Please write clearly in block capitals.

Centre number                 Candidate number

Surname
Forename(s)
Candidate signature

GCSE
SCIENCE A
PHYSICS
Foundation Tier    Unit Physics P1

Wednesday 24 May 2017  Afternoon  Time allowed: 1 hour

Materials
For this paper you must have:
  • a ruler
  • a calculator
  • the Physics Equations Sheet (enclosed).

Instructions
  • Use black ink or black ball-point pen.
  • Fill in the boxes at the top of this page.
  • Answer all questions.
  • You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
  • Do all rough work in this book. Cross through any work you do not want to be marked.

Information
  • The marks for questions are shown in brackets.
  • The maximum mark for this paper is 60.
  • You are expected to use a calculator where appropriate.
  • You are reminded of the need for good English and clear presentation in your answers.
  • Question 9 should be answered in continuous prose.
    In this question you will be marked on your ability to:
    – use good English
    – organise information clearly
    – use specialist vocabulary where appropriate.

Advice
  • In all calculations, show clearly how you work out your answer.
Answer all questions in the spaces provided.

1 Figure 1 shows an outdoor pizza oven.

1 (a) The pizza oven is designed to stay hot for a long time.

Use the correct answer from the box to complete each sentence. Each answer may be used once, more than once or not at all. 

[2 marks]

```
| conduction | convection | radiation |
```

The white surface reduces energy transfer by ________________________ .

The concrete has a low U-value which means energy is transferred slowly by ________________________ .

1 (b) The pizza oven is heated by burning wood.

What type of fuel is wood?

[1 mark]

Tick (✓) one box.

<table>
<thead>
<tr>
<th>Tick (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>biofuel</td>
</tr>
<tr>
<td>fossil fuel</td>
</tr>
<tr>
<td>non-renewable fuel</td>
</tr>
</tbody>
</table>
1 (c) The concrete used to make the pizza oven has a specific heat capacity of 880 J/kg °C
The mass of the concrete is 250 kg

Calculate the energy transferred to the concrete to increase its temperature by 380 °C

Use the correct equation from the Physics Equations Sheet. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Energy transferred = _________________ J

Turn over for the next question
2 Figure 2 shows an electric road sign.

\[\text{Figure 2}\]

The road sign is powered by an electrical generator which has an efficiency of 40%.

Complete the Sankey diagram in Figure 3 for an electrical generator which has an efficiency of 40%.

[2 marks]
2 (b) The road sign uses high efficiency LED bulbs. What does high efficiency mean?

Tick (√) one box. [1 mark]

- the bulbs have a high energy input
- a high proportion of the energy output is useful
- a high proportion of the energy output is wasted

2 (c) Some road signs are powered by batteries recharged by solar cells.

In one sign the solar cells have a total power output of 200 W

Calculate the energy that the solar cells will transfer in 3600 seconds.

Use the correct equation from the Physics Equations Sheet. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Energy = ______________________ J

2 (d) Some road signs are powered by batteries recharged by both solar cells and wind turbines.

Give two advantages of having both solar cells and wind turbines available to recharge the batteries. [2 marks]

1 ___________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

2 ___________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

3 (a) Figure 4 shows an electromagnetic wave.

![Figure 4]

3 (a) (i) Which arrow, K, L, M or N, shows the wavelength of the wave? [1 mark]

3 (a) (ii) Which arrow, K, L, M or N, shows the amplitude of the wave? [1 mark]

3 (b) Figure 5 shows the electromagnetic spectrum.

![Figure 5]

A laser emits visible light.

Which letter, A, B or C, on Figure 5 shows the position of visible light? [1 mark]
Laser light is used in some burglar alarms. 

Figure 6 shows laser light being reflected by a mirror. The light then reaches a detector.

Figure 6

3 (c) (i) How does the size of the angle of incidence compare with the size of the angle of reflection?

[1 mark]

_____________________________________________________________________________________
_____________________________________________________________________________________

3 (c) (ii) When a burglar gets in the way of the laser light, the light no longer reaches the detector.

Suggest one reason why.

[1 mark]

_____________________________________________________________________________________
_____________________________________________________________________________________
4 Figure 7 shows how electricity is distributed from power stations to consumers.

4 (a) Which parts of Figure 7 form the National Grid?

Tick (√) one box.

- power station, transformers and power cables
- transformers and power cables
- transformers, power cables and consumer

4 (b) The power cables in Figure 7 are overhead power cables. Power cables can be buried underground.

Give one disadvantage of burying power cables underground.

_____________________________________________________________________________________
_____________________________________________________________________________________
4 (c) Use the correct answers from the box to complete each sentence.

Each word can be used once or not at all. [3 marks]

| energy | current | efficiency | power | voltage |

The step-up transformer increases the _________________________________ which decreases the _________________________________.

Using a step-up transformer increases the _________________________________ of the electricity distribution process.

4 (d) A householder reads his electricity meter at the start and at the end of a month.

Start: 34 523 (kWh)       End: 34 713 (kWh)

The cost of 1 kWh is 15 pence.

Calculate the cost of the electricity used that month. [2 marks]

........................................................................................................................................

........................................................................................................................................

........................................................................................................................................

Cost = _____________ pence

Turn over for the next question
Figure 8 shows an electric kettle being used to heat some water.

Figure 8

Heating element

5 (a) Complete the following sentences to describe how the water in the kettle is warmed by convection.

[4 marks]

When the kettle is switched on, the temperature of the water near the heating element increases.

As the temperature of the water increases, the water _______________ and becomes less ________________.

The heated water _______________ towards the top of the kettle.

The movement of the water sets up a convection ________________.
Three different designs of hot water bottle are each filled with water at 90 °C from the kettle.

Figure 9 shows the three different designs. Each hot water bottle is made from a different material but holds the same amount of water.

Figure 9

Design A

Design B

Design C

State two factors that would affect the time it would take the hot water bottles to cool down to room temperature.

[2 marks]

1 ___________________________________________________________________________________

2 ___________________________________________________________________________________

Turn over for the next question
Starter pistols are used in athletics events to start races. A starter pistol makes a loud bang and produces a puff of smoke.

Figure 10 shows two people who investigated the speed of sound using a starter pistol and a stopclock.

6 (a) The person at Point B sees the puff of smoke before hearing the bang from the starter pistol.

What does this tell you about the speed of sound compared with the speed of light?

_____________________________________________________________________________________
_____________________________________________________________________________________

6 (b) The frequency of the sound wave produced by the pistol was 800 Hz

The wavelength of the sound wave was 0.42 m

Calculate the speed of the sound wave.

Use the correct equation from the Physics Equations Sheet.

Choose the correct unit.

$m/s^2$ $m/s$ $m^2/s$

[3 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Speed = _______________ unit _______________

Figure 10 is not drawn to scale.
6 (c) Complete **Table 1** to show the properties of the sound wave at **Point B** compared with the sound wave at **Point A**.

Tick (√) **one** box for each property comparison.

[3 marks]

**Table 1**

<table>
<thead>
<tr>
<th>Properties of the sound wave at Point B compared to Point A</th>
<th>greater than</th>
<th>less than</th>
<th>the same as</th>
</tr>
</thead>
<tbody>
<tr>
<td>amplitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>speed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6 (d) A sound wave can be reflected. What name is given to a reflected sound wave?

[1 mark]

6 (e) Which **two** of these statements are true for sound waves?

Tick (√) **two** properties.

[2 marks]

Tick (√)

- Sound waves can travel through a vacuum.
- Sound waves are transverse waves.
- Sound waves are longitudinal waves.
- Sound waves transfer energy.
- Sound waves are electromagnetic waves.

---

Turn over for the next question
7 A student investigated how the output voltage of a model wind turbine was affected by the number of turbine blades. The equipment he used is shown in Figure 11.

**Figure 11**

- Hairdryer
- Turbine blade
- Voltmeter

7 (a) Suggest two factors, other than the number of turbine blades, that will affect the output voltage of the model wind turbine.

[2 marks]

1 ____________________________________________

2 ____________________________________________

7 (b) Some of the student’s results are shown in Figure 12.

**Figure 12**

- **Output voltage in volts**
- **Number of turbine blades**

- Graph showing data points.
7 (b) (i) Plot the remaining results in Figure 12 using the data in Table 2. [2 marks]

Table 2

<table>
<thead>
<tr>
<th>Number of turbine blades</th>
<th>Output Voltage in volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.39</td>
</tr>
<tr>
<td>7</td>
<td>0.50</td>
</tr>
<tr>
<td>8</td>
<td>0.56</td>
</tr>
</tbody>
</table>

7 (b) (ii) The output voltage for 6 turbine blades is lower than expected. The low value was caused by a measurement error.

State the name of this type of measurement error. [1 mark]

_____________________________________________________________________________________

7 (b) (iii) What two conclusions can be made from the student’s results as the number of blades is increased from 1 to 4? [2 marks]

1 ___________________________________________________________________________________

_____________________________________________________________________________________

2 ___________________________________________________________________________________

_____________________________________________________________________________________

7 (c) Commercial wind turbines can be manufactured with a number of blades between 2 and 8.

Suggest two factors that manufacturers would need to consider when designing and constructing commercial wind turbines. [2 marks]

1 ___________________________________________________________________________________

_____________________________________________________________________________________

2 ___________________________________________________________________________________

_____________________________________________________________________________________

Turn over for the next question
A radar gun can be used to measure the speed of a car.

Microwaves are emitted by the radar gun and reflected by the car, as shown in Figure 13.

**Figure 13**

Microwaves emitted by the radar gun

Microwaves reflected by the car

---

8 (a) The microwaves reflected by the moving car have a different frequency from the microwaves emitted by the radar gun.

What is the name of the effect causing this change in frequency?  

[1 mark]

---

8 (b) The data in Table 3 are measurements taken from three different cars on the same piece of road.

**Table 3**

<table>
<thead>
<tr>
<th>Car</th>
<th>Frequency of emitted microwaves in kHz</th>
<th>Frequency of reflected microwaves in kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>27 000 000</td>
<td>27 000 002</td>
</tr>
<tr>
<td>B</td>
<td>27 000 000</td>
<td>27 000 000</td>
</tr>
<tr>
<td>C</td>
<td>27 000 000</td>
<td>26 999 997</td>
</tr>
</tbody>
</table>
8 (b) (i) State which car in Table 3 is moving towards the radar gun. Give a reason for your answer.
[2 marks]
Car _____________________________________________
Reason _____________________________________________

8 (b) (ii) State which car in Table 3 is moving the fastest. Give a reason for your answer.
[2 marks]
Car _____________________________________________
Reason _____________________________________________

Turn over for the next question
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Solar panels use energy from the Sun to heat water.

Two different designs of solar panel are shown in Figure 14.

Both designs have the same water flow rate.

**Figure 14**

<table>
<thead>
<tr>
<th>Design A</th>
<th>Design B</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, shiny</td>
<td>Dark, matt surface</td>
</tr>
<tr>
<td>surface</td>
<td></td>
</tr>
<tr>
<td>Black metal</td>
<td>White plastic pipe</td>
</tr>
<tr>
<td>pipe</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>20 °C water in</td>
<td>20 °C water in</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>40 °C water out</td>
<td>30 °C water out</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explain why **Design A** is better than **Design B** at heating water.

[6 marks]
Extra space __________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

END OF QUESTIONS
There are no questions printed on this page

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