OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B651/02

PHYSICS B

Unit 1 Modules P1 P2 P3
(Higher Tier)

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Monday 19 January 2009
Morning

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Section	**Max.**	**Mark**
A	**20**	
B	**20**	
C	**20**	
TOTAL	**60**	

OCR is an exempt Charity

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

fuel energy input = waste energy output + electrical energy output

power = voltage × current

energy supplied = power × time

energy (kilowatt hours) = power (kW) × time (h)

wave speed = frequency × wavelength

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

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

force = mass × acceleration

work done = force × distance

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}\,mv^2$$

potential energy = mgh

weight = mass × gravitational field strength

Answer **all** the questions.

Section A – Module P1

1 **(a)** Doctors use thermometers to measure a patient's temperature.

They sometimes take a picture called a **thermogram**.

The thermogram shows the temperatures of different parts of the skin.

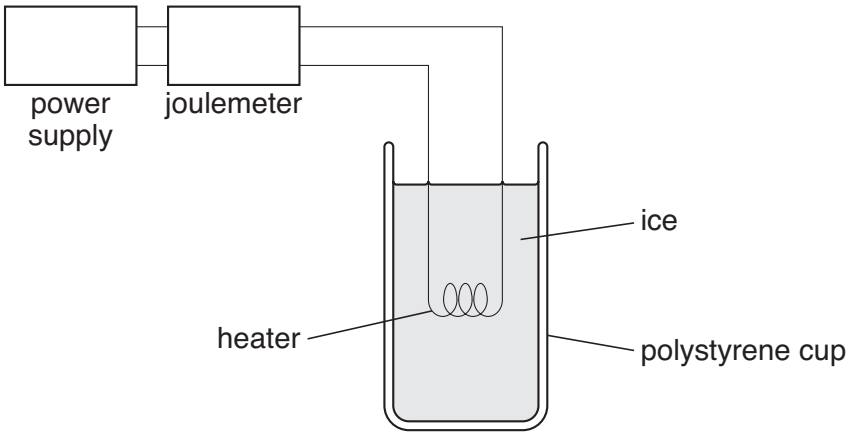
How does a thermogram show **different** temperatures?

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

(b) Jasmine investigates how much heat is needed to melt ice.

She uses the following equipment.

Look at the diagram.



The heater melts 4.2 g of ice.

This takes 1500 joules of energy.

Calculate the **specific latent heat** of ice.

The equations on page 2 may help you.

.....

.....

.....

answer ..... J/g **[2]**

[Total: 3]

2 **(a)** Kevin wants to save money by insulating his house.

He wants to reduce the energy lost by conduction.

Suggest **one** way he could reduce the energy lost by **conduction**.

.....

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

(b) To save more money Kevin replaces the light bulbs in his house with 'low-energy bulbs'.

One of the light bulbs uses 40 000 joules of electrical energy in one hour.

It gives out 10 000 joules of light energy in one hour.

Calculate the **efficiency** of the bulb.

The equations on page 2 may help you.

.....

.....

.....

answer ..... **[2]**

(c) Energy from Kevin's central heating radiator warms his room by **convection**.

Explain how a convection current is produced and how it warms his room.

In your answer write about

- the movement of air particles
- changes in density
- transfer of energy.

.....

.....

.....

.....

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

[Total: 6]

3 This question is about electromagnetic waves.

(a) A laser produces an intense beam of light waves.

All the waves have the same frequency and are in phase with each other.

(i) Explain what is meant by an **intense** beam of light.

.....

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

(ii) Explain what is meant by **in phase** with each other.

.....

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

(iii) CD players use laser beams.

The light is reflected from a shiny surface.

This produces a digital signal.

What is a digital signal?

.....

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

(b) **(i)** Louis cooks a large potato.

The middle of the potato gets hot more quickly if he uses a microwave oven instead of a conventional oven.

Explain why.

.....

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

(ii) The walls of his microwave oven are made of **shiny metal**.

The shiny metal walls do **not** get hot.

Explain why.

.....

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

(iii) Microwaves are used for cooking.

Write down one **other** use of microwaves.

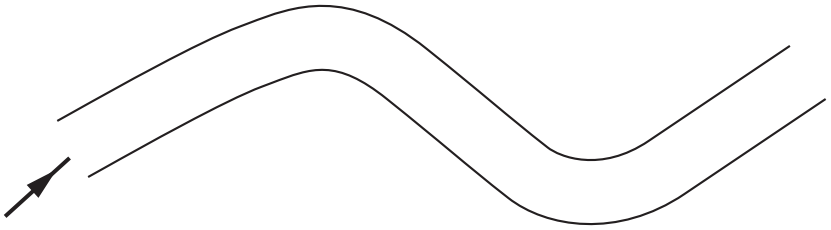
..... **[1]**

[Total: 6]

4 Mirrors reflect light.

Light can also be reflected along optical fibres without mirrors.

(a) Complete the diagram to show a ray of light passing along the optical fibre and out the other end.



[1]

(b) Certain conditions are needed for total internal reflection.

Complete the sentences.

Light is reflected at the boundary between …… and …… .

The angle of incidence must be …… than the critical angle. **[2]**

[Total: 3]

5 There is an ozone layer in the Earth's upper atmosphere.

A 'hole' has appeared in this layer.

(a) Suggest what causes the hole in the ozone layer.

.....

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

(b) Why is the hole in the ozone layer harmful to humans?

.....

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

[Total: 2]

Section B – Module P2

6 Some road signs have lights.

These lights are powered by photocells.

The picture shows one of these signs.

(a) Using photocells has **advantages** and **disadvantages**.

Describe **one** advantage and **one** disadvantage of using photocells.

advantage .....

.....

disadvantage .....

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

(b) The power output of photocells can vary.

The power output of the photocells on the street sign **decreases**.

Suggest **two** different causes for this.

1 .....

.....

2 .....

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

[Total: 4]

7 This question is about electrical power.

Sam has many electrical appliances in his house. One of them is an electric cooker.

The electric cooker has a power of 5 kW (5000 watts).

It is switched on and used for 3 hours.

Electricity costs 12 p for each unit.

Calculate the **cost** of using the electric cooker for 3 hours.

The equations on page 2 may help you.

.....

.....

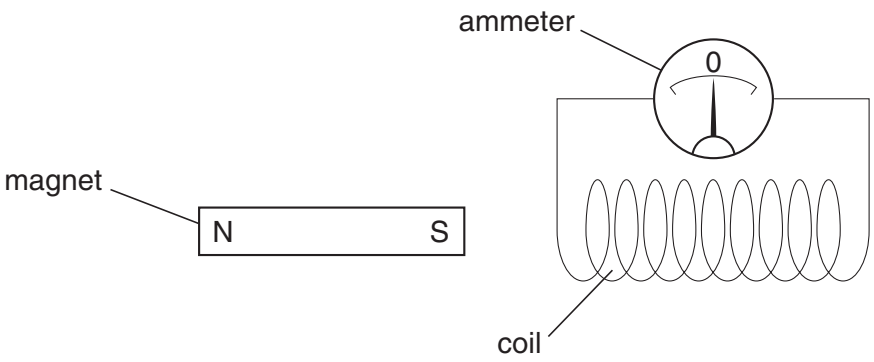
.....

answer = ... pence **[2]**

[Total: 2]

8 This question is about the **dynamo effect**.

Look at the diagram.



The ammeter shows that a current is produced if

- the magnet is moved
- the coil is moved.

(a) Describe two things that would **increase** the current.

1 .....

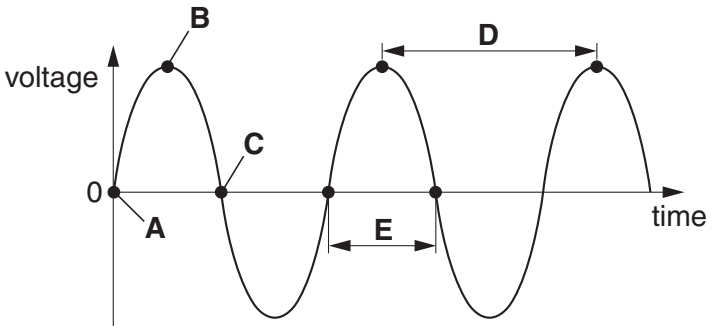
2 ..... **[2]**

(b) The ammeter is replaced by a cathode ray oscilloscope (CRO).

The magnet is moved steadily towards and away from the coil.

Alternating current (AC) is produced.

The pattern on the screen of the CRO looks like this:



(i) Where does the current change direction?

Choose from: **A** **B** **C** **D** **E**

answer ..... **[1]**

(ii) Which letter represents **one cycle** of AC?

Choose from: **A** **B** **C** **D** **E**

answer ..... **[1]**

(iii) The AC produced has a frequency of 4 hertz (Hz).

Explain what the term **frequency of 4 Hz** means.

.....

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

[Total: 6]

9 This question is about the Earth, the Moon and other objects in the Universe.

This is a photograph of the Earth-Moon system.

(a) Some scientists think that our Earth-Moon system was formed after a collision.

They think that billions of years ago something hit the Earth.

Describe how our Earth-Moon system could have been formed in this way.

.....

.....

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

(b) Describe **one** piece of evidence for this explanation of how our Moon was formed.

.....

.....

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

[Total: 4]

10 This question is about space.

Draw **one** line from each **object** to the best **statement** about it.

object	statement
galaxy	ends its life as a white dwarf
black hole	can produce a supernova
heavy-weight star	does not allow light to escape from it
medium-weight star	moves away from us if distant

[2]

[Total: 2]

11 Dealing with nuclear waste is a difficult problem.

One problem is that it is very expensive to reprocess the nuclear waste.

Write down one other problem of dealing with nuclear waste.

.....

.....

Explain why this is a problem.

.....

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

[Total: 2]

Section C – Module P3

12 Mark calculates the average speed of pupils running on the school field.

He needs to measure

- **distance**
- **time**.

He then calculates the speed of the runners.

(a) These are the results for one of the runners.

distance = 120 metres	**time = 20 seconds**

Calculate the average **speed** of this runner.

The equations on page 2 may help you.

.....

.....

.....

answer .....m/s **[2]**

(b) This runner then runs again at a **faster** speed.

(i) What happens to the **distance** travelled in 20 seconds?

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

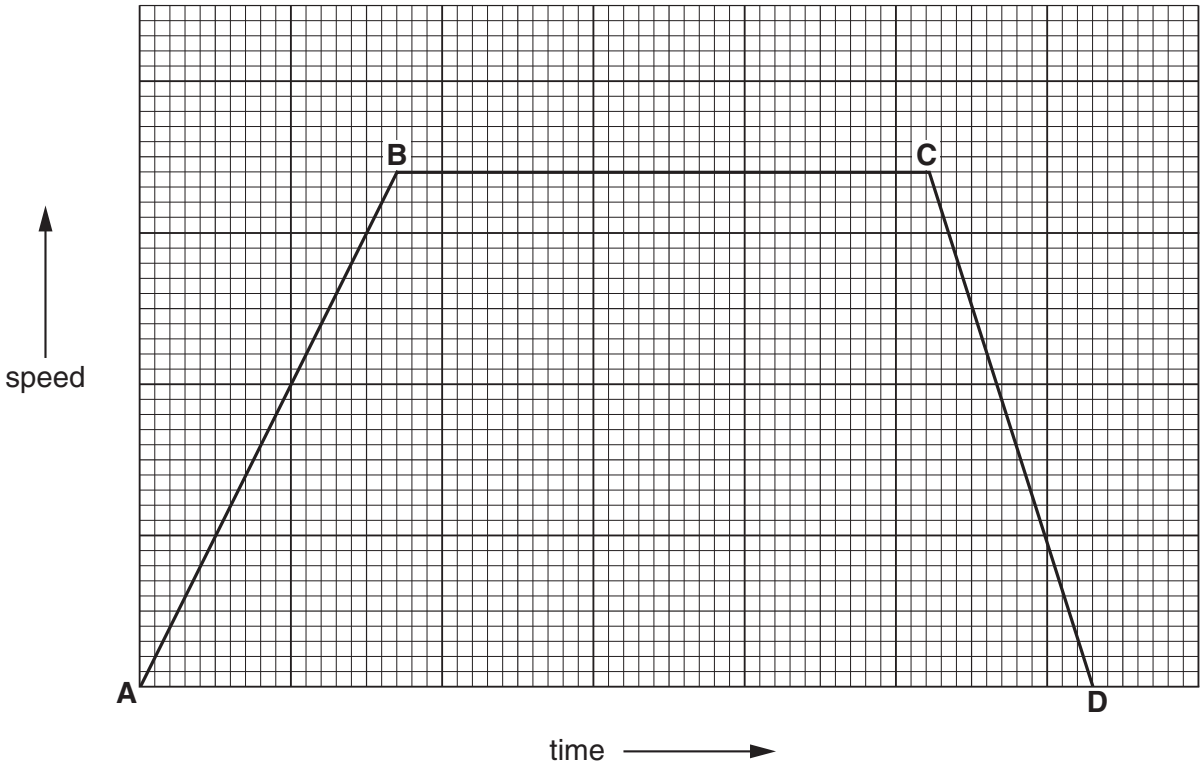
(ii) What happens to the **time** taken to run 120 metres?

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

(c) Mark measures the speed and time for Tom running.

He draws a graph of the results.

Look at the speed-time graph for Tom.



(i) Describe what is happening to Tom's speed between points **A** and **B** on the graph.

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

(ii) Describe what is happening to Tom's speed between points **C** and **D** on the graph.

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

(iii) How could Mark calculate the distance travelled using the **graph**?

.....

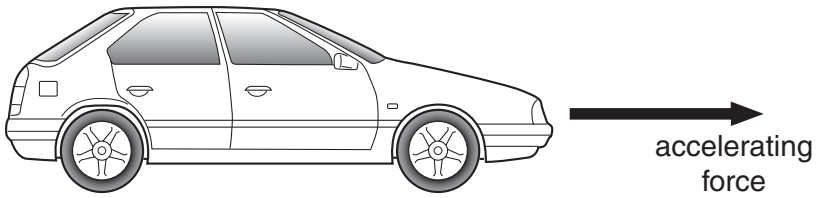
..... **[1]**

[Total: 7]

13 This question is about forces and motor cars.

Emily is going to drive her car.

Look at the diagram of Emily's car.



(a) Emily starts her car and drives forwards.

The car accelerates at 3 metres per second squared (m/s^2).

Calculate the accelerating **force** on the car.

The equations on page 2 may help you.

.....

.....

.....

answer ..... N **[2]**

(b) When Emily's car is moving it has **kinetic energy (KE)**.

How could she **increase** the KE of her car?

Write down **two** things that she could change.

1 .....

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

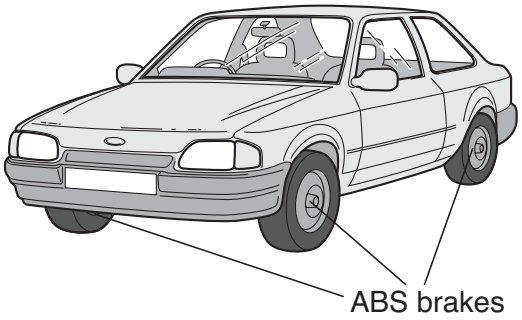
[Total: 4]

14 This question is about car safety.

Matthew is learning about safety features in motor cars.

Modern cars have many safety features.

Look at the diagram.



(a) ABS brakes are an example of an **active** safety feature on a car.

Matthew has just started to make some notes about ABS brakes.

Complete the notes to explain how this feature works.

In your answer write about

- how ABS helps the driver to drive the car safely
- the forces on the road and the brake pedal
- the possible effect on braking distance.

ABS brakes:

ABS brakes help a car stop more safely.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

(b) Matthew is also interested in the **power** of cars.

He finds some information about a car.

Look at the information.

driving force on car = 3000 newtons
car moves 250 metres in 15 seconds

Use this information to calculate the power of the car.

The equations on page 2 may help you.

.....

.....

.....

answer ..... watts **[3]**

[Total: 6]

15 Britney is a skydiver.

Skydivers jump out of planes.

Britney's speed increases for several seconds.

Britney then reaches a **terminal velocity (terminal speed)**.

(a) Complete these sentences to explain why Britney's speed changes and reaches terminal velocity as she falls.

Use your ideas about the **forces** acting on Britney in your answers.

1 Britney's speed increases because .....

.....

2 Britney reaches terminal velocity when .....

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

(b) Britney changes the position of her body as she falls.

She **now** falls with her body in a horizontal position.

She has a **lower** terminal velocity.

Explain why.

.....

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

END OF QUESTION PAPER **[Total: 3]**

PLEASE DO NOT WRITE ON THIS PAGE