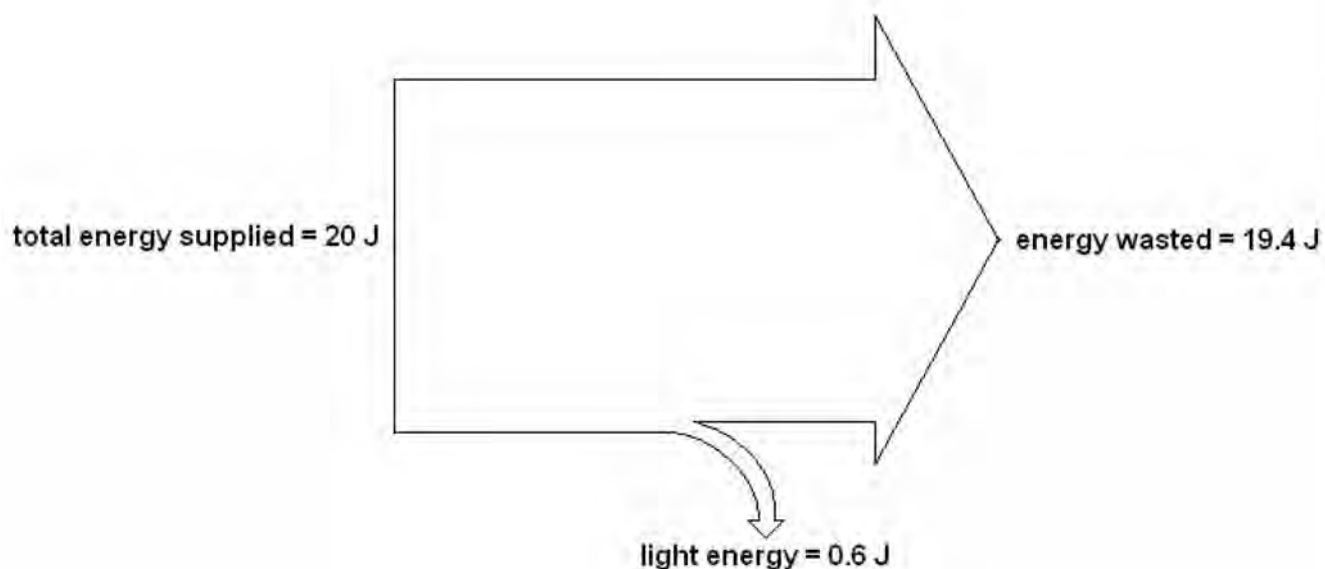
SECTION C: PHYSICS

Answer all of the questions in this section

- 7 Dr. Booth works for a company that makes lamps.



The energy transfer in their halogen lamps can be shown by this diagram.



(a)
$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}} \times 100\%$$



Calculate the efficiency of the halogen lamp.

(2)

efficiency =

Dr Booth has designed a new LED cluster lamp.
This gives out the same amount of light as their halogen lamp.

The table shows how the two lamps compare.

	halogen lamp	LED cluster lamp
		
Power consumption	20 W	4 W
Expected life	2 500 hours	50 000 hours
Price	£1.75	£6.20

(Source: © Shutterstock)

- (b) The lighting company is considering how well the new LED cluster lamp will sell.
Explain why you think that people would buy the new lamp.

Use a calculation to justify your answer.

(4)

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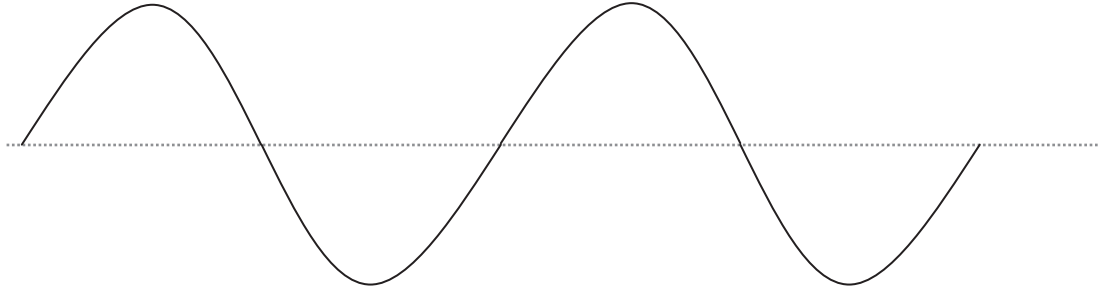
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(Total for Question 7 = 6 marks)

8 The diagram shows the electromagnetic spectrum.

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays
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(a) All of these waves have the following structure.



Label the diagram to show the following parts of the wave:

(i) wavelength (1)

(ii) amplitude (1)

(b) Complete the table to show one use and one harmful effect for each type of electromagnetic wave.

Some of the answers have been completed for you.

(2)

Type of electromagnetic wave	Use	Harmful effect
Infrared	Radiant heater	Skin burns at high doses
Ultraviolet		Damage to eyes
X-rays	Imaging	

(c) A mobile phone transmits microwaves with a frequency of 1.8×10^9 Hz.

The microwaves travel in air with a speed of 3.0×10^8 m/s.

$$\text{wave speed} = \text{wavelength} \times \text{frequency}$$

Calculate the wavelength of the microwaves transmitted by the mobile phone.

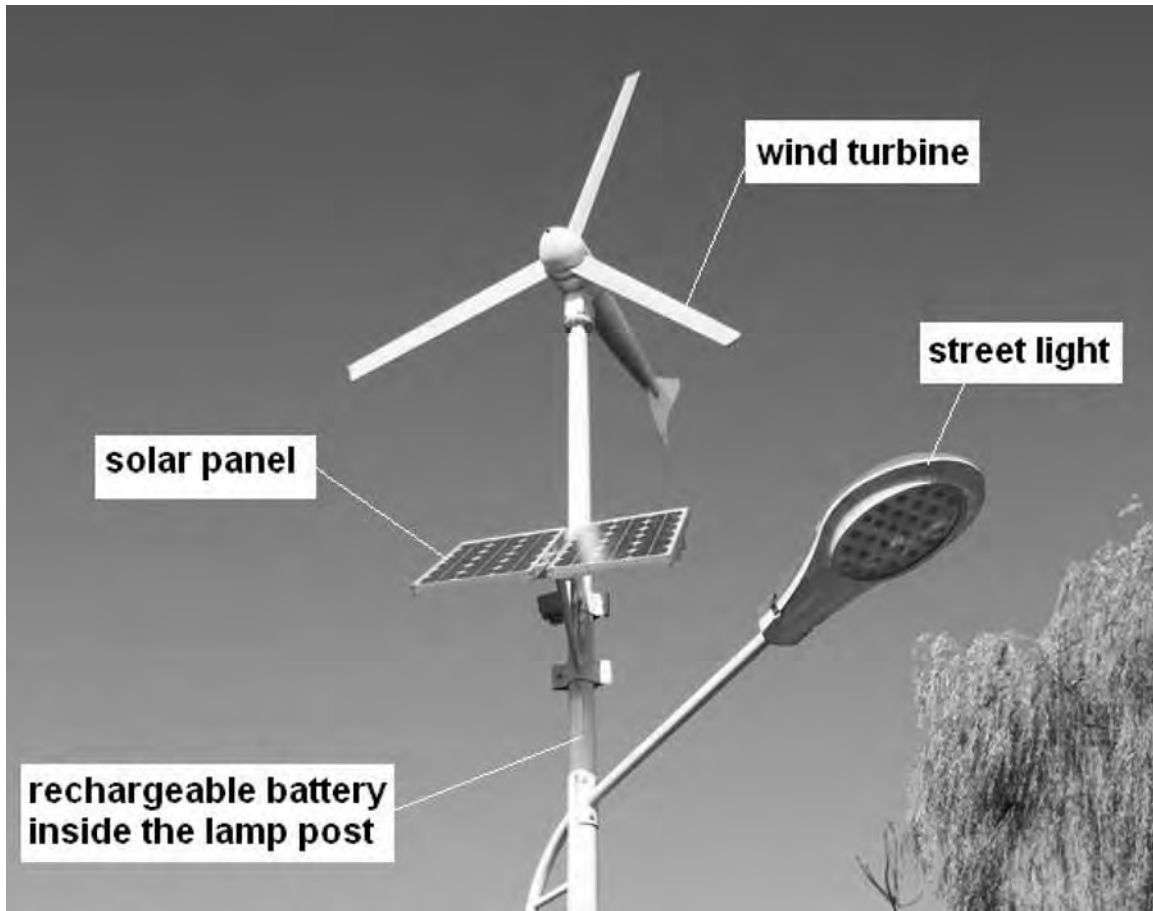
Show your working.

(2)

Wavelength = m

(Total for Question 8 = 6 marks)

- 9 The photograph shows part of a prototype for a street light that is designed to be powered entirely by renewable forms of energy. It uses both a small wind turbine and a solar panel.



(Source: © Azzim/Shutterstock)

Assess how successful the system, as shown in the photograph, would be at running the street light at a consistent level of brightness throughout the night, indicating what else might be needed to make it run effectively. Give a justification for your response.

(6)

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(Total for Question 9 = 6 marks)

TOTAL FOR SECTION C = 18 MARKS
TOTAL FOR PAPER = 54 MARKS

Unit 1: Principles of Science - Sample mark scheme

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

SECTION A: BIOLOGY

Item	Expected answers	Additional guidance	Marks
1 (a) (i)	Photosynthesis (1)		1
1 (a) (ii)	It contains genetic information (1) which controls the activities of the cell (1)		2
1 (b) (i)	Transpiration (1)		1
1 (b) (ii)	Any one of the following: Loss of water vapour from the leaf (1) causes water to travel through the xylem (1) Water enters into the plant through root hairs by osmosis (1) due to root pressure (1)		2
Total mark			6

Item	Expected answers	Additional guidance	Marks									
2 (a)	D		1									
2 (b)	<p>correct gametes (1)</p> <p>correct offspring (1)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>B</td> <td>b</td> </tr> <tr> <td>B</td> <td>BB</td> <td>Bb</td> </tr> <tr> <td>b</td> <td>Bb</td> <td>bb</td> </tr> </table>		B	b	B	BB	Bb	b	Bb	bb	Accept bB instead of Bb	2
	B	b										
B	BB	Bb										
b	Bb	bb										
2 (c)	<p>An explanation linking:</p> <ul style="list-style-type: none"> pedigree analysis will determine the likelihood that their offspring could inherit the CF allele (1) <p>with either of the following:</p> <ul style="list-style-type: none"> if heterozygous there is a 50% chance (that the CF allele) will be passed on/if 2 heterozygous parents 25% chance the offspring will have CF (1) if either parent is homozygous dominant there is 0% chance that their offspring could have the disease (1) 		2									
Total mark			5									

Item	Expected answers	Additional guidance	Marks
3 (a)	Motor neurone	Accept motor	1
3 (b)	<p>Sweat excreted by sweat glands (1) removes heat by evaporation of the sweat from the skin (1)</p> <p>Hair lies flat (1) so there is less insulation/less air trapped so heat escapes (1)</p> <p>Vasodilation/widening of blood vessels (1) as more blood is closer to skin surface so more heat escapes (1)</p>	<p>Award one mark for identification of each way her body responds.</p> <p>Award one mark for each linked explanation.</p>	6
Total mark			7

SECTION B: CHEMISTRY

Item	Expected answers	Additional guidance	Marks
4 (a)	5		1
4 (b)	An electron has a much smaller mass than a proton.		1
4 (c)	$(20 \times 10) + (80 \times 11)/100$ (1) = 10.8 (1)	$(200 + 80)/100$ (1) or $1080/100$ (1)	2
4 (d)	2 or 8 but not 3 for 1 mark 2, 8, 3 for 2 marks		2
Total mark			6

Item	Expected answers	Additional guidance	Marks
5 (a)	Any one of the following: It is on the right hand side of the periodic table (1) It is an inert gas/rare gas/noble gas (1)		1
5 (b)	Any two of the following: They have similar reactions to each other (1) They have similar properties to each other (1) They all have 1 electron in their outer shell (1)	Do not accept 'they are all alkali metals'	2
Total mark			3

Item	Expected answers	Additional guidance	Marks
6 (a)	Test – (bubble through) limewater (1) Result – (limewater turns) cloudy/milky (1)	Allow first mark if second is incorrect Do not allow second mark if first is not correct	2
6 (b)	Calcium chloride	Accept correct formulae CaCl_2	1
6 (c)	An explanation linking the following: Calcium carbonate doesn't dissolve in water (1) so adding excess calcium carbonate is not harmful (1) You could add excess sodium hydroxide (1) then the stomach becomes alkaline/too damaging (1)		4
6 (d)	Correct formulae in equation (1) Balancing of equation $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ (1)	Ignore state symbols Accept multiples/fractions	2
Total mark			9

SECTION C: PHYSICS

Item	Expected answers	Additional guidance	Marks
7 (a)	(0.6/20) X 100 (1) 3 (%) (1)		2
7 (b)	An explanation linking the following LED cluster lamp uses less power and lasts longer (1) which offsets higher price (1) And including a calculation: (175/2500)/(620/50000) (1) = 5.65 times more cost effective (1)	0.07/0.0124 (1)	4
Total mark			6

Item	Expected answers	Additional guidance	Marks
8 (a) (i)	A line from the mid-point of one trough/peak to the mid-point of the next (1)		1
8 (a) (ii)	A line from the mid-point of the wave to either a trough or a peak (1)		1
8 (b)	Ultraviolet use: fluorescent lamps/detecting forged bank notes/disinfecting water (1) X-ray harmful effect: mutation/damage to cells (1)	Accept any other correct answers	2
8 (c)	wavelength = $\frac{\text{wave speed}}{\text{frequency}}$ (1) 0.17(m) (1)	Allow 1.7×10^{-1} , 0.166666	2
Total mark			6

Item		Indicative content	Marks
9		<ul style="list-style-type: none"> • Wind and solar energy can be transformed into electrical energy. • Electrical energy cannot be stored by solar panels or turbines. • A rechargeable battery is required for a consistent supply of electrical energy. • Solar/wind to electrical to potential energy to electricity is not efficient. • A controller is needed to switch the street light on and off when required, so that energy is not wasted. • In sustained periods of overcast and low/very high wind conditions, not enough electrical energy would be generated to last a whole night. • A back-up mains supply may still be needed under certain conditions. <p>Answers should use appropriate scientific terminology.</p> <p>Answers should be given in terms of electrical energy rather than electricity.</p> <p>Do not accept answers related to costs, aesthetics or maintenance.</p>	6
Level	0	No rewardable material	
1	1-2	<ul style="list-style-type: none"> • A few key points identified, or one point described in some detail. The answer is likely to be in the form of a list. Points made will be superficial/generic and not applied/directly linked to the situation in the question. If a view on the effectiveness of the system is given it will not be justified. 	
2	3-4	<ul style="list-style-type: none"> • Some points described, or a few key points explained. The answer is unbalanced. Most points made will be relevant to the situation in the question, but the link will not always be clear. A view on the effectiveness of the system is given, but only partially or not clearly justified. 	
3	5-6	<ul style="list-style-type: none"> • A detailed explanation is given as to how the system works. The majority of points made will be relevant and there will be a clear link to the situation in the question. A view on the effectiveness of the system is given and fully justified. 	
Total mark			6

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