

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

Unit 2 Modules B5 C5 P5 (Higher Tier)

WEDNESDAY 18 JUNE 2008

Afternoon
 Time: 40 minutes

Candidates answer on the question paper.

Additional materials (enclosed):

None

Calculators may be used.

Additional materials: Pencil
 Ruler (cm/mm)



Candidate
Forename

Candidate
Surname

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE

Qu.	Max	Mark
1	5	
2	5	
3	4	
4	4	
5	7	
6	3	
7	4	
8	5	
9	5	
TOTAL	42	

This document consists of **18** printed pages and **2** blank pages.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved by the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric Circuits

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

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

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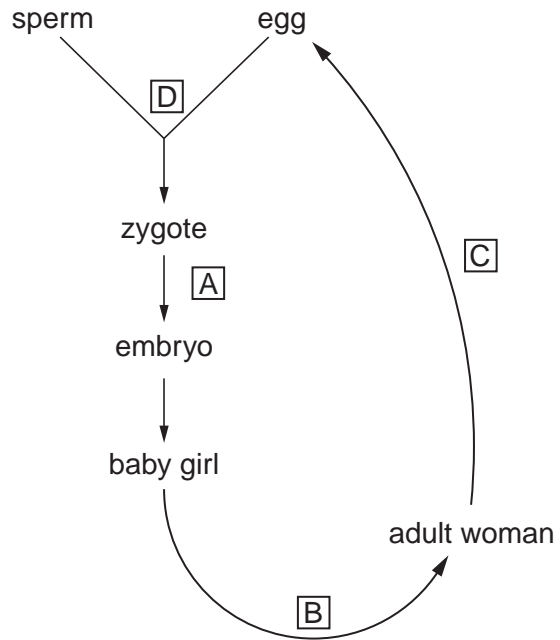
Question 1 starts on page 4

Answer **all** the questions.

- 1 This baby girl has just been born.
She is part of the human life cycle.



© Mother & Baby Picture Library / EMAP



- (a) At which stage, **A**, **B**, **C** or **D**, in the cycle does meiosis take place?

answer [1]

- (b) The chromosome number in most human body cells is 46.

Put a **ring** around the number of chromosomes in human cells produced by meiosis.

2 **23** **46** **92** [1]

- (c) Mitosis also takes place in the human life cycle.

What happens to the chromosome number when body cells divide by mitosis?

Put a **ring** around the correct answer.

doubles **halves** **quarters** **stays the same** [1]

(d) One of the stages in the human life cycle is the formation of a zygote.

Put ticks (✓) in the boxes to show if the statements about the zygote are **true** or **false**.

The zygote contains ...	true	false
... a unique combination of chromosomes.		
... a set of chromosomes from each parent.		
... only chromosomes from the mother.		
... twice the number of chromosomes found in the sperm.		
... half the number of chromosomes found in the egg.		

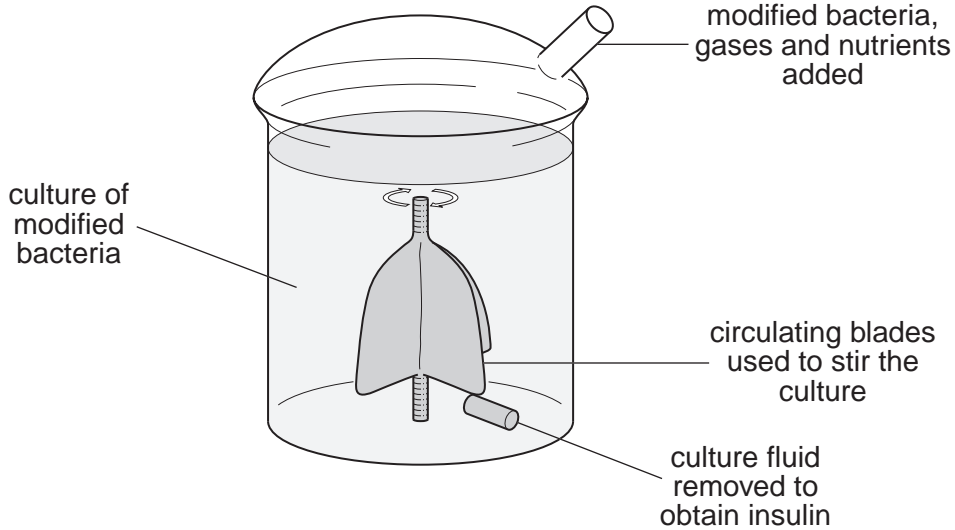
[2]

[Total: 5]

2 This question is about **genetic engineering**.

Bacteria have been modified by scientists so that they produce insulin.

These bacteria are grown in fermenters.



(a) Complete the following sentences.

Choose words from the list.

- | | | | | |
|--------------------|--------------|--------------------|-----------------|---------------|
| amino acids | bases | fatty acids | proteins | sugars |
|--------------------|--------------|--------------------|-----------------|---------------|

Bacteria that have not been modified cannot produce insulin. This is because their DNA does not have the correct sequence of

Human DNA is added to the bacteria so that they make insulin by putting the in the correct order.

[2]

(b) Most human cells cannot produce insulin.

What is the reason for this?

Put a tick (✓) in the box next to the correct answer.

- Human cells must remain unspecialised to produce insulin.
- Different cells in the body contain different genes.
- Some genes are not active in different human cells.
- All cells in the body contain the same genes.

[1]

(c) It is now possible to create **human** tissue cultures using embryonic stem cells.

The cultures can be used to make insulin commercially.

This technique is successful for a number of reasons.

Put ticks (✓) in the boxes to show if each reason is **true** or **false**.

reason	true	false
Embryonic stem cells are unspecialised.		
Embryonic stem cells grow rapidly.		
Some of the genes in the embryonic stem cells are switched on by the process.		
Genes coding for the production of insulin are added to the embryonic stem cells.		

[2]

[Total: 5]

3 Peter is studying the growth of plants.

(a) He examines the tissues inside a plant shoot and finds the **meristem**.

What is the function of the meristem?

Put a tick (✓) in the box next to the correct answer.

production of cells

site of photosynthesis

storage of food

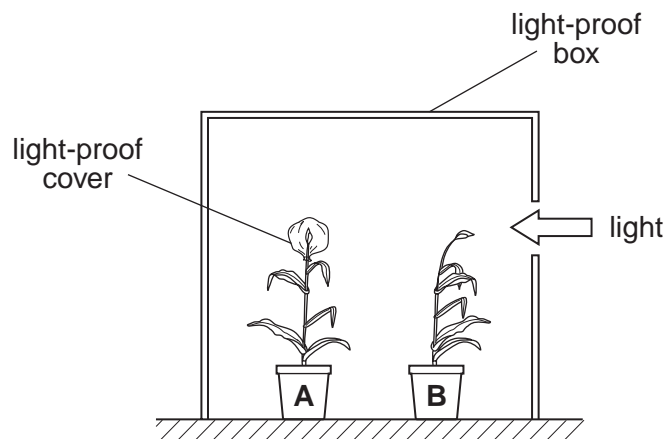
transport of water

[1]

(b) He then does an experiment to show the link between **auxin** and shoot growth.

He puts two young plants in a box for 3 days.

Look at the diagram.



Auxin is produced at the tip of the plant shoots.

What is the distribution of auxin in the shoots at the end of the experiment?

Put a tick (✓) in the correct box for shoots **A** and **B**.

shoot	more auxin in the side nearest the light	more auxin in the side away from the light	auxin in equal amounts on both sides
A			
B			

[2]

- (c) Peter takes a cutting from another plant and dips the cut surface in rooting powder containing auxins.

Complete the sentences.

Choose words from the list.

enzyme

fertiliser

hormone

inactive

specialised

unspecialised

Auxins are a type of plant

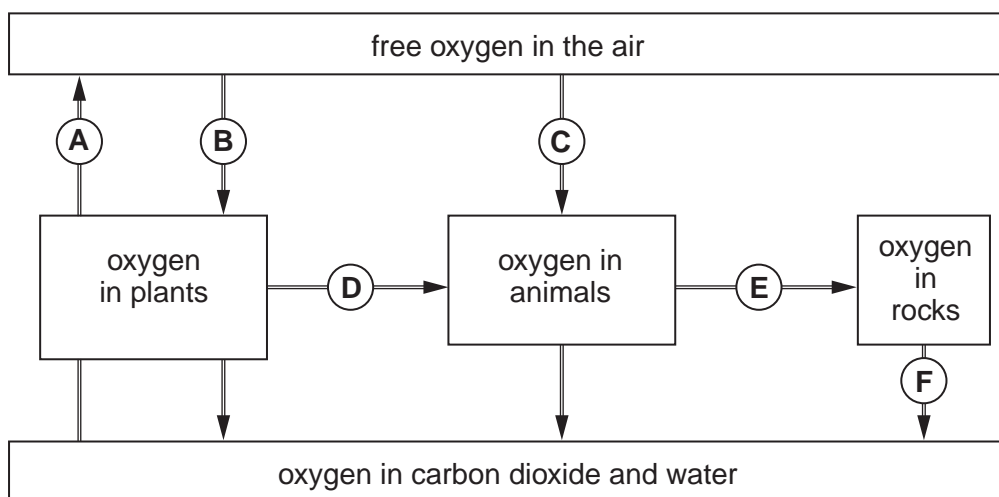
Auxins can change cells into xylem and phloem cells. [1]

[Total: 4]

10
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4 Tony draws a diagram of an oxygen cycle.



(a) Most of these stages take place fairly quickly.

Which stage, **A**, **B**, **C**, **D**, **E** or **F**, is most likely to keep the oxygen out of the air for millions of years?

answer [1]

(b) Give the letter for **one** stage which removes oxygen from the air.

Give the letter for **one** stage which puts oxygen into the air. [1]

(c) Oxygen gas is removed from the air when carbon burns to form carbon dioxide, CO₂.

How much carbon dioxide is formed when 12 g of carbon burns?

(relative atomic mass: C = 12, O = 16)

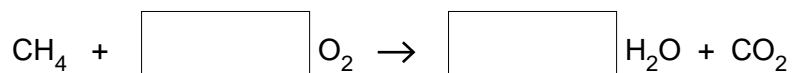
Put a (ring) around the correct answer.

- 28 g** **32 g** **44 g** **56 g**

[1]

(d) Another substance which removes oxygen gas from the air is methane, CH₄.

Put numbers in the boxes to balance the equation for this reaction.



[1]

[Total: 4]

5 We dig millions of tonnes of rock from the surface of the Earth.

(a) What is this part of the Earth called?

Put a (ring) around the correct answer.

atmosphere

biosphere

hydrosphere

lithosphere

troposphere

[1]

(b) Sometimes compounds from this rock are melted and then electrolysed to produce a metal.

Put a (ring) around each of the **two** of these substances which, when melted, can be electrolysed to produce metals.

aluminium oxide

carbohydrate

DNA

protein

silicon dioxide

sodium chloride

[2]

(c) Other compounds can be heated with carbon to extract the metal.

Put ticks (✓) in the **two** correct boxes to show what happens in this reaction.

The metal compound is oxidised.

The metal compound is reduced.

The carbon is oxidised.

The carbon is reduced.

[1]

(d) What can you say about the metals which can be extracted in this way?

Choose the **best** answer from **A**, **B**, **C** or **D**.

A They are totally unreactive.

B They are less reactive than carbon.

C They are just as reactive as carbon.

D They are more reactive than carbon.

answer [1]

(e) Which metals can be extracted by heating their ore with carbon?

Put a (ring) around each correct answer.

aluminium

copper

sodium

zinc

[1]

(f) Several reactions take place when iron is extracted from its ore.

Put numbers in the boxes to balance the equation for this reaction.

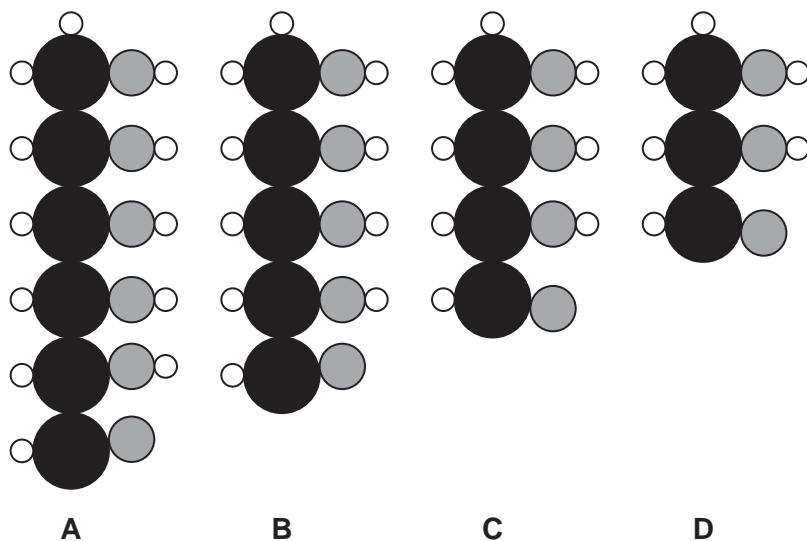


[1]

[Total: 7]

6 There are different types of sugar.

Here are diagrams of four of them.

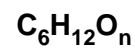
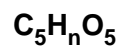
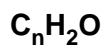
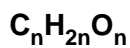
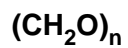


(a) Which sugar, **A**, **B**, **C** or **D**, has the formula $\text{C}_4\text{H}_8\text{O}_4$?

answer [1]

(b) Sometimes we use the letter 'n' for a number in a formula.

Put a (ring) around each formula which applies to **all** these sugars.

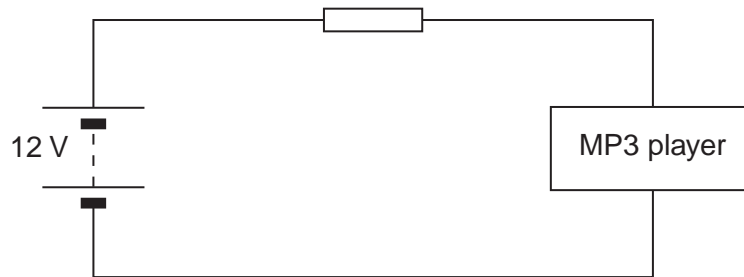


[2]

[Total: 3]

7 Jo likes to listen to her MP3 player in the car.

She uses this circuit to connect her MP3 player to the 12 V car battery.



(a) When the MP3 player is switched on, the potential difference across it is 1.5 V and the current in it is 0.05 A.

What is the power of her MP3 player?

Put a (ring) around the correct answer.

0.033 W

0.075 W

30 W

[1]

(b) Complete the sentences. Choose words from the list.

charge

power

resistance

temperature

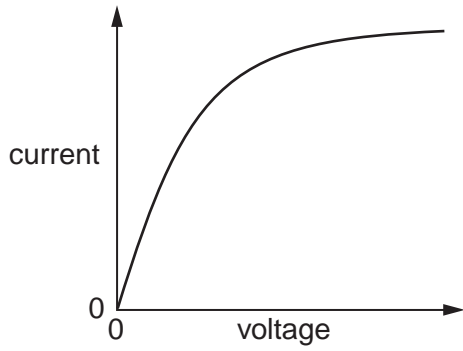
voltage

The resistor resists the flow of through the MP3 player.

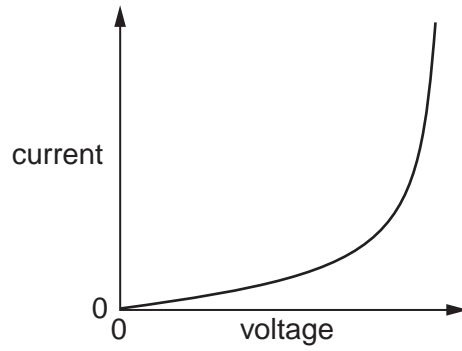
This results in an increase in for the resistor.

[2]

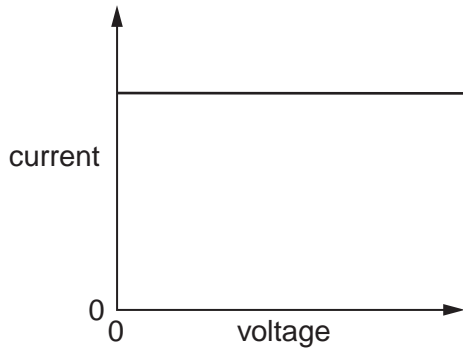
(c) Which of these graphs, **A**, **B**, **C** or **D**, shows how the current in the resistor depends on the voltage across it?



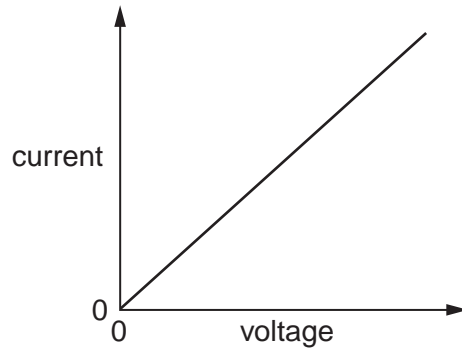
A



B



C

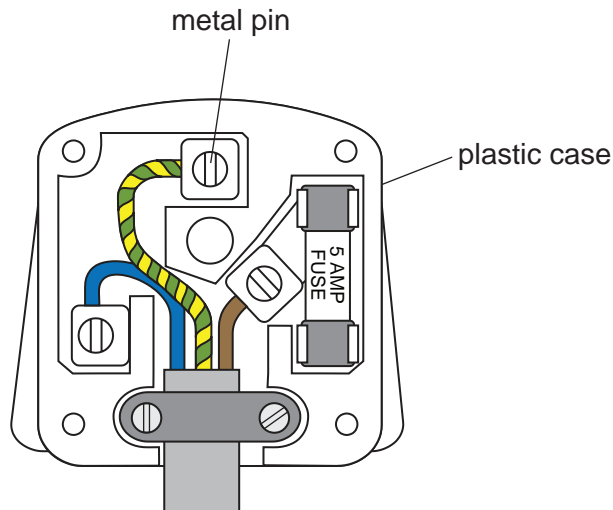


D

answer [1]

[Total: 4]

- 8 Julie investigates the mains plug on her computer.



- (a) The fuse contains a piece of wire which melts when the current is greater than 5 A.

Put a tick (✓) in the box next to the correct explanation of this heating effect.

The heating effect of the fuse wire is caused by ...

- ... emission of moving electrons by stationary atoms.
- ... absorption of moving electrons by stationary atoms.
- ... collisions between moving electrons and stationary atoms.

[1]

- (b) Julie calculates the **maximum power** she can draw from a mains socket using the plug.

Which of these is the correct calculation?

Put a (ring) around the correct answer.

$\frac{230}{5}$ 230×5 $\frac{5}{230}$ $\frac{50}{5}$ 50×5

[1]

(c) Complete the sentences.

Choose words from the list.

atoms

conductors

current

electrons

insulators

ions

resistance

voltage

The metal pins on the plug are

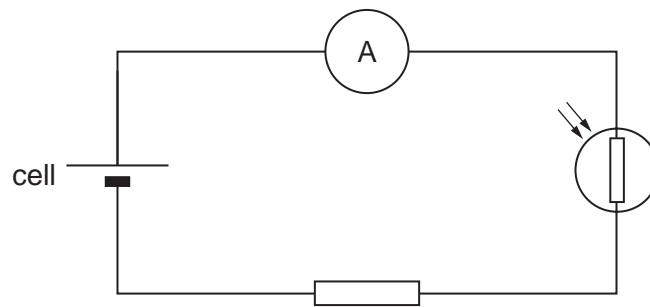
This is because they contain free

They have a low

[3]

[Total: 5]

- 9 Daniel builds this circuit. It contains an LDR.



- (a) Daniel needs to measure the potential difference across the LDR.

To do this he adds a meter to the circuit.

Draw on the circuit diagram to show the meter connected correctly.

[1]

- (b) Daniel increases the amount of light on the LDR.

The sentences explain how this affects the ammeter reading.

They are **not** in the correct order.

- A The current in the circuit increases.
- B The resistance of the LDR decreases.
- C There are more free electrons in the LDR.

Fill in the boxes to show the correct order.

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[2]

- (c) The voltage across the cell is **1.5 V**.

When the voltage across the LDR is 0.5 V, what is the voltage across the resistor?

Put a **ring** around the correct answer.

0 V

0.5 V

1.0 V

1.5 V

2.0 V

[1]

(d) Daniel replaces the cell with two cells in parallel.

Complete the sentence.

Choose from this list.

bigger than

smaller than

the same as

The current in the circuit is now it was for just one cell.

[1]

[Total: 5]

END OF QUESTION PAPER

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