OCR
RECOGNISING ACHIEVEMENT

H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B651/02

PHYSICS B

Unit 1 Modules P1 P2 P3
(Higher Tier)

OCE/T74768

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)

Wednesday 10 June 2009
Afternoon

Duration: 1 hour

B651 02

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 **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

Answer **all** the questions.

Section A – Module P1

1 Earthquakes produce shock waves. These shock waves can cause damage.

There are two types of shock wave.

These are called **p-waves** and **s-waves**.

(a) P-waves are **longitudinal** waves.

What **type** of wave is an s-wave?

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

(b) P-waves travel through solids and liquids.

What will **s-waves** travel through?

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

(c) The s-wave from an earthquake travels at a speed of 4000 m/s.

Suggest the speed of a p-wave.

Put a (ring) around the correct answer.

10 m/s

300 m/s

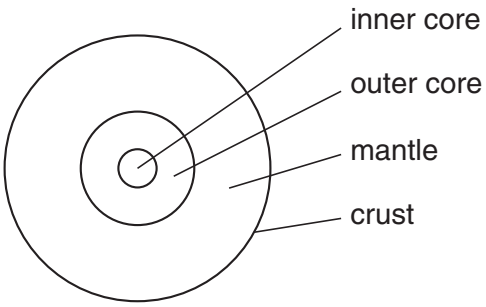
3000 m/s

4000 m/s

6000 m/s

[1]

(d) The diagram shows a simplified structure of the Earth.



Describe how s-waves provide evidence for the structure of the **outer** core.

.....

.....

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

[Total: 5]

2 Mel is on holiday.

She has taken her laptop computer and radio with her.

She uses her laptop to send emails.

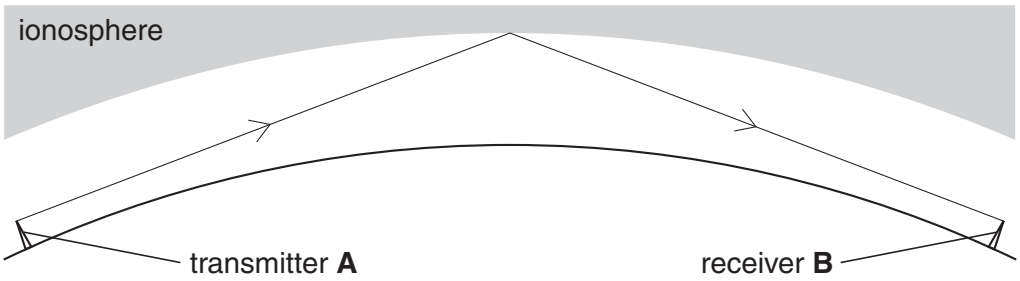
(a) The laptop and radio both use **wireless** technology.

Write down **one** other use of wireless technology.

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

(b) Wireless signals can be transmitted over long distances.

Sometimes a signal from the transmitter is reflected from the ionosphere.



Signals can also be transmitted from **A** to **B** with the aid of a satellite.

Describe how.

.....

.....

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

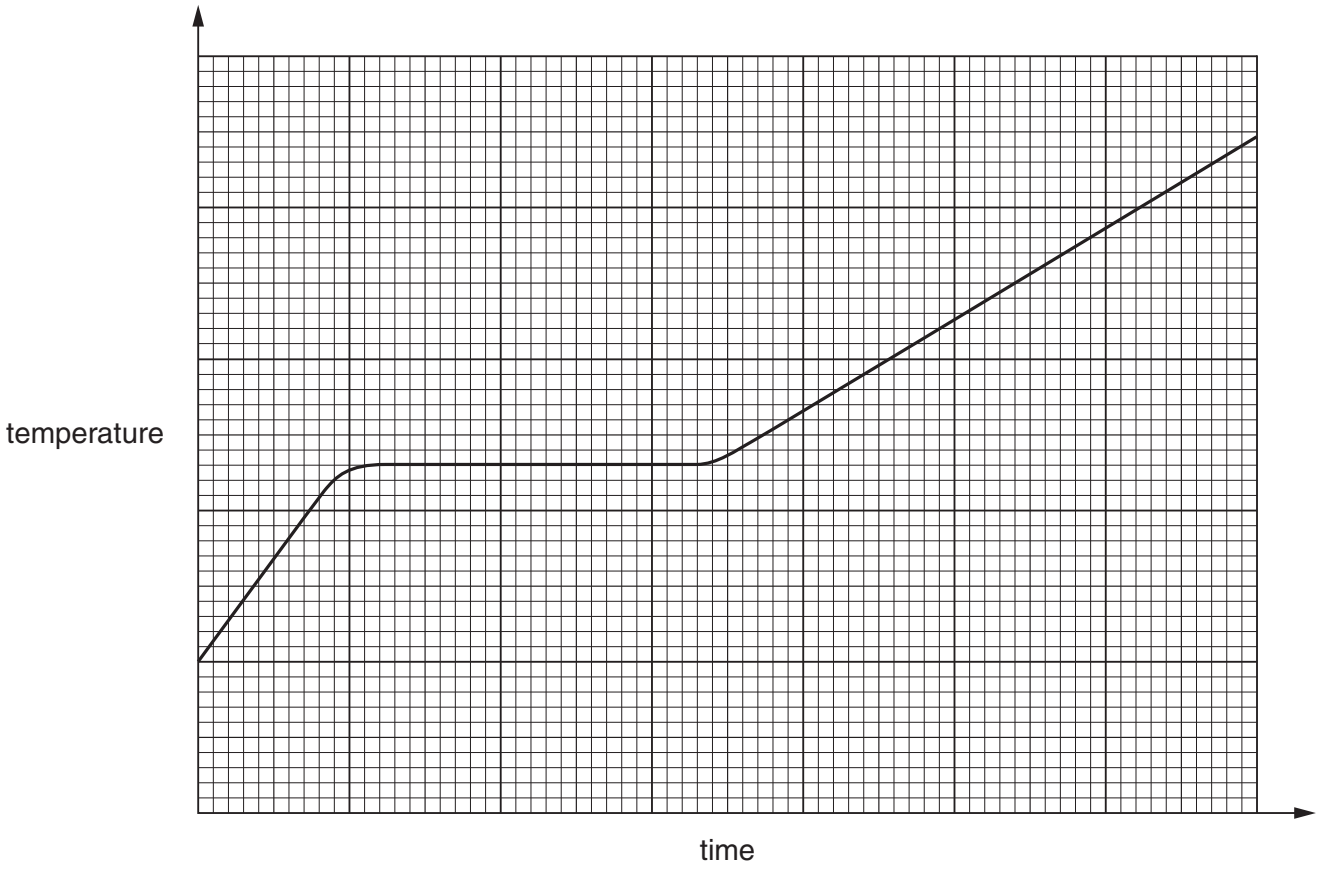
[Total: 3]

3 Jack heats a beaker containing some ice.

He measures the temperature of the contents of the beaker every 30 seconds and records the results.

He draws a graph to show how the temperature changes.

This is his graph.



(a) (i) Complete the sentence. Choose words from this list.

energy

mass

state

temperature

time

The specific latent heat of ice is the …… needed to change 1 kg of ice into water without a change in …… . **[2]**

(ii) Explain what happens to the energy supplied as the ice changes to water.

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

(b) The ice has all melted.

Jack discovers that 105 kJ of energy is needed to raise the temperature of 0.5 kg of water by 50 °C.

Calculate the specific heat capacity of water.

The equations on page 2 may help you.

.....

.....

.....

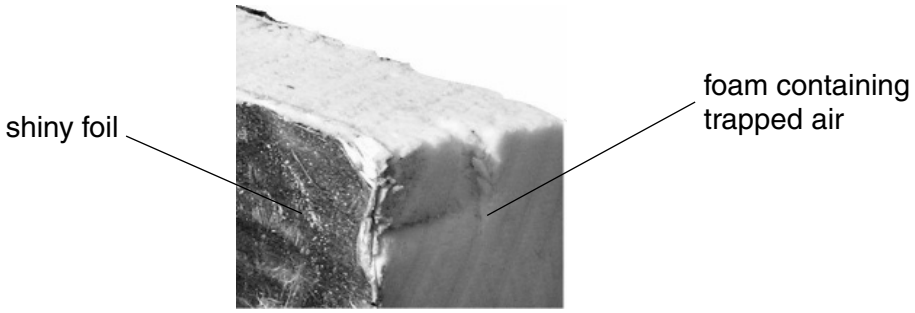
answer ..... J / kg °C **[2]**

[Total: 5]

4 Foam is used to reduce energy loss from a home.

Blocks of foam are put in the cavity wall.

They are placed between the outer and inner walls.



(a) The foam in the cavity contains trapped air.

Air is a poor conductor.

Explain how **trapping** the air reduces energy loss from the home.

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

(b) What type of energy transfer does shiny foil reduce?

Put a (ring) around the correct answer.

conduction

convection

dispersion

radiation

[1]

(c) **Temperature** and **heat** are measurements of different things.

Complete the sentences.

Temperature is a measurement of .....

.....

Heat is a measurement of .....

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

(d) A home owner decides to move his open fire from an outside wall into the centre of his living room.

This makes his fire more efficient.

(i) The energy stored in 5 kg of coal is 160 MJ.

This coal is burnt. It releases 40 MJ of heat into the room.

Calculate the efficiency of the open fire.

The equations on page 2 may help you.

.....

.....

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

(ii) Why is the fire more efficient in the centre of the room?

.....

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

[Total: 7]

Section B – Module P2

5 This question is about energy from the Sun.

Ocrashire County Council builds a new school.

It has large glass windows in each room.

These windows provide **passive** solar heating.

(a) Most of the windows face south.

Suggest why.

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

(b) Explain how passive solar heating works.

In your answer you should write about

- why glass is used
- how the process heats the room.

.....

.....

.....

.....

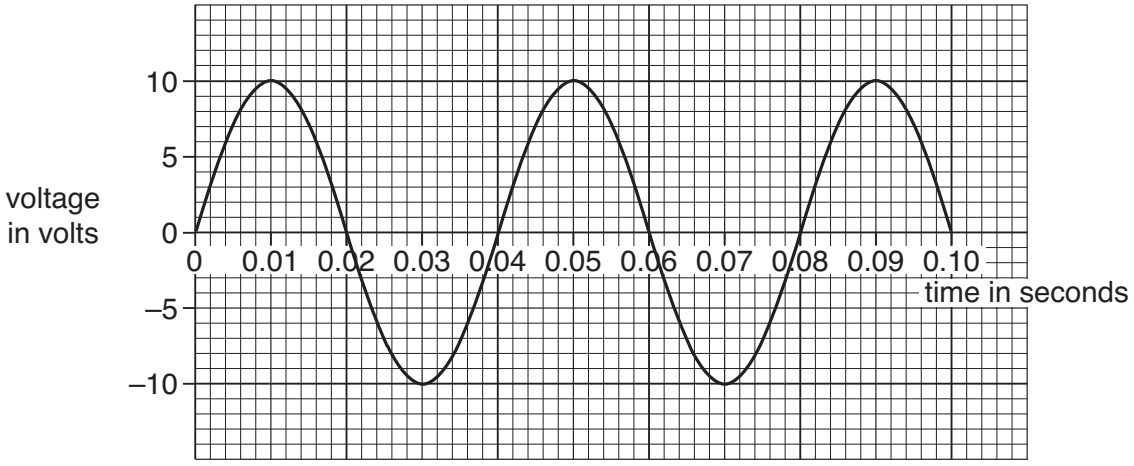
.....

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

[Total: 4]

6 This question is about alternating current (AC).

(a) Look at the graph of the output from a transformer.



(i) What is the peak output voltage?

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

(ii) How long does it take for one complete cycle of alternating current (AC)?

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

(b) Transformers are used in power stations to change voltage.

They are connected to the output of generators.

(i) What type of transformer is used in power stations?

.....

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

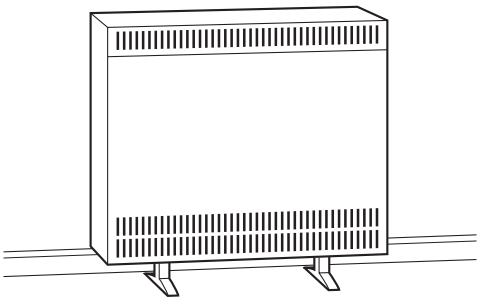
(ii) Why is the voltage changed at the output of the power station?

.....

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

Turn over for the remainder of question 6

(c) Sian has an electric heater.



The heater is connected to the 230 volt mains.

When it is switched on, a current of 13 amps passes through the heater.

Calculate the power of the heater.

The equations on page 2 may help you.

.....

.....

.....

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

(d) Sian's heater uses '**off peak**' electricity.

Describe **one** advantage and **one** disadvantage of using 'off peak' electricity in the home.

advantage .....

.....

disadvantage .....

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

[Total: 8]

7 The three types of nuclear radiation are alpha (α), beta (β) and gamma (γ).

(a) Draw a straight line from each **radiation** to its correct **use**.

radiation	use
alpha	**sterilising equipment**
beta	**paper thickness gauge**
gamma	**smoke detectors**

[2]

(b) There is radiation that is always present in the atmosphere.

It is called background radiation.

Some of the background radiation is caused by cosmic rays.

What are cosmic rays?

.....

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

[Total: 3]

8 **(a)** Scientists think that the Universe started with a Big Bang.

Evidence exists today that supports the Big Bang theory.

Write down **two** pieces of evidence that exist today.

1 .....

.....

2 .....

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

(b) In our Solar System, planets orbit the Sun.

Asteroids also orbit the Sun.

Where are most asteroids found?

Choose from: **between Mercury and Venus**

between Venus and Earth

between Mars and Jupiter

between Jupiter and Saturn

between Uranus and Neptune

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

(c) Astronomers often use the term **light-year**.

(i) What is a light-year?

.....

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

(ii) Explain why astronomers find light-years a **useful** measurement.

.....

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

[Total: 5]

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Section C continues on page 16.

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Section C – Module P3

9 A speed camera uses radar to detect when a car is speeding.

There are lines painted on the road in front of the camera to measure distance.

The camera takes **two** photographs of a speeding car, as it passes over the lines, to confirm the speed.

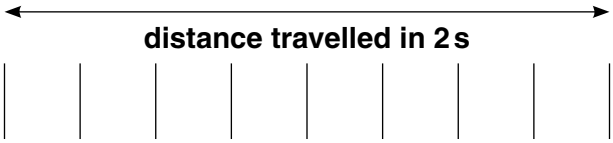
Mr Green is accused of speeding. The speed limit is 13.5 m/s (30 mph).

He is shown the two photographs taken by the speed camera.

The time between the photographs is 2 s.

The distance between each of the lines on the road is 4 m.

The photographs show that his car passed over 9 lines in the time between when the two photographs were taken.



Calculate the speed of his car.

The equations on page 2 may help you.

.....

.....

.....

answer ..... m/s **[3]**

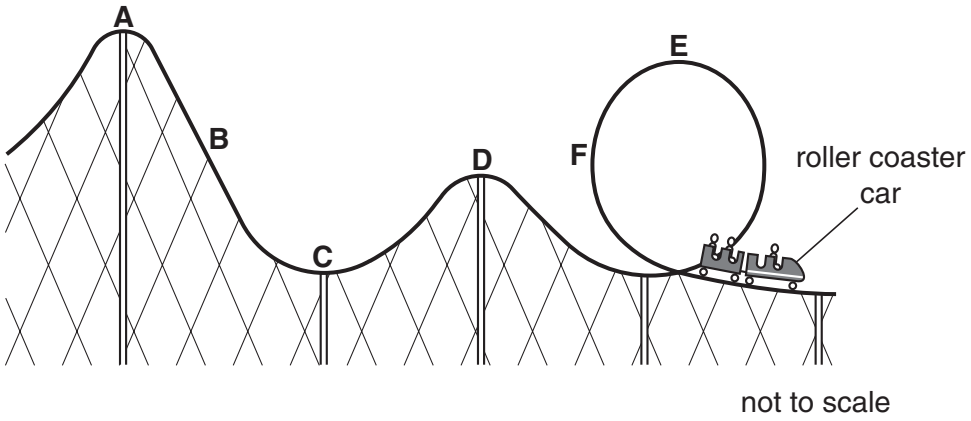
[Total: 3]

10 Mark is riding on a roller coaster.

The roller coaster car is lifted to the top of the ride.

It is then released at point **A**.

The diagram shows the roller coaster with the car at the end of the ride.



(a) Where does the car have the most gravitational potential energy?

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

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

(b) Where is the car moving fastest?

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

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

(c) At maximum speed the kinetic energy of the car is 200 kJ.

More people then get into the car.

The total **mass** doubles.

The maximum speed stays the same.

What is the maximum kinetic energy now?

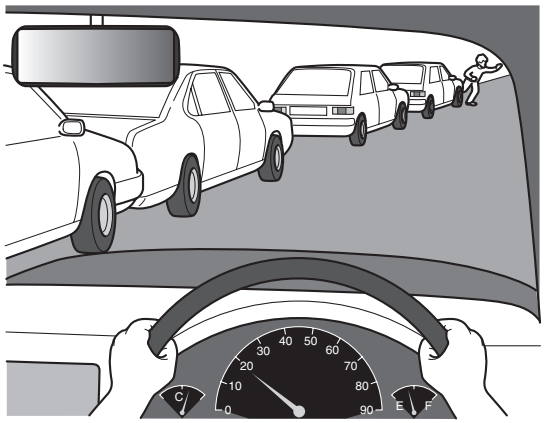
answer ..... kJ **[1]**

[Total: 3]

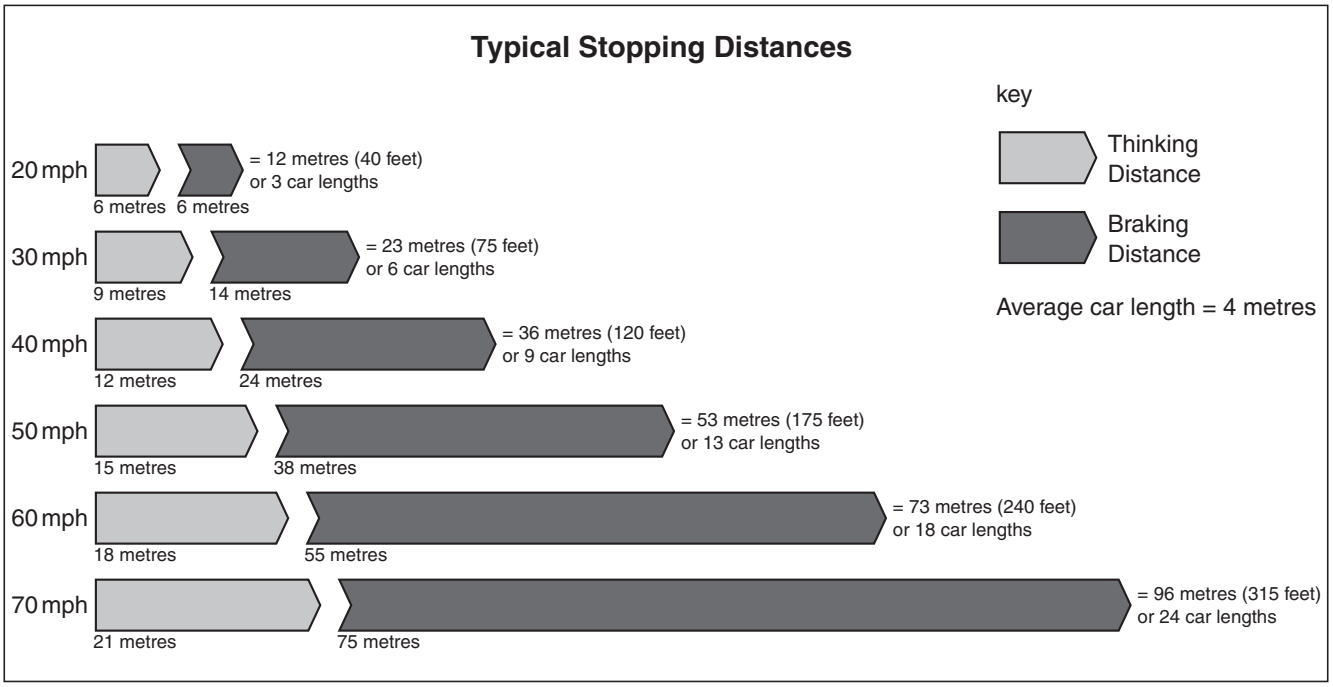
11 Mrs Brown is driving her car slowly because she is near a school.

A child runs out into the road.

The car stops safely.



The chart shows typical stopping distances.



(a) The speed limit in towns is usually 30 mph.

Explain why the speed limit outside schools is often 20 mph.

.....

.....

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

(b) (i) Mrs Brown drives at 50 mph.

Her braking distance is 38 m.

What is her thinking distance?

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

(ii) Write down **two** factors that could increase her thinking distance.

1 .....

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

(c) Mrs Brown drives faster on a motorway.

Her speed is now 70 mph.

The chart shows that the braking distance increases to 75 metres.

Explain two situations which could increase the braking distance for her car at 70 mph.

Link your answers to

- friction
- mass.

1 .....

.....

2 .....

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

[Total: 6]

12 (a) Modern cars have air bags and seat belts.

A car is in a crash.

The airbag and seatbelt change shape and absorb energy in the crash.

Airbags and seat belts reduce injuries to drivers and passengers.

Use ideas about forces to explain how.

.....

.....

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

(b) Many cars now have the controls for the cd-player mounted on the steering wheel.

How can this make driving a car safer?

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

[Total: 3]

13 Steve is a member of the Red Devils free fall display team.

(a) Steve jumps out of the plane.

His speed increases until he reaches terminal velocity.

Use ideas about forces to explain how Steve **reaches** terminal velocity.

.....

.....

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

(b) As Steve falls, he loses gravitational potential energy and gains kinetic energy.

After he has reached terminal velocity, he continues to lose gravitational potential energy but does **not** gain kinetic energy. Use ideas about energy transfer to explain why.

.....

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

(c) Steve and his parachute have a mass of 85 kg.

His maximum gravitational potential energy is 2 720 000 J.

Calculate the height he jumps from.

The equations on page 2 may help you.

(g = 10 N/kg)

.....

.....

.....

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

[Total: 5]

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