chermistry.com
Practice paper written from an analysis of every
O-Level Science (Physics) paper, 2010–2025

CANDIDATE NAME									
CENTRE NUMBER	S					INDEX NUMBER				

SCIENCE (PHYSICS)

Specimen

Paper 2 Physics

PRACTICE PAPER · PAPER 2.5

For practice before the next examination

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

This is a **chermistry practice paper**.

READ THESE INSTRUCTIONS FIRST

Write your name, centre number and index number in the boxes above.

You may use an HB pencil for any diagrams, graphs or rough working.

Write in dark blue or black pen.

Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.

You may lose marks if you do not show your working or if you do not use appropriate units.

Take g = 10 m/s^2 (or 10 N/kg) unless you are told otherwise.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **one** question.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total mark for this paper is 65.

This document consists of **18** printed pages.

NOT AN OFFICIAL EXAMINATION PAPER

Written for classroom practice from the topic frequencies in the chermistry theory-paper analysis. It follows the layout, wording and mark scheme conventions of the O-Level Science (Physics) papers but is not set, endorsed or marked by any examination board.

Section A

Answer **all** the questions in the spaces provided.

1 A weather balloon is released from the ground. It carries a box of instruments up through the atmosphere.

(a) The balloon rises through falling rain. Tick (✓) the box next to the best estimate of the diameter of a raindrop.

diameter	tick (✓) one box
2×10^{-9} m	☐
2×10^{-6} m	☐
2×10^{-3} m	☐
2 m	☐

[1]

(b) The wind carries the balloon sideways at a steady 5.0 m/s. State what else must be given, as well as 5.0 m/s, to describe the velocity of the balloon.

.....

[1]

(c) The upward speed of the balloon is measured every 4 s. The results are in the table.

time / s	0	4	8	12	16	20	24
speed / m/s	0	2.0	4.0	6.0	6.0	6.0	4.0

The balloon accelerates uniformly between 4 s and 12 s. Use the table to calculate its acceleration during this time.

acceleration = ... m/s^2 [2]

(d) Plot the points from the table on Fig. 1.1. Draw a straight line between each pair of neighbouring points.

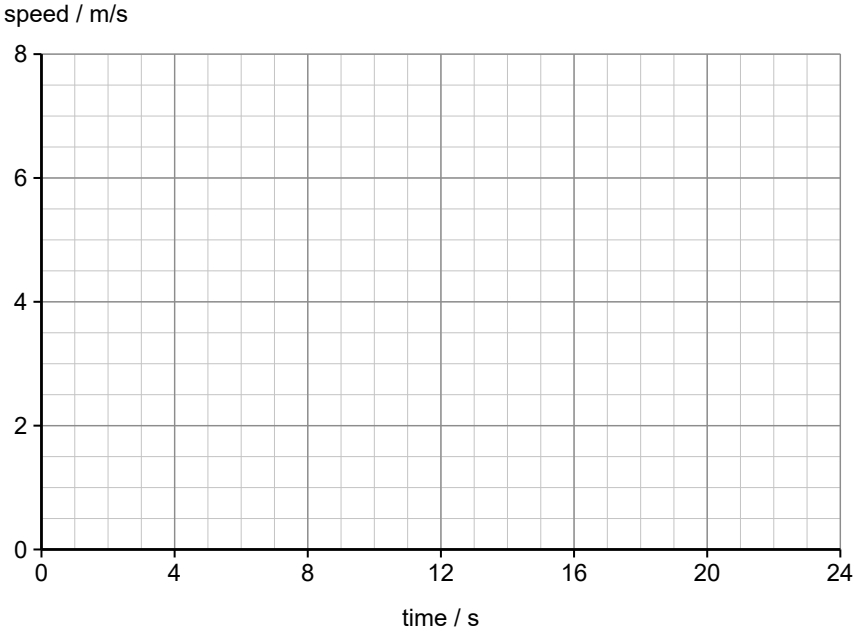


Fig. 1.1

[1]

(e) Use your graph to find the speed of the balloon at 22 s.

speed = ... m/s [1]

[Total: 6]

2 A solar panel of mass 20 kg is a flat rectangle 1.6 m long, 1.0 m wide and 0.050 m thick. It is carried on to a flat roof.

(a) Distinguish between the mass of the panel and the weight of the panel.

.....

.....

..... [2]

(b) The gravitational field strength is 10 N/kg.

(i) The panel is laid flat on the roof. Calculate the pressure that the panel exerts on the roof.

pressure = ... N/m^2 [1]

(ii) The panel is then stood on its 1.0 m by 0.050 m edge. Calculate the pressure that the panel now exerts on the roof.

pressure = ... N/m^2 [1]

(c) In a storm, hailstones of total mass 3.0 kg land on the panel and then melt. The water runs into a tank that already contains 12 kg of water. State the total mass of water in the tank and explain why melting does not change the mass of the 3.0 kg of hailstones.

.....

.....

..... [2]

[Total: 6]

3 A land yacht is a wheeled vehicle that is driven along a beach by the wind blowing on its sail.

(a) The wind drives the land yacht along a level beach at a constant speed. In the box, draw and label a free-body diagram of the land yacht to show all the forces acting on it. Represent the land yacht by a dot.

[2]

(b) The wind suddenly stops. Describe how the speed of the land yacht changes and explain your answer in terms of the forces acting on it.

.....

.....

.....

..... [2]

[Total: 4]

4 Fig. 4.1 shows a cardboard model of a weather vane. It is hung freely from a pin at P and comes to rest. The centre of gravity of the model is at X.

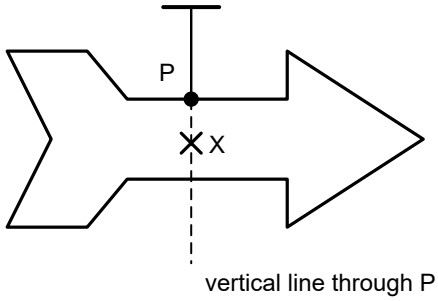


Fig. 4.1

(a) State the principle of moments for a body in equilibrium.

.....

.....

..... [1]

(b) Explain why X is vertically below P when the model is at rest.

.....

.....

.....

..... [2]

[Total: 3]

5 A tidal power station generates electricity from the movement of sea water through turbines.

(a) Each second, 8.0 MJ of energy is transferred from the moving water to the turbines. The generators transfer 5.0 MJ of energy to the electricity supply each second. State the principle of the conservation of energy and use it to calculate the energy that is not transferred to the supply each second.

.....

.....

.....

..... [2]

(b) In one hour the station transfers 1.8×10^{10} J of energy to the electricity supply. Calculate the power output of the station.

power = ... W [2]

(c) A winch raises a sluice gate of mass 400 kg at a steady speed through a height of 2.5 m. The gravitational field strength is 10 N/kg. Calculate the work done on the gate by the winch.

work done = ... J [1]

[Total: 5]

6 A geyser throws hot water and steam out of the ground. A copper pipe carries some of the hot spring water to a bath house.

(a) When 1.0 kg of the hot water changes into 1.0 kg of steam, its volume becomes much greater. Describe how the arrangement of the particles in the steam differs from that in the liquid water, and use the kinetic particle model to explain why the volume increases so much.

.....

.....

.....

..... [2]

(b) The water in the underground chamber is at 150 °C. It has more energy in its internal store than the same mass of spring water at 20 °C at the surface. State what is meant by the internal energy of the water and explain why the hotter water has more.

.....

.....

.....

..... [2]

(c) After a time the water in the copper pipe is at 80 °C. The pipe is buried in soil at 18 °C. State the direction in which energy is transferred by heating between the water and the soil.

.....

..... [1]

(d) Describe how energy is transferred through the copper wall of the pipe by conduction.

.....

.....

.....

..... [2]

[Total: 7]

7 A foghorn on a harbour wall warns ships in fog. A diaphragm inside the horn vibrates, and the sound is heard on a ship far away.

(a) Explain how the vibrating diaphragm makes it possible for sound to be heard on the ship.

.....

.....

.....

..... [2]

(b) Fig. 7.1 shows the positions of the air particles (the vertical lines) along the path of the sound at one instant. X, Y and Z mark three places along the path of the sound.

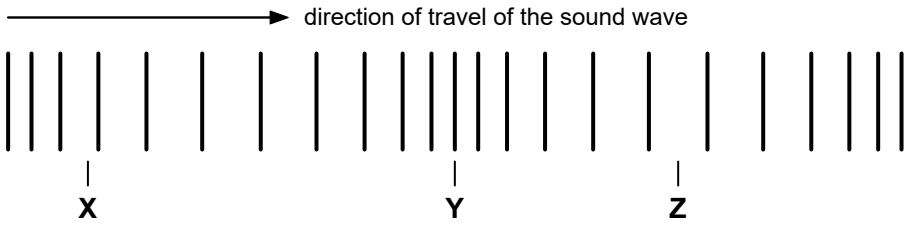


Fig. 7.1

(i) State which of X, Y and Z is at the centre of a compression and which is at the centre of a rarefaction.

compression = ...

rarefaction = ... [1]

(ii) Describe, in terms of the spacing of the air particles, what is meant by a rarefaction.

.....

..... [1]

(c) Waves on a stretched rope are transverse waves, but the sound wave in (b) is longitudinal. State one difference between a transverse wave and a longitudinal wave, and give one other example of a transverse wave.

.....

.....

..... [2]

[Total: 6]

8 A dust storm blows across a desert in bright sunshine.

(a) Energy from the Sun reaches the desert as visible light, infrared radiation and ultraviolet radiation. These are all electromagnetic waves.

(i) State whether electromagnetic waves are transverse or longitudinal.

.....[1]

(ii) Ultraviolet radiation takes 500 s to travel from the Sun to the Earth. State how long infrared radiation takes to travel from the Sun to the Earth, and give a reason for your answer.

.....

.....[1]

(b) In the storm, two dust grains P and Q rub against each other. Electrons are transferred from grain Q to grain P.

(i) State the type of electric charge on grain P and the type of electric charge on grain Q after the transfer.

charge on P = ...

charge on Q = ...[1]

(ii) State the SI unit in which electric charge is measured.

.....[1]

[Total: 4]

9 A gardener grows seedlings in a greenhouse in a cold climate. The greenhouse has a heating mat and a set of grow-lamps. The mains supply is 230 V.

(a) The heating mat is connected to the 230 V supply. The current in the mat is 2.5 A. Calculate the resistance of the mat.

resistance = ... Ω [2]

(b) The mat contains a long thin wire. Explain why the wire becomes hot when there is a current in it.

.....

.....

..... [1]

(c) Four identical grow-lamps each have a power rating of 0.10 kW. They are on for 12 hours every day. Electricity costs 28 cents per kW h. Calculate the cost of using the lamps for 30 days. Give your answer in dollars.

cost in dollars = ... [2]

(d) The four lamps (total power 400 W) are connected to the 230 V supply through a plug fitted with a fuse. Calculate the normal current in the lamps. The fuses available are rated 1 A, 3 A and 13 A. State which fuse should be used and explain your choice.

.....

.....

.....

.....

..... [2]

[Total: 7]

10 An electric bicycle has a motor that is powered by a rechargeable battery.

(a) Fig. 10.1 shows a straight wire between a north pole above and a south pole below. The dot shows that the current in the wire is out of the page.

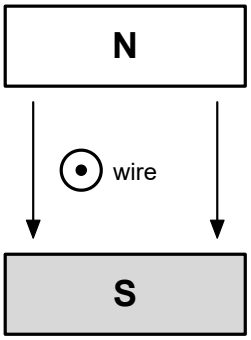


Fig. 10.1

(i) State the direction of the force on the wire: to the left or to the right.

.....[1]

(ii) The current in the wire is reversed and, at the same time, the magnets are turned round so that the south pole is above the wire. State the new direction of the force on the wire.

.....[1]

(b) Fig. 10.2 shows the coil of the motor, seen from the end, between the poles of the magnets. There is a current in the coil. A student says that the coil cannot turn because the two forces on it are equal in size. Is the student correct? Explain your answer.

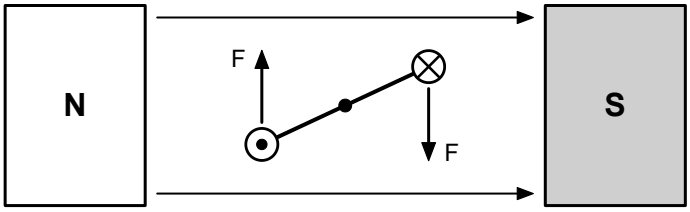


Fig. 10.2

.....

.....

.....[2]

[Total: 4]

11 A melting glacier uncovers wood from an ancient forest. Scientists find the age of the wood by measuring the radioactivity of the carbon-14 in it.

(a) A neutral atom of carbon-14 has 6 protons and 8 neutrons. State the number of electrons in the atom.

.....[1]

(b) Radioactive substances have other useful applications but can also be hazardous. State one use of radioactivity, other than finding the age of an object, and one hazard of radioactivity.

.....

.....

.....[2]

[Total: 3]

Section B

Answer **one** question from this section.

12 An automatic weather station on a mountain top is powered by a 12 V battery. The battery supplies three heating resistors that stop ice forming on the rain gauge. Fig. 12.1 shows the circuit.

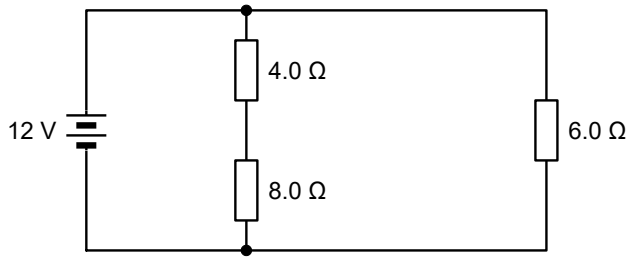


Fig. 12.1

(a) Calculate the effective resistance of the circuit.

effective resistance = ... Ω [3]

(b) The p.d. across each of the two branches is 12 V. Calculate the current in the branch that contains the 4.0 Ω and 8.0 Ω resistors and the p.d. across the 4.0 Ω resistor. Then use the relationship between the p.d.s in a series circuit to calculate the p.d. across the 8.0 Ω resistor.

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.....

.....

..... [2]

(c) The weather station also has a sunshine recorder. A converging lens focuses parallel rays of sunlight onto a card that is at the principal focus F of the lens (Fig. 12.2). The card is burnt when the Sun shines. Define the focal length of the lens and explain why the card is burnt only when it is at F.

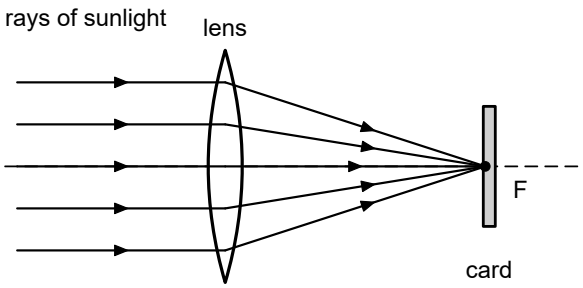


Fig. 12.2

.....

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..... [2]

(d) The station also has a camera with a converging lens of focal length 4.0 cm. It is used in two ways. Fig. 12.3 shows the lens, its principal focus F and a distant cloud that is more than twice the focal length from the lens. The lens is then used as a magnifying glass to read a thermometer scale placed 3.0 cm from the lens. For each use, write one word from each pair in the table to describe the image. One mark is given for each row if both words are correct.

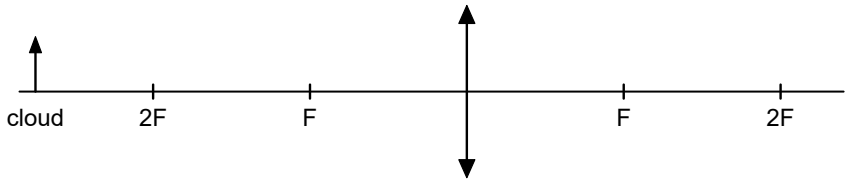


Fig. 12.3

	cloud	thermometer scale
real / virtual		
upright / inverted		
magnified / diminished		

[3]

[Total: 10]

13 Iodine-131 is a radioactive nuclide. A small amount is added to river water to trace where polluted water flows.

(a) A nucleus of iodine-131 contains 53 protons.

(i) Write the nuclide notation for iodine-131 in the form ${}^{A}_{Z}X$. Use the symbol I for iodine.

.....[1]

(ii) Calculate the number of neutrons in a nucleus of iodine-131.

number of neutrons = ...[1]

(b) A detector downstream measures the count rate from a sample of the water. The table shows how the count rate falls with time.

time / days	0	4	8	12	16	20	24
count rate / counts per minute	800	566	400	283	200	141	100

Use the table to determine the half-life of iodine-131. Hence calculate the time taken for the count rate to fall from 800 to 50 counts per minute.

time = ... days [3]

(c) A microphone records the sound from a storm-warning siren P. Fig. 13.1 shows how the displacement of the air at the microphone changes with time. Use the graph to determine the amplitude and the frequency of the sound.

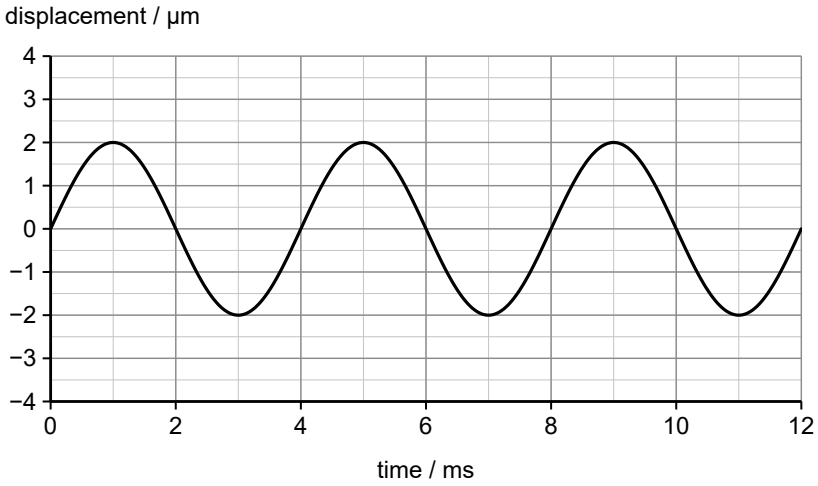


Fig. 13.1

amplitude = ... μm

frequency = ... Hz [2]

(d) A second siren produces sound Q. Sound Q has half the amplitude of P and twice the frequency of P.

(i) State which of P and Q is quieter and which has the higher pitch. Explain each answer.

.....

.....

..... [2]

(ii) On Fig. 13.2, draw the displacement–time graph for sound Q. Use the same scales as in Fig. 13.1.

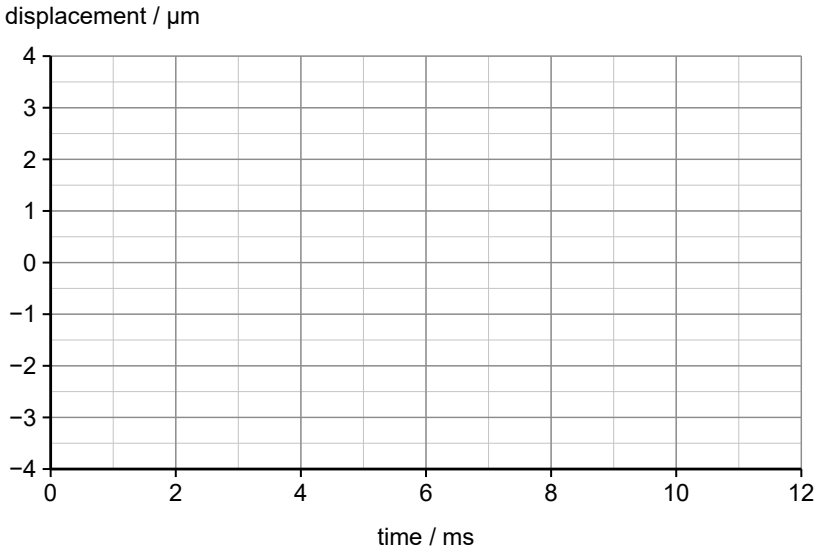


Fig. 13.2

[1]

[Total: 10]