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Wednesday 30 May 2012 – Afternoon

GCSE GATEWAY SCIENCE
PHYSICS B

B651/02 Unit 1 Modules P1 P2 P3 (Higher Tier)

B621080612

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)

Duration: 1 hour

B651102

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. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- 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).
- 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.

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

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Question 1 begins on page 4.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

Section A – Module P1

1 Alfie has high fuel bills for his house in winter.

He uses energy saving methods to reduce his fuel bills.

(a) Alfie has cavity foam insulation added to his house.

It costs **£900**.

It saves him **£200** each year in fuel bills.

Calculate the **payback time** for cavity foam insulation.

.....

.....

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

(b) Alfie has a new gas fire fitted. He thinks it is better than his old fire.

Look at the information in the table.

	old fire	**new fire**
energy input by gas in J	2000	.....
heat output to room in J	880	900
wasted energy through exhaust gases in J	1120	.....
efficiency	.....	.....

Alfie's new fire has **twice** the efficiency of the old fire.

Complete the table for both fires.

Calculate the efficiency of the old fire first.

The equations on page 2 may help you.

[3]

[Total: 4]

2 This question is about waves.

(a) Of all the radiations in the electromagnetic spectrum gamma radiation has the highest frequency.

What does **frequency** mean?

.....

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

(b) **Laser beams** are used in CD players.

Explain how a laser beam is used in a CD player.

In your answer write about

- what a laser beam is
- how information is stored on the CD
- how information is retrieved from the CD using the laser beam.

.....

.....

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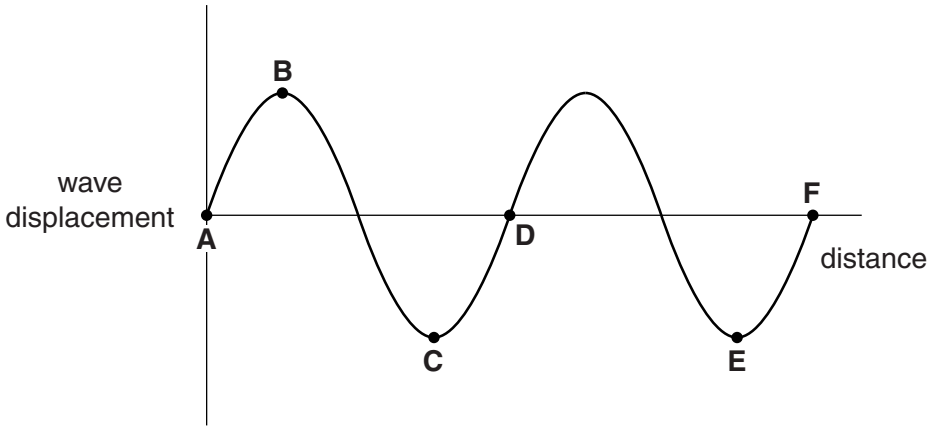
.....

.....

..... **[4]**

(c) Look at the diagram of a wave.



The distance between **A** and **F** is 8 cm.

The frequency of the wave is 0.6 Hz.

What is the **speed** of the wave?

The equations on page 2 may help you.

Choose from

0.15 **2.4** **4.8** **7.4** **8.6**

answer ..... cm/s **[1]**

(d) Microwaves are used to cook food.

(i) A potato is cooked in a microwave oven.

Explain what happens to the potato when it absorbs microwaves.

Use ideas about particles in your answer.

.....

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

(ii) Microwave ovens have **shiny** metal walls inside.

Explain why.

.....

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

(iii) Ready meals for the microwave oven cook quickly.

These meals are usually about 2 cm thick.

Suggest why.

.....

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

(iv) Microwave turntables and dishes are made of glass.

Explain why.

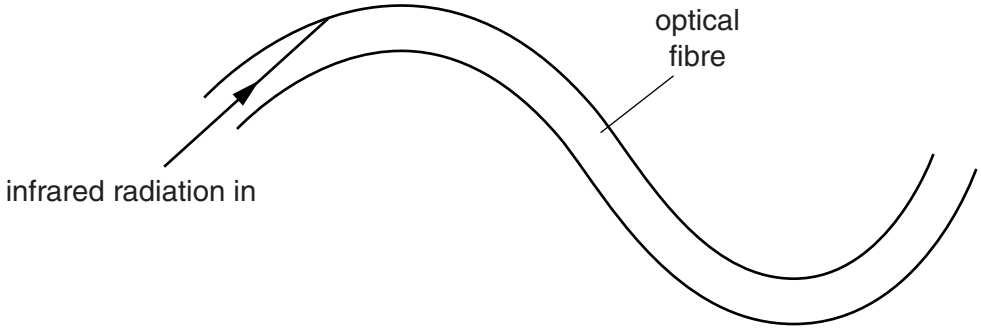
.....

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

[Total: 10]

3 This question is about communicating using waves.

(a) (i) Look at the diagram of an optical fibre.



Infrared radiation travels along the fibre from one end to the other.

Describe **how** the infrared radiation travels along the fibre.

.....

.....

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

(ii) Optical fibres are used to transmit information.

Information can be carried by **analogue** or **digital** signals.

Describe analogue **and** digital signals to show how they are **different**.

.....

.....

.....

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

(b) **Analogue** and **digital** signals are used to transmit radio broadcasts.

Explain the **advantages** of using **digital signals** for radio broadcasts.

.....

.....

.....

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

[Total: 6]

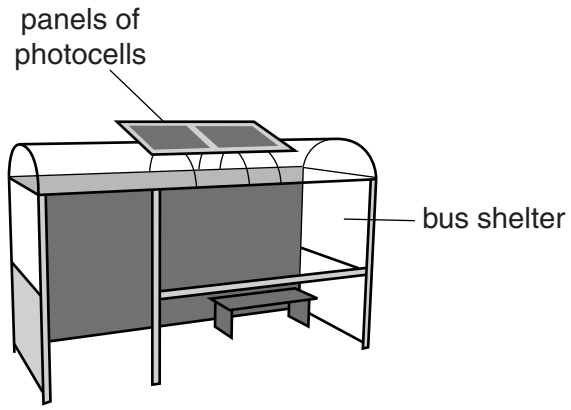
Answer **all** the questions.

Section B – Module P2

4 Energy from the Sun can be harnessed in different ways.

(a) Bus shelters in some parts of China have panels of photocells on the top.

The panels provide energy to light the shelter at night.



(i) The following sentences describe how electricity is produced in the photocells.

Complete the sentences.

The photocells ..... light energy from the Sun and transfer it to electricity.

The light energy causes ..... to be ..... from the silicon atoms.

The ..... of ..... creates a current in the circuit. **[2]**

(ii) The photocells charge a battery during the day.

At night the battery delivers a current of 2.5 A at a voltage of 12 V for 8 hours.

Calculate the **power** output from the battery.

The equations on page 2 may help you.

.....

.....

.....

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

(b) Winds blowing on Earth are caused by energy from the Sun.

The energy of the wind can be harnessed using wind turbines.

A factory in the North of England gets about 10% of its energy from wind turbines.

Describe one **advantage** and one **disadvantage** of using wind turbines.

advantage .....

.....

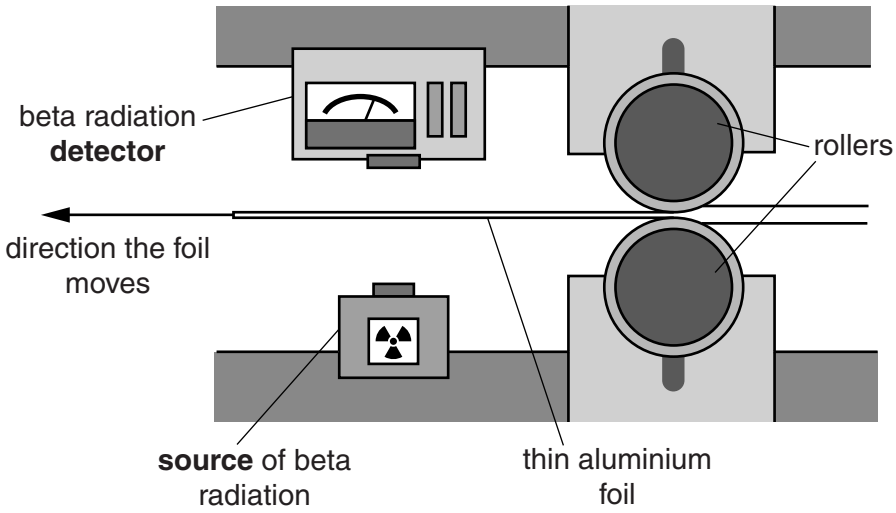
disadvantage .....

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

[Total: 6]

5 Beta radiation is used in a factory to monitor the thickness of aluminium cooking foil.

The diagram shows the system being used.



(a) The source of radiation and the radiation detector are fixed in place.

As the foil passes between the source and the detector, the amount of beta radiation detected suddenly drops.

Suggest why this happens.

.....

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

(b) Why is alpha radiation **not** used for monitoring the thickness of the foil?

.....

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

(c) The radioactivity of the beta source decreases over time.

When it is no longer useful, it becomes radioactive waste that cannot be disposed of in a landfill site.

Describe **one** way of safely disposing of it.

.....

.....

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

[Total: 3]

6 Solar flares are given out by the Sun.

Solar flares and the Sun are both examples of objects in the Solar System.

(a) Look at the objects in the Solar System and the statements which describe them.

Draw **one** line from each **object** to the correct **1st statement**.

Draw **one** line from each **1st statement** to the correct **2nd statement**.

object	1st statement	2nd statement
Earth and Moon	centre of Solar System	ejected at very high speed
solar flare	formed when planets collided	planets orbit it
Sun	clouds of charged particles	iron cores merged when created

[2]

(b) Complete the sentences about asteroids and comets.

Asteroids are made of rock and are left over from .....

..... .

A comet is made of ..... and ..... . **[2]**

[Total: 4]

7 Electricity is produced on a large scale in power stations.

(a) Some power stations use **nuclear fuel** rather than a fossil fuel.

Describe the advantages **and** disadvantages of **nuclear** power stations.

.....

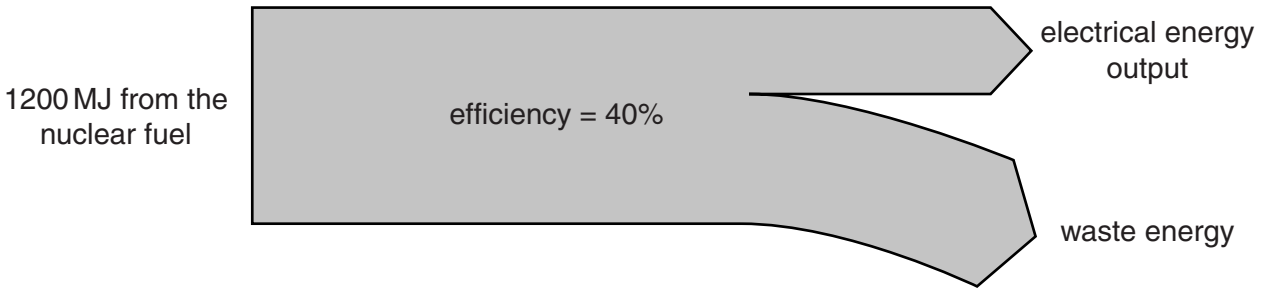
.....

.....

.....

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

(b) The diagram represents the energy use in a power station.



The efficiency of the power station is 40 %.

Calculate the **waste energy** for each 1200 MJ of energy from the nuclear fuel.

The equations on page 2 may help you.

.....

.....

.....

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

[Total: 5]

8 Sanjay is learning about the Big Bang at the start of the Universe.

He starts to make some notes.

Complete Sanjay's notes.

According to the Big Bang theory, the Universe started with a huge explosion.

The Universe is still expanding.

Most galaxies are moving .....

..... .

but distant galaxies are moving .....

..... .

Scientists detect ..... radiation from the

Big Bang coming from all parts of the..... .

[2]

[Total: 2]

Answer **all** the questions.

Section C – Module P3

9 Pujitha and Anna have different cars.

Pujitha's car runs on electricity

Anna's car runs on petrol

(a) How does the **electric** car get its energy?

.....

.....

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

(b) Pujitha thinks that his electric car does **not** pollute the environment in any way.

Anna says that Pujitha's electric car does cause pollution.

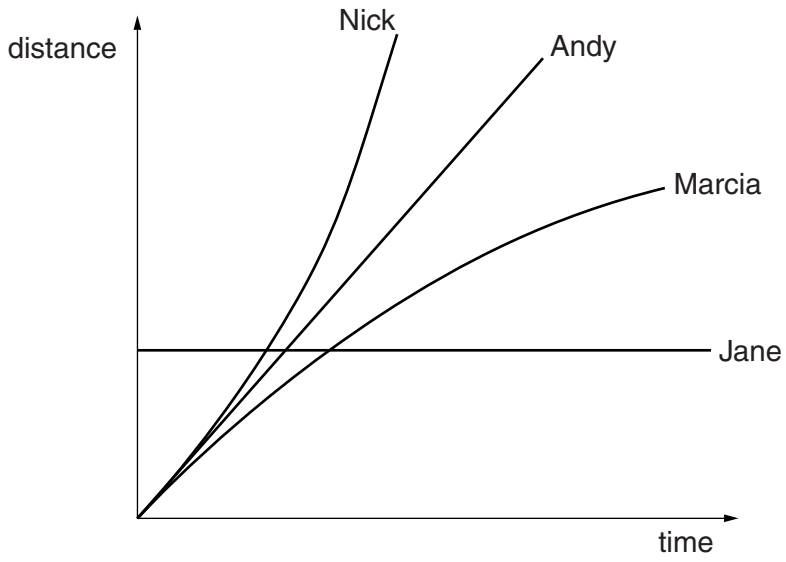
Explain why Anna is correct.

.....

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

[Total: 3]

10 Look at the distance-time graphs for four runners.



(a) Which runner has the **highest** average speed?

Choose your answer from

Andy **Jane** **Marcia** **Nick**

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

(b) Andy runs at a steady speed of 4.5 m/s for 110 s.

Calculate the **distance** he runs.

The equations on page 2 may help you.

.....

.....

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

[Total: 3]

11 Gita and Dan are free-falling parachutists.

They jump from an aeroplane and start to accelerate.

(a) Complete the sentences.

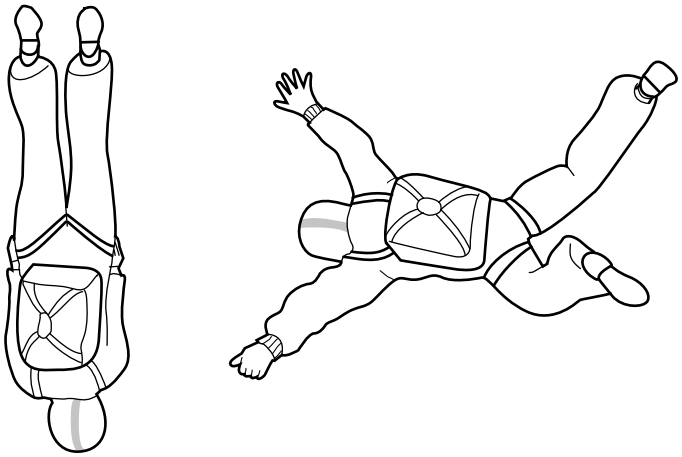
Acceleration is the change in ..... per unit ..... .

They start to accelerate because .....

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

(b) Gita and Dan have the **same** weight.

Their speeds increase until they both reach **terminal speed**.



Gita
terminal speed = 60 m/s

Dan
terminal speed = 55 m/s

Dan's terminal speed differs from Gita's terminal speed.

Explain why.

.....

.....

.....

.....

.....

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

(c) At terminal speed Dan's kinetic energy does **not** increase.

At terminal speed his potential energy does decrease.

What happens to the **potential energy**?

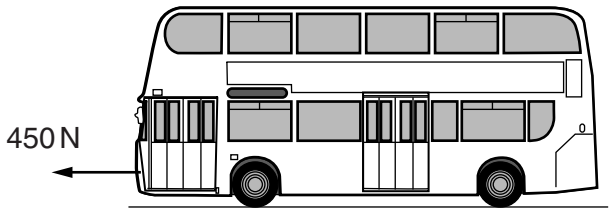
.....

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

[Total: 6]

12 This question is about force and motion.

(a) Look at the information in the diagram.



The bus moves a distance of 120 m in 8 s.

The driving force of the bus is 450 N.

Calculate the **work done** by the bus.

The equations on page 2 may help you.

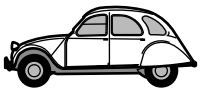
.....

.....

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

(b) Look at the diagrams of the five different vehicles.

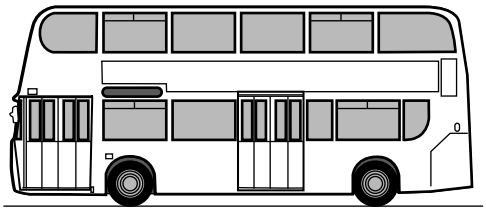
They show the speed and mass of each vehicle.



← 20 m/s
600 kg

← 12 m/s
900 kg

← 9 m/s
2000 kg



← 22 m/s
8000 kg

← 12 m/s
1500 kg

All these vehicles have **kinetic energy**.

The bus has the **most** kinetic energy.

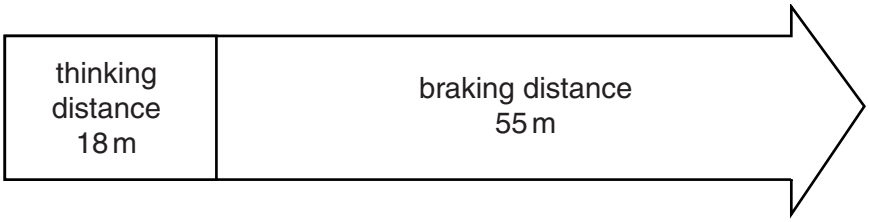
Explain why.

.....

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

[Total: 3]

13 Look at the information about the stopping distance for a car travelling at 30 m/s.



(a) The **thinking distance** at this speed is 18 m.

Write down two things that **increase** thinking distance at this speed.

1 .....

2 ..... **[1]**

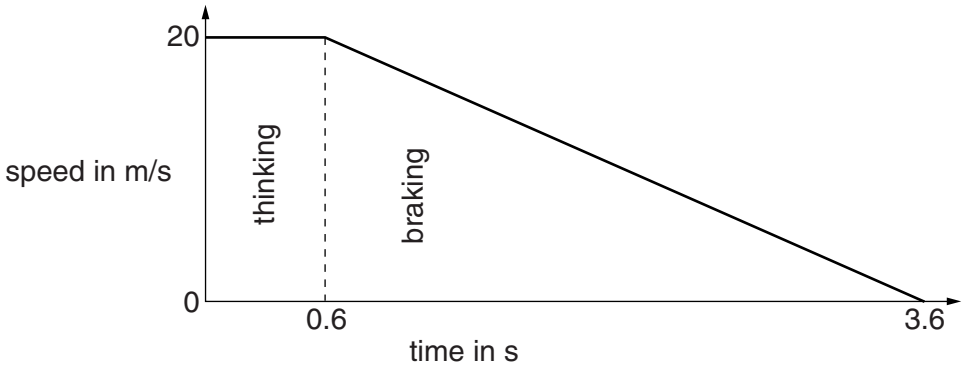
(b) Poor brakes increase **braking distance**.

Write down two other things that **increase** braking distance at this speed.

1 .....

2 ..... **[1]**

(c) Look at the graph of a car stopping from a speed of 20 m/s.



The thinking **time** for the driver is 0.6 s.

Calculate the **stopping** distance for the car.

.....

.....

.....

answer ..... m **[3]**

[Total: 5]

END OF QUESTION PAPER

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