

Please write clearly in block capitals.

H

Centre number

Candidate
number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

PHYSICS

Higher Tier Paper 1

Practice Paper Series – Set 1

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the Physics Equations Sheet (printed at the back of this booklet).

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 08.4 and 11.1 you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully developed
 - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
TOTAL	

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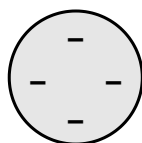
0 1 A student rubs a polythene rod with a woollen cloth. The rod becomes negatively charged.

0 1 . 1 Explain how the rod becomes negatively charged. [2 marks]

0 1 . 2 The student holds the charged rod near a second polythene rod that has also been rubbed with the cloth. [1 mark]
What happens to the rods?

Figure 1 shows a negatively charged metal sphere.

Figure 1



0 1 . 3 Draw the electric field around the sphere on **Figure 1**. [2 marks]

0 1 . 4 Where is the electric field around the sphere strongest? [1 mark]

0 1 . 5 When an earthed metal object is brought close to the charged sphere, a spark can jump between them. [2 marks]

Explain how the spark is produced.

02

A student investigated how well different materials insulate a beaker of hot water.

The student wrapped identical beakers of hot water in equal thicknesses of different materials and measured the temperature of the water after 10 minutes.

Table 1 shows the results.

Table 1

Material	Temperature at the start in °C	Temperature after 10 minutes in °C
No insulation	80	46
Bubble wrap	80	62
Cotton wool	80	58
Aluminium foil	80	50

02.1

Give **two** variables the student controlled in this investigation.

[2 marks]

1

.....

2

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02.2

Which material is the best thermal insulator?

[2 marks]

Use data from **Table 1** to justify your answer.

Material

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02.3

Explain why bubble wrap is a good thermal insulator.

[2 marks]

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Question 2 continues on the next page

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0 2 . 4 Each beaker contained 0.20 kg of water. [2 marks]

Calculate the energy transferred from the water in the beaker with **no** insulation during the 10 minutes.

specific heat capacity of water = 4200 J/kg °C

Energy transferred = ... J

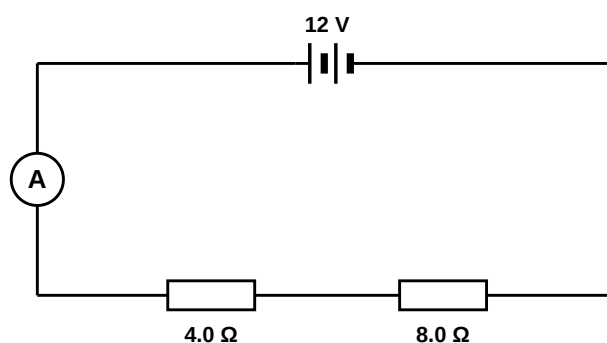
0 2 . 5 Calculate the mean rate of energy transfer from the water in this beaker. [2 marks]

Use your answer to **02.4**.

Mean rate of energy transfer = ... W

0 3 **Figure 2** shows a circuit with two resistors connected in series.

Figure 2



0 3 . 1 Which statement is correct for the circuit in **Figure 2**? [1 mark]

Tick (✓) **one** box.

- The current is the same at all points in the circuit
- The potential difference is the same across each resistor
- The total resistance is less than 4.0 Ω
- The current splits between the two resistors

☐

☐

☐

☐

Question 3 continues on the next page

0 3 . 2 Calculate the total resistance of the circuit.

[1 mark]

Total resistance = ... Ω

0 3 . 3 Calculate the reading on the ammeter.

[2 marks]

Current = ... A

0 3 . 4 Calculate the potential difference across the 8.0Ω resistor.

[2 marks]

Potential difference = ... V

0 3 . 5 Explain why the potential difference across the 8.0Ω resistor is greater than the potential difference across the 4.0Ω resistor. [2 marks]

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0 3 . 6 The two resistors are now connected in parallel with each other across the same battery. [2 marks]

Explain why the total resistance of the circuit is now less than 4.0Ω .

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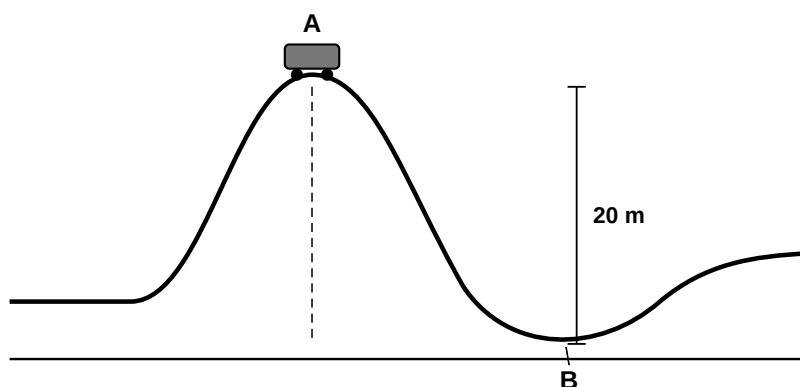
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Turn over for the next question

0 4 Figure 3 shows part of a roller coaster.

Figure 3



A motor pulls a car of mass 500 kg up to point **A**. The car is released from rest and rolls down the track to point **B**.

Point **A** is 20 m higher than point **B**.

gravitational field strength = 9.8 N/kg

0 4 . 1 Calculate the decrease in the gravitational potential energy of the car as it moves from **A** to **B**. [2 marks]

Decrease in gravitational potential energy = ... J

0 4 . 2 Assume that all of the gravitational potential energy is transferred to the kinetic energy store of the car. [3 marks]

Calculate the speed of the car at point **B**.

Use your answer to **04.1**.

Speed = ... m/s

Question 4 continues on the next page

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04.3

The actual speed of the car at point **B** is less than the speed calculated in **04.2**.

[2 marks]

Explain why.

04.4

The motor takes 25 s to pull the car from point **B** up to point **A**.

[2 marks]

Calculate the minimum power of the motor.

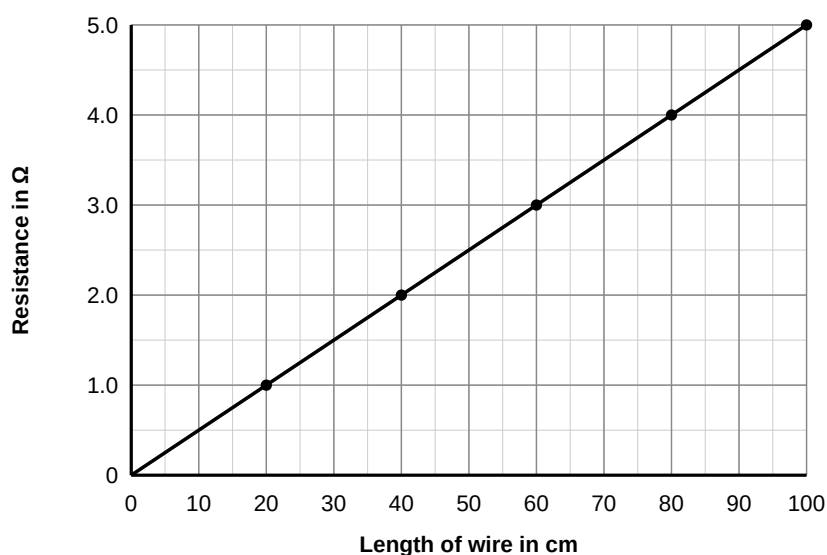
Power = ... W

05

A student investigated how the resistance of a wire depends on the length of the wire.

Figure 4 shows the results.

Figure 4



Question 5 continues on the next page

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0 5 . 1 Describe the relationship between the resistance of the wire and its length. [2 marks]

Use **Figure 4** to justify your answer.

0 5 . 2 Determine the resistance of a 150 cm length of the same wire. [2 marks]
Use **Figure 4**.

Resistance = ... Ω

0 5 . 3 The student switched the circuit off between readings. [2 marks]
Explain why.

0 5 . 4 A thermistor is used as the temperature sensor in a thermostat that controls a heater. [2 marks]
Explain how the thermistor allows the thermostat to switch the heater off when the room is warm enough.

0 5 . 5 Give **one** use of a light-dependent resistor (LDR). [1 mark]

06 A cylinder with a movable piston contains 0.050 m^3 of gas at a pressure of 1.2×10^5 Pa.

06.1 Explain how the gas exerts a pressure on the walls of the cylinder. [2 marks]

06.2 The piston is pushed in slowly so that the volume of the gas decreases to 0.020 m^3 . The temperature of the gas does not change. [3 marks]
Calculate the new pressure of the gas.

Pressure = _____ Pa

06.3 Explain, in terms of particles, why the pressure of the gas increases when the volume decreases. [2 marks]

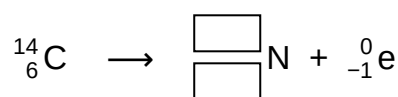
06.4 When the piston is pushed in very quickly, the temperature of the gas increases. [2 marks]
Explain why.

Question 6 continues on the next page

- 06.5** Describe the motion of the particles in the gas **and** explain how the temperature of the gas is related to this motion. [2 marks]

- 07** Carbon-14 is a radioactive isotope. A carbon-14 nucleus decays by emitting a beta particle to form a nitrogen (N) nucleus.

- 07.1** Complete the nuclear equation for this decay. [2 marks]



- 07.2** Describe what happens in the nucleus when a beta particle is emitted. [2 marks]

- 07.3** What happens to the atomic number of the nucleus when a beta particle is emitted? [1 mark]

- 07.4** A different radioactive source has an activity of 1600 Bq. The half-life of the source is 8.0 days. [3 marks]

Calculate the ratio of the activity of the source after 24 days to its initial activity.

Give your answer in the form 1 : n

Ratio = ...

07.5

Radioactive decay is a random process.

[2 marks]

Explain what is meant by **random** in this context.

08

Everyone is exposed to background radiation.

08.1

Give **two** sources of background radiation.

[2 marks]

1

2

Table 2 shows the mean radiation dose per year from different sources for people in one country.

Table 2

Source	Mean dose per year in mSv
Radon gas from rocks and soil	1.30
Cosmic rays	0.35
Food and drink	0.30
Medical procedures	0.45

08.2

Calculate the percentage of the total mean dose that comes from medical procedures.

[3 marks]

Percentage = _____ %

Question 8 continues on the next page

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A student measures the count rate from a radioactive source in a laboratory.

[1 mark]

Explain why the student must also measure the background count rate.

A medical tracer is a radioactive isotope that is injected into a patient. A detector outside the body is used to follow the movement of the tracer inside the patient. The test takes about two hours.

Table 3 gives information about three radioactive isotopes.

Table 3

Isotope	Type of radiation emitted	Half-life
A	alpha	6 hours
B	gamma	6 hours
C	gamma	8 days

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Evaluate the suitability of the three isotopes for use as the medical tracer.

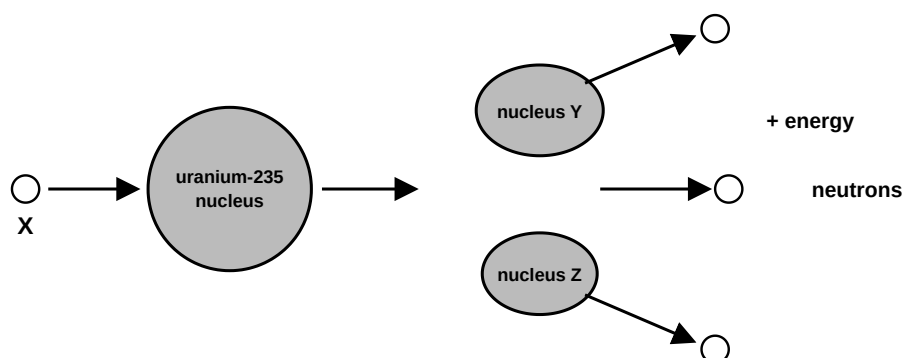
[6 marks]

Use information from **Table 3**.

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09 **Figure 5** shows the nuclear fission of a uranium-235 nucleus.

Figure 5



09.1 Name particle X.

[1 mark]

Question 9 continues on the next page

0 9 . 2 Describe what happens when the uranium-235 nucleus undergoes fission. [3 marks]

0 9 . 3 In a nuclear reactor the fission reactions form a controlled chain reaction. [2 marks]

Explain how a chain reaction occurs **and** how it is controlled in the reactor.

0 9 . 4 Nuclear fusion happens in the Sun. [2 marks]

Describe the process of nuclear fusion.

0 9 . 5 Nuclei are positively charged. [1 mark]

Explain why nuclear fusion requires very high temperatures.

Turn over for the next question

1 0 A solar farm has 40 000 solar panels. Each panel has a maximum power output of 300 W.

1 0 . 1 Calculate the maximum power output of the solar farm. [2 marks]
Give your answer in megawatts (MW).

Maximum power output = ... MW

1 0 . 2 Explain why the actual power output of the solar farm is usually much less than the maximum. [1 mark]

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.....

1 0 . 3 A nuclear power station has a power output of 1200 MW. [2 marks]
Give **one** advantage and **one** disadvantage of using a nuclear power station rather than solar farms to generate electricity.

Advantage

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Disadvantage

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1 1 A student wants to investigate how the current through a filament lamp varies with the potential difference across the lamp.

The student has a filament lamp, a d.c. power supply, a variable resistor, an ammeter, a voltmeter, a switch and connecting wires.

1 1 . 1 Describe how the student should carry out the investigation. [6 marks]
Your answer should include the circuit the student should use and the measurements the student should take.

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[illegible]

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END OF QUESTIONS

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[illegible]

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Additional page, if required.

Write the question numbers in the left-hand margin.

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Do not write outside the box

There are no questions printed on this page

There are no more questions in this paper. Original practice paper © sciencegcse.co.uk – free to use for non-commercial education. Not an AQA paper.

Physics Equations Sheet

GCSE Physics – Practice Paper Series, Set 1

You may use these equations in your answers. HT = Higher Tier only equations. The equations are those listed in the AQA specification; this sheet is provided by sciencegcse.co.uk and is not an AQA document.

	Word equation	Symbol equation
1	kinetic energy = $0.5 \times \text{mass} \times (\text{speed})^2$	$E_k = \frac{1}{2} m v^2$
2	elastic potential energy = $0.5 \times \text{spring constant} \times (\text{extension})^2$	$E_e = \frac{1}{2} k e^2$
3	gravitational potential energy = mass $\times$ gravitational field strength $\times$ height	$E_p = m g h$
4	change in thermal energy = mass $\times$ specific heat capacity $\times$ temperature change	$\Delta E = m c \Delta \theta$
5	power = energy transferred $\div$ time	$P = E / t$
6	power = work done $\div$ time	$P = W / t$
7	efficiency = useful output energy transfer $\div$ total input energy transfer efficiency = useful power output $\div$ total power input	
8	charge flow = current $\times$ time	$Q = I t$
9	potential difference = current $\times$ resistance	$V = I R$
10	power = potential difference $\times$ current	$P = V I$
11	power = (current) $^2 \times$ resistance	$P = I^2 R$
12	energy transferred = power $\times$ time	$E = P t$
13	energy transferred = charge flow $\times$ potential difference	$E = Q V$
14	density = mass $\div$ volume	$\rho = m / V$
15	thermal energy for a change of state = mass $\times$ specific latent heat	$E = m L$
16	pressure $\times$ volume = constant (fixed mass of gas, constant temperature)	$p V = \text{constant}$
17	weight = mass $\times$ gravitational field strength	$W = m g$
18	work done = force $\times$ distance (along the line of action of the force)	$W = F s$
19	force = spring constant $\times$ extension	$F = k e$
20	moment of a force = force $\times$ distance (normal to direction of force)	$M = F d$
21	pressure = force normal to a surface $\div$ area of that surface	$p = F / A$
22 HT	pressure due to a column of liquid = height of column $\times$ density of liquid $\times$ gravitational field strength	$p = h \rho g$
23	distance travelled = speed $\times$ time	$s = v t$
24	acceleration = change in velocity $\div$ time taken	$a = \Delta v / t$
25	(final velocity) ^{2} – (initial velocity) ^{2} = $2 \times$ acceleration $\times$ distance	$v^2 - u^2 = 2 a s$
26	resultant force = mass $\times$ acceleration	$F = m a$
27 HT	momentum = mass $\times$ velocity	$p = m v$
28 HT	force = change in momentum $\div$ time taken	$F = m \Delta v / \Delta t$
29	period = $1 \div$ frequency	$T = 1 / f$
30	wave speed = frequency $\times$ wavelength	$v = f \lambda$
31	magnification = image height $\div$ object height	
32 HT	force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density $\times$ current $\times$ length	$F = B I l$
33 HT	potential difference across primary coil $\div$ potential difference across secondary coil = number of turns in primary coil $\div$ number of turns in secondary coil	$V_p / V_s = n_p / n_s$
34 HT	potential difference across primary coil $\times$ current in primary coil = potential difference across secondary coil $\times$ current in secondary coil	$V_p I_p = V_s I_s$