Pearson Edexcel

# Additional Assessment Materials
# Summer 2021

## Pearson Edexcel GCSE in Physics (1PH0)
## Higher

## Resource Set Topic B – Test 1: Energy and Forces doing work, Forces, and their effects

## Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

## General guidance to Additional Assessment Materials for use in 2021

### Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate’s grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

### Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

7 (a) Which of these is a non-renewable source of energy?

(1)

- ☐ **A** geothermal
- ☒ **B** natural gas
- ☐ **C** tidal
- ☐ **D** solar

(b) Explain why renewable sources provide an increasing fraction of the electricity supply for many countries.

(2)

Increasing use of renewable sources lowers the use of non-renewable sources, which pollute the environment and can cause global warming from the release of greenhouse gasses.

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(c) Electricity can be generated using a water turbine.

(i) Water gains kinetic energy by falling from the top of a dam.

Calculate the minimum height that 7.0 kg of water must fall to gain 1300 J of kinetic energy.

(3)

$E = mgh$

$1300 = 7 \times 10 \times h$

$h = \frac{1300}{7 \times 10}$

$= 18.57$

$\approx 19$

minimum height = 19 m

(ii) As water enters the turbine at the bottom of the dam, the kinetic energy of 8.0 kg of moving water is 1100 J.

Calculate the speed of the moving water as it enters the turbine.

(3)

$KE = \frac{1}{2} m v^2$

$1100 = \frac{1}{2} \times 8 \times v^2$

$v^2 = \frac{1100 \times 2}{8}$

$v = \sqrt{275}$

$= 16.58$

$\approx 17$

speed = 17 m/s

(d) Moving air can be used to generate electricity using a wind turbine.

Figure 8 is a graph of kinetic energy against wind speed for a mass of moving air.

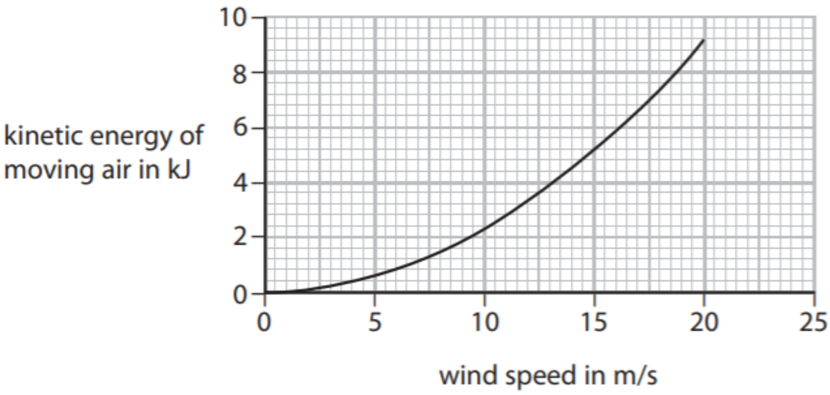


**Figure 8**

Just before the air reaches a wind turbine it has a wind speed of 15 m/s.

When the air has gone through the turbine it has a wind speed of 13 m/s.

As the air moves through the turbine some of its kinetic energy is transferred to the turbine.

Use the graph to determine the percentage of the kinetic energy transferred to the turbine from the air.

(3)

$KE_{v=15} - KE_{v=13}$

$5.2 - 4 = 1.2$

$\frac{1.2}{5.2} \times 100 = 23.077$

$\approx 23\%$

percentage of kinetic energy transferred from the air = 23 %

**5** Figure 5 shows a way of projecting a small trolley up a sloping track.

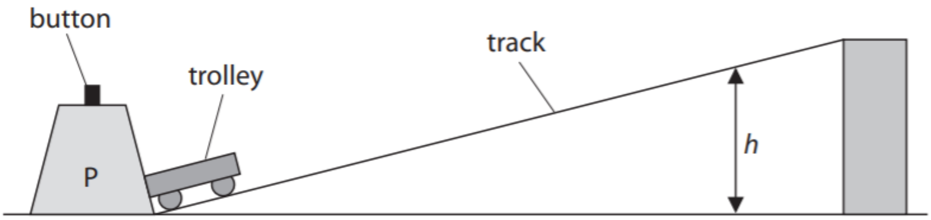


**Figure 5**

When the button is pressed, a spring is released in P that projects the trolley up the track.

The trolley travels up the track, stops and then rolls back down.

The spring in P always exerts the same force when projecting the trolley.

(a) A student investigates how the mass of the trolley affects the maximum vertical height, *h*, reached by the trolley.

State the measurements the student should make to complete the investigation.

You should make use of the equipment shown in Figure 5 and any other equipment that is needed.

**(4)**

The mass of the trolley should be measured using an electronic balance. Keep a ruler on the track with zero mark coinciding with the front-side of the trolley at the starting point. Measure the distance travelled ( L ) by reading the position of the front side of the trolley at instantaneous rest after the button is pressed. Use a high speed camera to assist and read the mark on the ruler coinciding with the front-side of the trolley at instantaneous rest. Measure the constant slope (θ) of the track with a protractor and use the equation $h = L \times \sin(\theta)$ to obtain height.

(b) Figure 6 is a graph of the student's results.

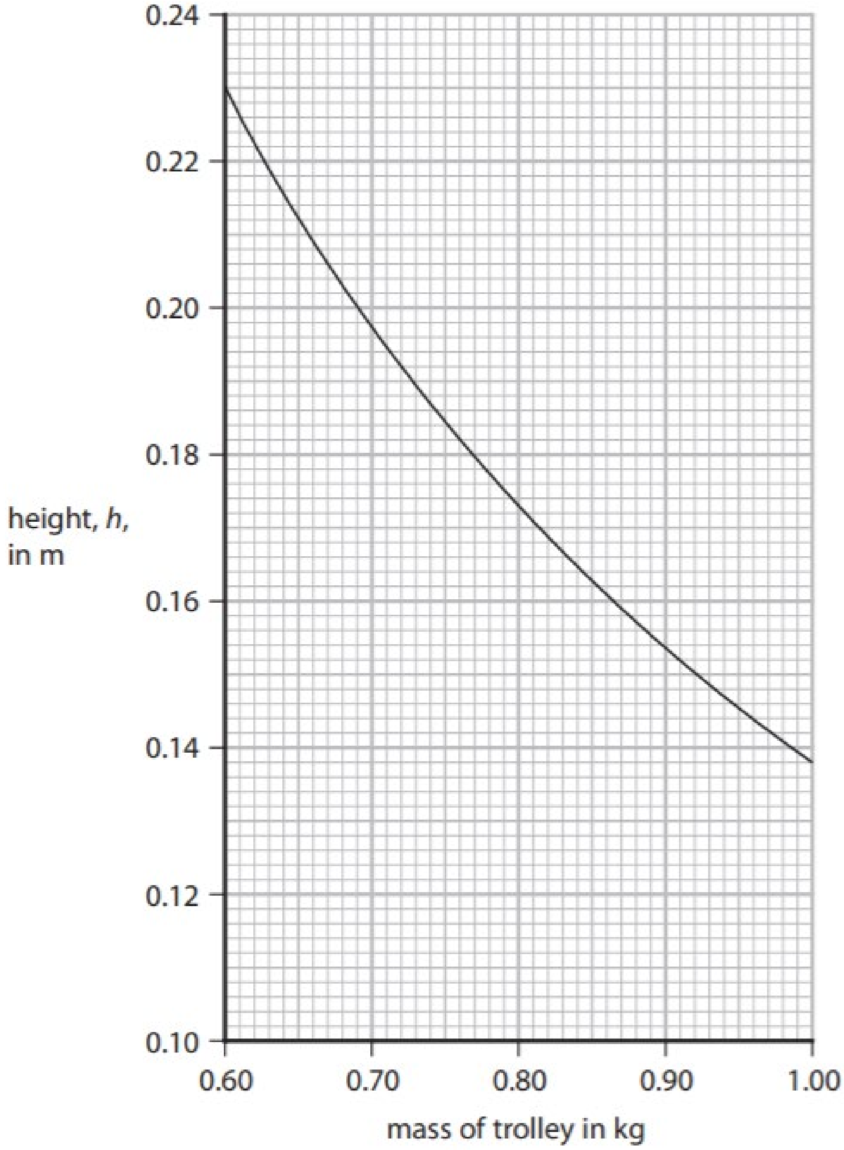


**Figure 6**

The student states that the energy transferred by the spring is the same each time it is used.

Use data from any two points on the graph in Figure 6 to support this statement.

(3)

The energy transferred by the spring converts to GPE at the highest point. Using GPE= m x g x h ; when m= 0.6, GPE= 0.6 x 10 x 0.23 ≈ 1 . 4 J ; and when m= 0.8, GPE= 0.8 x 10 x 0.173 ≈ 1 . 4 J. The same GPE gain means the same energy is transferred each time.

(c) Describe how the student could extend the investigation to determine the average speed of the trolley as it rolls back down the track.

**(3)**

Using the method explained in the first part measure the distance travelled by the trolley on the ramp as it rolls back down. Measure the time taken from the end of the instantaneous rest and the time when the trolley hits the spring. Calculate the average speed by the equation speed= distance/time.

**2** A student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 2.

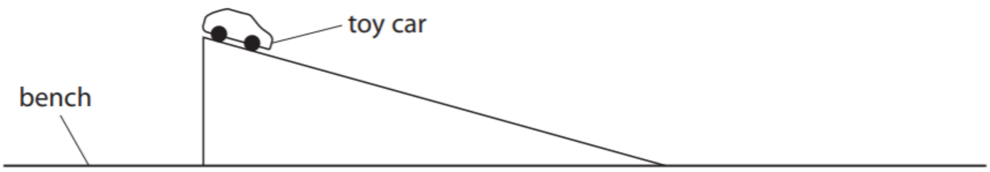


**Figure 2**

(a) Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope.

**(2)**

The chemical energy of the student is converted to gravitational potential energy in the car.

(b) The student lets the toy car roll down the slope.

Describe how the student could find, by experiment, the speed of the toy car at the bottom of the slope.

**(4)**

The student can keep two light gates on the bottom of the slope at known distance ( D ) apart from each other and log the time taken for the car to move between the two light gates ( T ). The speed can be found by taking the ratio of distance and the time taken ( D/T ).

(c) The student needs to develop the experiment to determine the loss in potential energy and the gain in kinetic energy as the toy car is rolling down the slope.

State the other measurements the student must make.

**(2)**

Mass of the toy car and vertical height of the slope

(d) When the toy car rolls down the slope, some energy is transferred to the surroundings as thermal energy.

State how the student could calculate the amount of energy transferred to the surroundings.

**(1)**

The difference in the loss in potential energy and the gain in kinetic energy will give the value of energy transferred to the surrounding.

**8** (a) A kettle is used to heat water.

Figure 11 shows a graph of temperature against time for the water in the kettle.

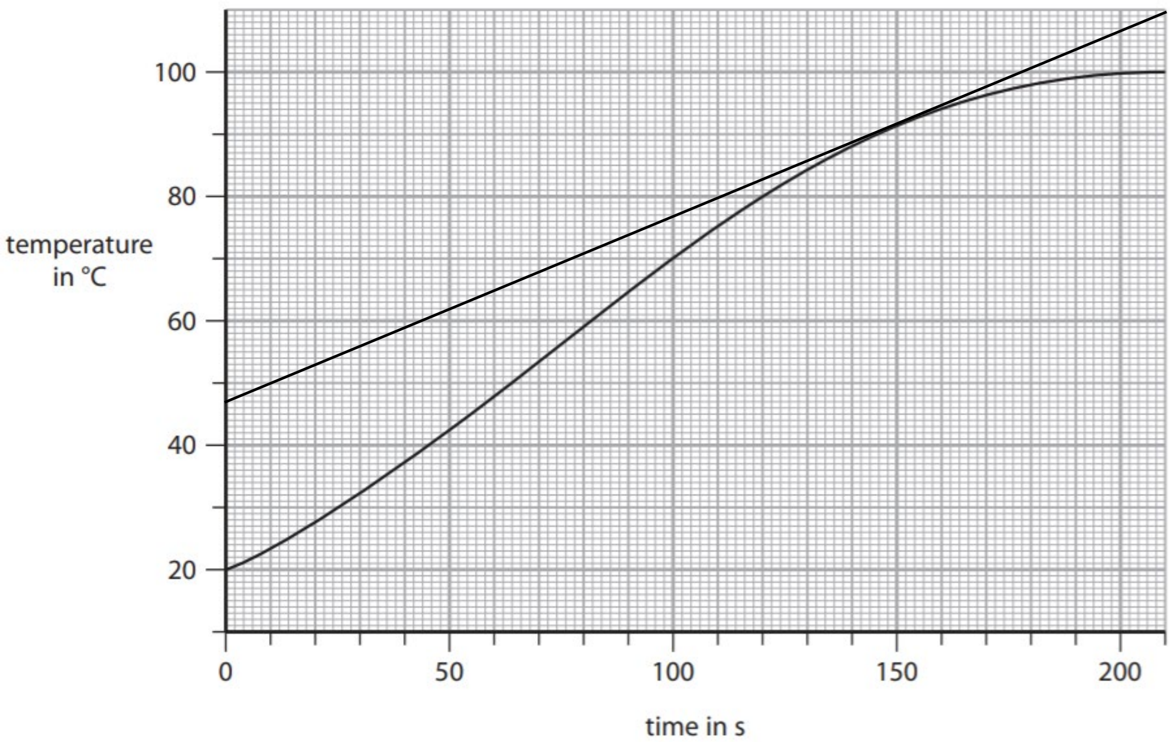


**Figure 11**

Calculate the rate of increase in temperature at a time of 150 s, by drawing a tangent to the curve in Figure 11 at a time of 150 s.

**(3)**

$$\frac{110 - 47}{210} = 0.3$$

0.3 °C / s

(b) The kettle has an efficiency of 91% in supplying energy to the water.
The thermal energy of the water increases by $3.3 \times 10^5$ J in 200 s.

Calculate the total amount of energy supplied to the kettle in the 200 s.

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$$

**(2)**

$$\frac{91}{100} = \frac{3.3 \times 10^5}{x}$$

$$x = \frac{3.3 \times 10^5 \times 100}{91} \approx 3.6 \times 10^5$$

total amount of energy supplied = $3.6 \times 10^5$ J

**TOTAL FOR PAPER IS 36 MARKS**