Name .... Class ....

Answers Due Date ....

Marking Due Date ....

Total marks .... out of 60

Revision Paper B (F)

Combined Sciences PHYSICS **PAPER 1**

(Edexcel Combined Sciences Paper 5)

FOUNDATION TIER

QR codes embedded in this paper link to relevant BBC Bitesize pages (December 2022)

This paper could contain content on the following topics:

T1 Key Concepts of Physics	T2 Motion and Forces	T3 Conservation of Energy
T4 Waves	T5 Light and the EM Spectrum	T6 Radioactivity

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) Figure 1 shows a speed/time graph for a car.

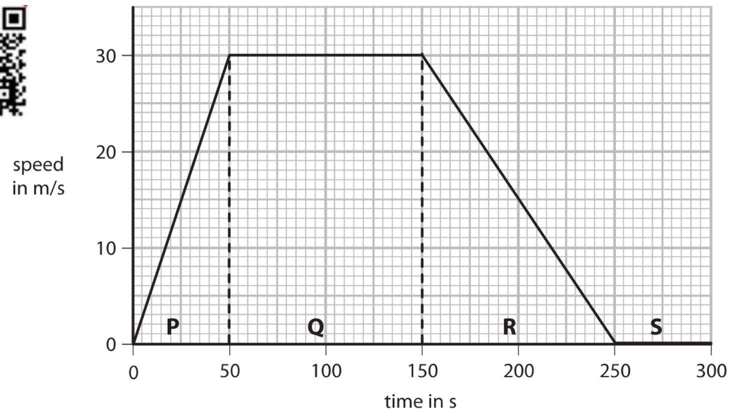

Figure 1

(i) The graph in Figure 1 is divided into four parts, **P**, **Q**, **R** and **S**.

Draw a line from the letter for each **part** to the correct **description of the motion** during that part.

One line has been drawn for you.

(2)

part	**description of the motion**
P	the car is standing still
Q	the car is accelerating
R	the car is decelerating
S	the car is travelling at constant speed

(ii) In two parts of the graph in Figure 1 the forces are balanced.

State the letters of the two parts of the graph where the horizontal forces acting on the car are balanced.

(2)

part .... and part ....

(iii) Calculate the distance travelled by the car in part Q.

Use the equation

distance travelled = average speed × time

(2)

distance travelled = ... m

(b) A car with a mass of 1800 kg is accelerating at $1.2\,m/s^2$.

Calculate the force used to accelerate the car.

Use the equation

force = mass × acceleration

(2)

force = ... N

(Total for Question 1 = 8 marks)

2 (a) Figure 2 shows an energy transfer diagram for a steam engine.

The diagram shows the amounts of energy transferred each second by the steam engine.

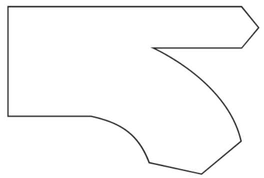

Figure 2

(i) Calculate the amount of wasted energy.

(1)

wasted energy = ... J

(ii) Calculate the efficiency of the steam engine.

Use the equation

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

(2)

efficiency = ...

(iii) State what happens to the wasted energy.

(1)

....

....

(iv) Coal is a fossil fuel that is burnt in some steam engines.

State **two** ways that the use of coal might be harmful to the environment.

(2)

1 ....

....

2 ....

....

(b) A model train has a mass of 8.0 kg.
It travels at a speed of 1.5 m/s.

Calculate the kinetic energy of the model train.

Use the equation

$$\text{kinetic energy} = \tfrac{1}{2} \times \text{mass} \times (\text{speed})^2$$

(3)

kinetic energy = ... J

(Total for Question 2 = 9 marks)

3 (a) (i) Use words from the box to complete the sentences below about ions.

absorbing	gaining	inner	losing	outer

(2)

Atoms may form positive ions by .... electrons.

The electrons involved in forming positive ions are the .... electrons.

(ii) Which of these radiations is both electromagnetic and ionising?

(1)

- ☐ **A** alpha
- ☐ **B** beta minus
- ☐ **C** gamma
- ☐ **D** neutron

(iii) Which type of radiation will travel the shortest distance in air?

(1)

- ☐ **A** alpha
- ☐ **B** beta minus
- ☐ **C** beta plus
- ☐ **D** gamma

(b) Lead-214 is a radioactive isotope.

(i) State **one** way in which radioactive isotopes can be harmful to people.

(1)

....

....

(ii) Lead-214 emits β^- particles.

Describe what happens to the nucleus of a lead-214 atom when it emits a β^- particle.

(2)

....

....

....

....

P 6 0 2 4 8 A 0 6 2 0

(c) The typical size of an atom is

(1)

- ☐ **A** 10^{-5} m
- ☐ **B** 10^{-10} m
- ☐ **C** 10^{-15} m
- ☐ **D** 10^{-20} m

(d) The mass of a proton is 1.6726×10^{-27} kg.
The mass of an electron is 9.1094×10^{-31} kg.

Calculate how many times the mass of a proton is greater than the mass of an electron.

Give your answer to two significant figures.

(3)

.... times

(Total for Question 3 = 11 marks)

P 6 0 2 4 8 A 0 7 2 0

Turn over

4 (a) (i) Which of these would be a typical speed for a racing cyclist travelling down a steep straight slope?

(1)

- ☒ **A** 0.2 m/s
- ☒ **B** 2 m/s
- ☒ **C** 20 m/s
- ☒ **D** 200 m/s

(ii) A cyclist travels down a slope.
The top of the slope is 20 m vertically above the bottom of the slope.
The cyclist has a mass of 75 kg.

Calculate the change in gravitational potential energy of the cyclist between the top and the bottom of the slope.

The gravitational field strength, g, is 10 N/kg.

(3)

change in gravitational potential energy = ... J

(b) An aircraft waits at the start of a runway.
The aircraft accelerates from a speed of 0 m/s to a speed of 80 m/s.
The acceleration of the aircraft is $4\,m/s^2$.

Calculate the distance, x, travelled by the aircraft while it is accelerating.

Use the equation

$$x = \frac{v^2 - u^2}{2a}$$

(2)

x = ... m

(c) A student needs to measure the average speed of an accelerating trolley between two marks on a bench.

Figure 3 shows the arrangement of some apparatus that the student can use.

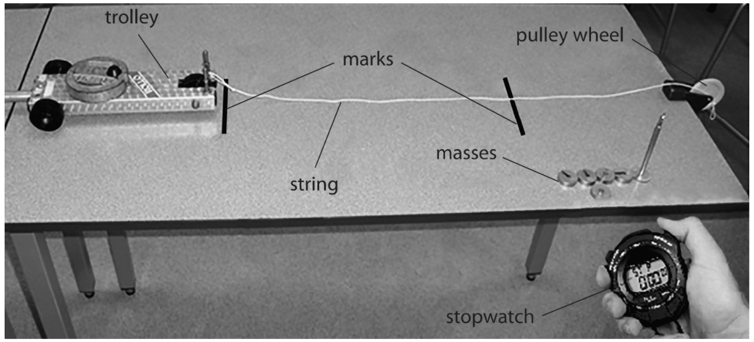

Figure 3

(i) One piece of apparatus is missing from the diagram.
This piece of apparatus is needed to determine the average speed.

State the extra piece of apparatus needed to determine the average speed.

(1)

....

(ii) Describe how the student can make the trolley accelerate along the bench.

(2)

....

....

....

....

(iii) The student wishes to develop the experiment to determine the acceleration of the trolley.

State **one other** measurement that the student must make to determine the acceleration of the trolley.

(1)

....

....

(Total for Question 4 = 10 marks)

5 (a) Which colour of visible light has the longest wavelength?

(1)

☒ **A** blue

☒ **B** green

☒ **C** red

☒ **D** yellow

(b) Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will.

(2)

....

....

....

....

(c) Figure 4 is a diagram of a water wave.

A cork is floating on the water.

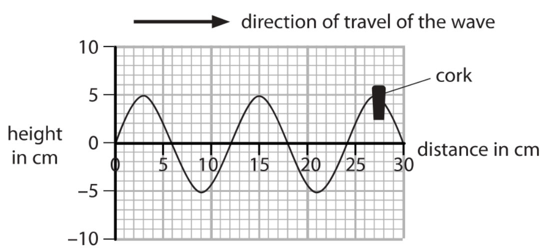

Figure 4

(i) Use the scale on the diagram to measure the wavelength of the wave. **(2)**

wavelength = ... cm

(ii) Describe the motion of the cork.

You should include how the cork moves relative to the direction of travel of the wave. **(2)**

....

....

....

....

(d) A different water wave has a wavelength of 0.25 m and a frequency of 1.5 Hz.

Calculate the wave speed. **(2)**

wave speed = ... m/s

(Total for Question 5 = 9 marks)

P 6 0 2 4 8 A 0 1 3 2 0

6 (a) Carbon-13 and carbon-14 are isotopes of carbon.

Nuclei of carbon-13 and carbon-14 can be represented by these symbols

$$^{13}_{6}C \quad \text{and} \quad ^{14}_{6}C$$

Complete the table for an atom of carbon-13 and an atom of carbon-14. **(2)**

	number of neutrons in the nucleus	number of electrons in orbit around the nucleus
carbon-13		
carbon-14		

(b) (i) State the name of an instrument that can be used to measure radioactivity. **(1)**

....

(ii) State **two** sources of background radiation. **(2)**

1 ....

2 ....

P 6 0 2 4 8 A 0 1 4 2 0

(c) Carbon-14 is radioactive and has a half-life of 5 700 years.

The number of radioactive carbon-14 atoms in a very old piece of wood is found to have decreased from 1 000 000 to 125 000.

Determine the age of the piece of wood.

(2)

age of wood = ... years

*(d) In 1908 a scientist called Rutherford was investigating ideas about atoms.

His students fired a beam of alpha particles at a thin piece of gold foil.

Figure 5 shows the arrangement of the experiment.

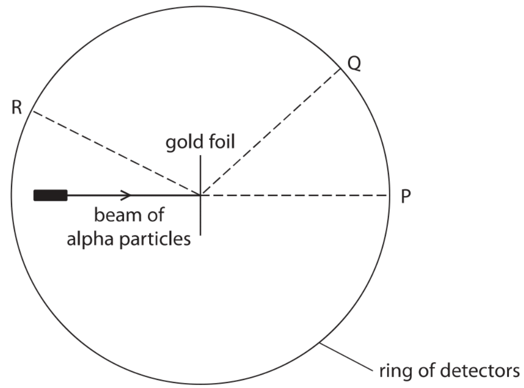

Figure 5

Some alpha particles were found at all parts of the ring of detectors.

The table in Figure 6 shows how many alpha particles were detected at P, at Q and at R, in one experiment.

position	number of alpha particles detected
P	72340
Q	25
R	2

Figure 6

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Explain what the information in Figure 5 and Figure 6 shows about the structure of an atom.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

If you're taking **GCSE (9–1) Combined Science** or **GCSE (9–1) Physics**, you will need these equations:

HT = higher tier

	distance travelled = average speed × time	
	acceleration = change in velocity ÷ time taken	$a = \frac{(v-u)}{t}$
	force = mass × acceleration	$F = m \times a$
	weight = mass × gravitational field strength	$W = m \times g$
HT	**momentum = mass × velocity**	$\boldsymbol{p = m \times v}$
	change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
	kinetic energy = 1/2 × mass × (speed)^2	$KE = \frac{1}{2} \times m \times v^2$
	efficiency = $\frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$	
	wave speed = frequency × wavelength	$v = f \times \lambda$
	wave speed = distance ÷ time	$v = \frac{x}{t}$
	work done = force × distance moved in the direction of the force	$E = F \times d$
	power = work done ÷ time taken	$P = \frac{E}{t}$
	energy transferred = charge moved × potential difference	$E = Q \times V$
	charge = current × time	$Q = I \times t$
	potential difference = current × resistance	$V = I \times R$
	power = energy transferred ÷ time taken	$P = \frac{E}{t}$
	electrical power = current × potential difference	$P = I \times V$
	electrical power = (current)^2 × resistance	$P = I^2 \times R$
	density = mass ÷ volume	$\rho = \frac{m}{V}$

Continue ▶

	force exerted on a spring = spring constant × extension	$F = k \times x$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 \times a \times x$
HT	**force = change in momentum ÷ time**	$\boldsymbol{F = \frac{(mv - mu)}{t}}$
	energy transferred = current × potential difference × time	$E = I \times V \times t$
HT	**force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length**	$\boldsymbol{F = B \times I \times l}$
	For transformers with 100% efficiency, potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_P \times I_P = V_S \times I_S$
	change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta\theta$
	thermal energy for a change of state = mass × specific latent heat	$Q = m \times L$
	energy transferred in stretching = 0.5 × spring constant × (extension)^2	$E = \frac{1}{2} \times k \times x^2$

If you're taking **GCSE (9–1) Physics**, you also need these extra equations:

	moment of a force = force × distance normal to the direction of the force	
	pressure = force normal to surface ÷ area of surface	$P = \frac{F}{A}$
HT	$\boldsymbol{\frac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}}$	$\boldsymbol{\frac{V_P}{V_S} = \frac{N_P}{N_S}}$
	to calculate pressure or volume for gases of fixed mass at constant temperature	$P_1 \times V_1 = P_2 \times V_2$
HT	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength**	$\boldsymbol{P = h \times \rho \times g}$

END OF EQUATION LIST