OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION
GATEWAY SCIENCE

B651/02

PHYSICS B
Unit 1 Modules P1 P2 P3 (Higher Tier)

Candidate forename		Candidate surname	

Centre number					Candidate number				

INSTRUCTIONS TO CANDIDATES

* Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
* Use black ink. Pencil may be used for graphs and diagrams only.
* Read each question carefully. Make sure you know what you have to do before starting your answer.
* Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
* Answer **all** the questions.
* Do **not** write in the bar codes.

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 **24** pages. Any blank pages are indicated.

Turn over

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

3

Answer **all** the questions.

Section A – Module P1

1 This question is about the electromagnetic spectrum.

Look at the diagram. It shows the seven types of electromagnetic radiation.

the electromagnetic spectrum

radio waves	microwaves	infrared	visible light	ultraviolet	X-rays	gamma rays

long wavelength   short wavelength
low frequency   high frequency

(a) Some ovens cook food using a grill.

The grill is in the top of the oven.

The walls of the oven are shiny.

Explain how the **infrared** waves cook the food.

In your answer write about

- why the walls of the oven are shiny

- what part of the food is cooked by the infrared waves

- the effect of the infrared waves on the food particles.

....

....

....

....

.... **[3]**

(b) Some infrared waves have a **higher** frequency. They can be dangerous.

The food could burn and cause a fire.

Why would the higher frequency waves do this?

....

.... **[1]**

Turn over for the remainder of question 1

(c) Ultraviolet (UV) waves cause sunburn.

Putting sun cream onto your skin can allow you to safely stay in the sun for longer.

The sun protection factor (SPF) is used to calculate the safe time you can be in the sun.

(i) Complete the table.

safe time in the sun without sun cream	safe time in the sun with sun cream, SPF 20
6 minutes	.... minutes

[1]

(ii) A person with dark skin can safely stay in the sun for longer.

Complete the sentences to explain why.

Choose from

absorbs

bone

organs

reflects

takes

tissue

Darker skin .... more UV radiation.

This means that **less** UV radiation reaches the .... beneath the skin surface. **[2]**

(d) An electromagnetic wave has

- a frequency of 30 000 000 Hz

- a wavelength of 10 metres.

Calculate the speed of the electromagnetic wave.

The equations on page 2 may help you.

....

....

....

....

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

[Total: 9]

2 Sanjay wants to save money on his energy bills.

He finds some information about the costs of some energy saving methods.

Look at the table.

	energy saving method	cost to fit in £	money saved each year on energy bills in £	payback time in years
A	cavity wall insulation	300		3
B	double glazing	6000		20
C	loft insulation	240		6

(a) Complete the table.

Sanjay thinks that double glazing will save him the **most** money in a year.

Is Sanjay correct?

answer ....

Explain your answer by using the completed table.

....

.... **[2]**

(b) Sanjay only has a small amount of money to spend.

He decides to have cavity wall insulation.

Explain why this is a **good** decision.

....

.... **[1]**

[Total: 3]

3 Leanne is cooking some potatoes in a pan.

boiling water inside pan

the temperature in the room is 20 °C

burning gas
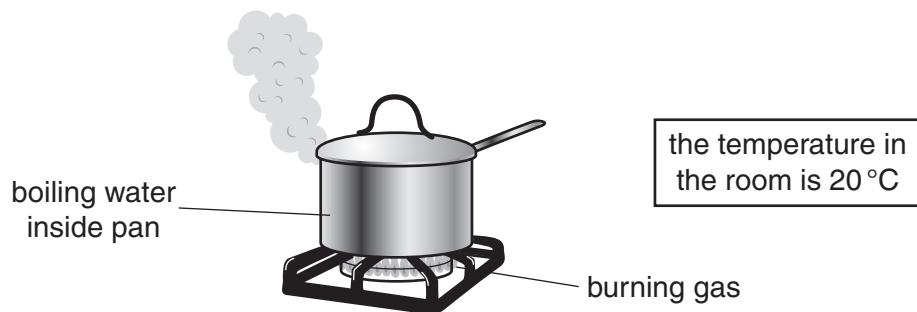
The water starts at room temperature (20 °C).

When the water is **boiling** heat is still being added.

When it is boiling the temperature of the water does **not** go above 100 °C.

Complete these sentences.

The temperature of the water is a measure of **hotness** on a scale which is ....

Heat being added is a measure of **energy** on a scale which is ....

When the water is boiling the energy is used to break the .... bonds. **[3]**

[Total: 3]

Turn over

8

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4 Signals are used to transmit data. There are two types of signal.

One type is digital.

(a) Complete this sentence to describe a **digital** signal.

A digital signal is either .... or .... **[1]**

(b) Most radio stations broadcast using digital signals.

Look at the diagram of a digital signal.

signal

time
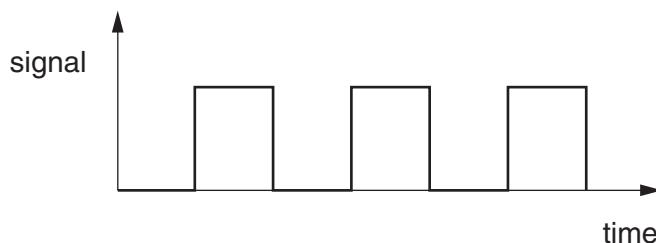
Using digital signals has **advantages**.

Describe two **advantages** of using digital radio signals.

1 ....

....

2 ....

.... **[2]**

[Total: 3]

Turn over

5 Look at the diagram of a radiator in a room.
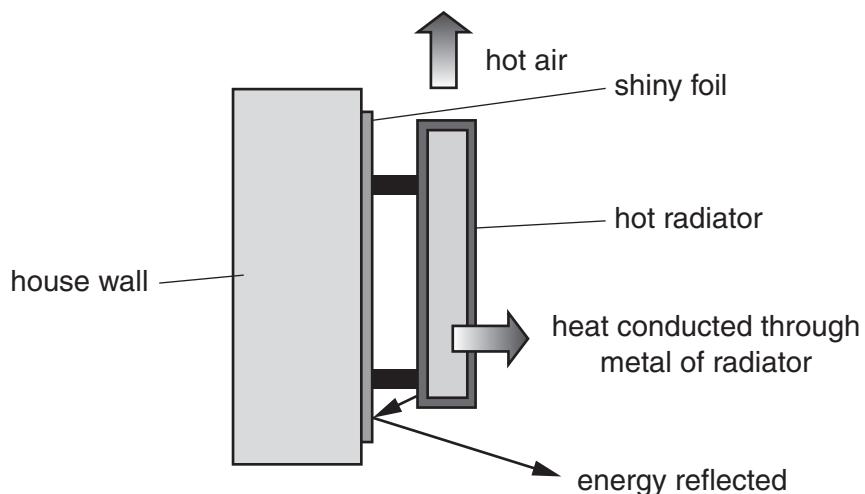
Energy is transferred by 3 methods

- conduction

- convection

- radiation.

Complete the boxes, on the next page, about how the hot radiator heats the room.

Choose the **best** words from the list.

air

container

density

heat

kinetic

mass

medium

metal

particles

temperature

water

conduction	This is the transfer of .... energy between .... in the metal radiator.

convection	This happens because of the fall in .... of the .... surrounding the radiator.

radiation	Infrared radiation can travel through a vacuum; it does not need a .... to travel in.

[2]

[Total: 2]

Turn over

Section B – Module P2

6 The Sun's energy can be harnessed in a number of ways.

(a) Wind turbines use the Sun's energy.

Look at the picture.

Complete the sentence.

Wind turbines transfer the .... energy of the air

into .... energy. **[2]**

(b) Photocells produce direct current (dc).

What is direct current (dc)?

....

.... **[1]**

(c) Passive solar heating can be used to heat offices and homes.

Explain how passive solar heating works.

In your answer write about the properties of glass and the properties of radiation.

....

....

....

....

.... **[3]**

[Total: 6]

7 This question is about fuels used to generate electricity.

(a) Biomass can be fermented to produce a fuel.

What gas is made when biomass is fermented?

Choose from

carbon monoxide

hydrogen

methane

propane

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

Turn over for the remainder of question 7

(b) It costs money to use electrical appliances.

The cost depends on the power rating of the appliance in watts (W).

(i) An 'old type' light bulb uses a current of 0.26 A when connected to a 230 V supply.

Calculate the power rating of this light bulb.

The equations on page 2 may help you.

....

....

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

(ii) An energy saving light bulb is just as bright as an 'old type' light bulb.

But the energy saving light bulb has a lower power rating.

This energy saving light bulb is rated at 230 V, 9 W.
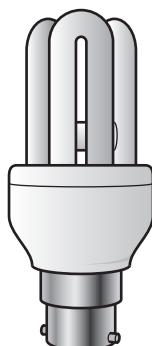
The bulb is switched on. It uses one unit of electricity (1 kWh).

How long is it switched on for?

The equations on page 2 may help you.

....

....

....

answer .... hours **[2]**
[Total: 5]

8 This question is about nuclear radiation.
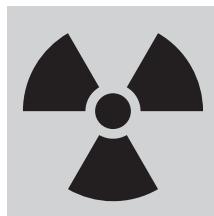
(a) Some unstable atoms give out nuclear radiation.

Write down the name that we give to unstable atoms.

.... **[1]**

(b) Nuclear radiation ionises particles.

When a particle is ionised it becomes an ion.

What happens to a particle when it is ionised?

....

.... **[1]**

(c) Nuclear material must be disposed of carefully.

Write down one way this can be done.

.... **[1]**

[Total: 3]

Turn over

9 Complete the following sentences about cosmic rays.

Cosmic rays are fast moving particles which spiral around the

Earth's .... and move towards the ....

When cosmic rays hit the Earth's .... they create

.... rays.

They are responsible for the brightly coloured lights in the northern sky called the

Northern Lights or the .... **[3]**

[Total: 3]

10 This question is about comets.

Comets have very large orbits.

(a) What is the **shape** of a comet's orbit?

.... **[1]**

(b) Comets need a centripetal force to keep them moving in an orbit.

What provides this force?

.... **[1]**

(c) The speed of a comet changes as it travels around the Solar System.

Where is the comet's speed highest?

....

.... **[1]**

[Total: 3]

Section C – Module P3

11 The hull of this ship is being painted.

The paint reduces friction.

hull of ship

(a) When the ship is moving at a **constant speed**, one of the following statements is true.

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

The thrust from the engines is equal to the drag. ☐

The thrust from the engines is greater than the drag. ☐

The thrust from the engines is less than the drag. ☐

The thrust from the engines is increasing as the drag is decreasing. ☐

The thrust from the engines is decreasing as the drag is increasing. ☐

[1]

(b) When the ship is full of cargo, its maximum speed decreases.

Explain why.

....

....

.... **[2]**

(c) What effect does speed have on drag?

.... **[1]**

[Total: 4]

Turn over

**12** Many years ago, the speed of a car was measured by two policemen.

One policeman would drop his hand as the car passed.

This was a signal to the second policeman further along the road.
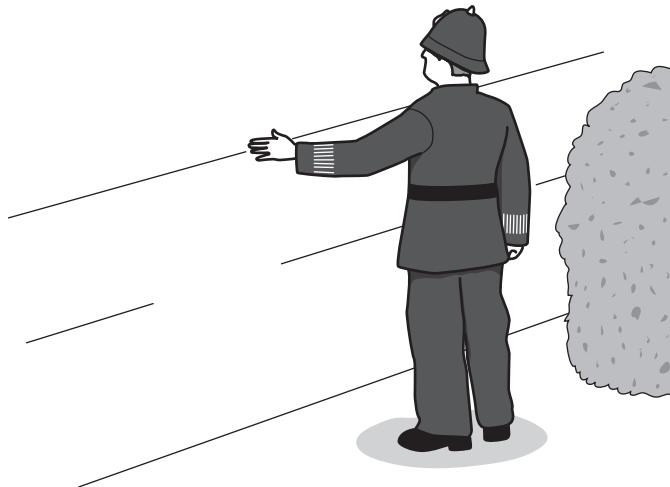
(a) The two policemen are 200 m apart.

The car they timed took 15 s to travel 200 m.

Calculate the **speed** of the car.

The equations on page 2 may help you.

....

....

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

(b) The car was travelling at a **constant speed**.

(i) Use the axes to sketch a distance-time graph for the car.

distance

↑
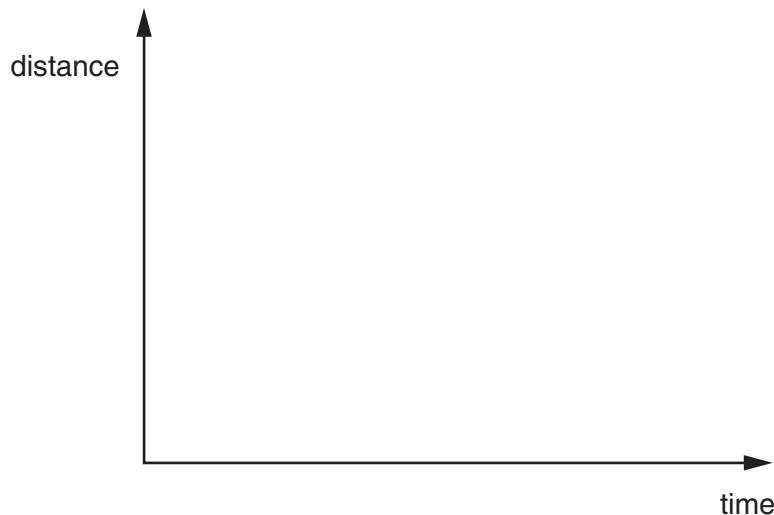
time →

[1]

(ii) How can you use a distance-time graph to find out the speed of a car?

....

.... **[1]**

(c) A car is travelling at a constant speed. It is also accelerating.

Explain how a car can accelerate but still travel at a constant speed.

....

.... **[1]**

[Total: 5]

13 Robert is doing chin-ups.

Every time he does a chin-up he is doing work.

(a) Robert does 540 J of work every time he does a chin-up.

He does 20 chin-ups in 60 seconds.

Calculate his power.

The equations on page 2 may help you.

....

....

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

(b) Robert lets go of the beam and falls.

Complete the sentence.

.... energy is converted to .... energy.   **[1]**

[Total: 3]

14 Car drivers must always be very careful when passing parked cars.

If a child runs out, the driver may need to brake suddenly.
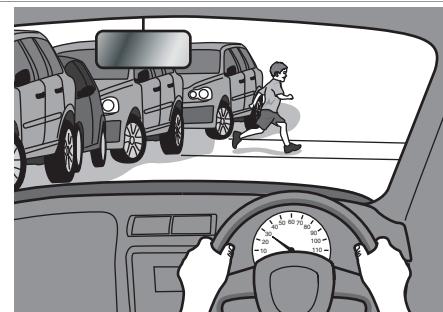
(a) When a driver is tired his **thinking distance** increases.

Suggest **one** other factor that will increase thinking distance.

.... **[1]**

(b) When the brakes are worn **braking distance** increases.

Explain why.

....

....

.... **[2]**

(c) The braking distance for a car travelling at 20 mph is 6 m.

The braking distance for a car travelling at 40 mph is 24 m.

The braking distance at 40 mph is a lot further than the braking distance at 20 mph.

Explain why.

....

....

....

.... **[2]**

[Total: 5]

Turn over

15 Most cars have airbags.

Airbags are an example of a safety feature.
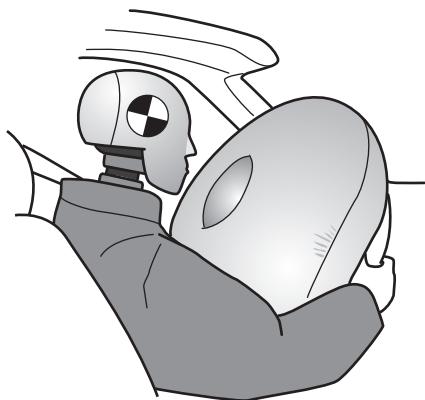
(a) A car has crashed.

Look at the picture. The airbag has inflated.

Describe what happens after the airbag has inflated.

....

....

.... **[2]**

(b) An airbag is one safety feature which is useful in a crash.

Write down the name of one **other** safety feature which is useful when a car crashes.

.... **[1]**

[Total: 3]

END OF QUESTION PAPER

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