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

CANDIDATE NAME									
CENTRE NUMBER	S					INDEX NUMBER				

PHYSICS

Specimen

Paper 2
PRACTICE PAPER

For practice before the next examination
1 hour 45 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 80.

This document consists of **19** 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 Physics papers but is not set, endorsed or marked by any examination board.

Section A

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

1 Fig. 1.1 shows how the displacement of a delivery robot from its charging point changes with time as it moves along a straight aisle in a warehouse.

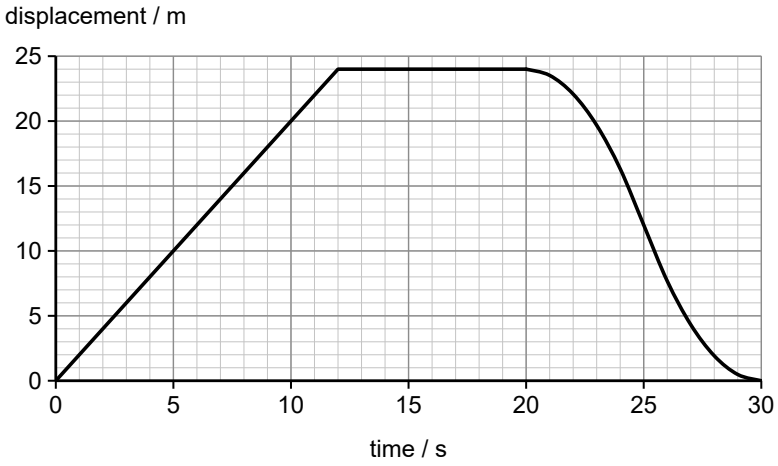


Fig. 1.1

(a) Determine the velocity of the robot during the first 12 s.

velocity = ... m/s [1]

(b) Describe the motion of the robot between t = 20 s and t = 30 s.

.....

.....

..... [2]

(c) Calculate the average speed of the robot for the whole 30 s.

average speed = ... m/s [2]

(d) The position sensor of the robot reads distances to the nearest 250 μm. Express 250 μm in metres.

distance = ... m [1]

[Total: 6]

2 A kite of mass 0.20 kg is held at rest in a steady wind by a string, as shown in Fig. 2.1. Three forces act on the kite: its weight *W*, the tension *T* in the string and the force *F* of the wind on the kite.

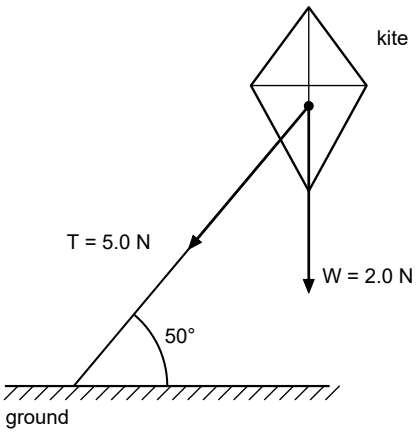


Fig. 2.1

(a) State which one of the three forces is a non-contact force.

.....[1]

(b) Use a scale diagram to find the magnitude and the direction of *F*. Use a scale of 1.0 cm to 1.0 N. Draw *W* vertically downwards.

magnitude of *F* = ... N

angle of *F* above the horizontal = ... ° [3]

(c) The string suddenly breaks. At that instant the force of the wind on the kite is unchanged. Calculate the magnitude of the initial acceleration of the kite.

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

[Total: 6]

3 Fig. 3.1 shows a tower crane. The horizontal jib turns about a pivot at the top of the tower. A counterweight of weight 40 kN hangs on one side at a distance of 6.0 m from the pivot. A load of weight 16 kN hangs on the other side at distance *x* from the pivot. The weight of the jib may be ignored.

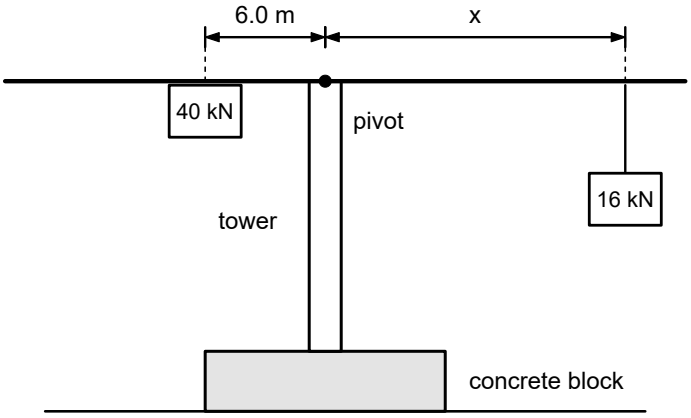


Fig. 3.1

(a) The jib is balanced. Calculate *x*.

x = ... m [2]

(b) The tower stands on a very heavy concrete block. Explain how the block makes the crane more stable.

.....

..... [1]

(c) The concrete block is a cuboid of length 5.0 m, width 5.0 m and height 1.2 m. Its mass is 72 000 kg. Calculate the density of the concrete.

density = ... kg/m^3 [2]

(d) The block rests on level ground. Calculate the pressure that the block alone exerts on the ground. Take g = 10 N/kg.

pressure = ... Pa [2]

[Total: 7]

4 Fig. 4.1 shows a hydroelectric power station. Water from a reservoir flows down a pipe and turns a turbine that drives a generator. The surface of the water in the reservoir is 250 m above the turbine.

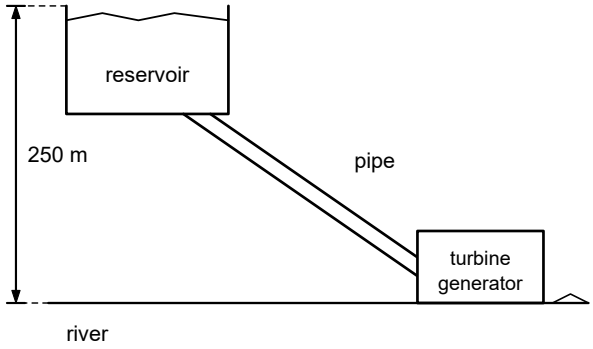


Fig. 4.1

(a) As the water flows down the pipe, energy is transferred from the gravitational potential store of the water to its kinetic store. State the way in which this energy is transferred.

.....[1]

(b) In 10 minutes, 3.0×10^6 kg of water flows through the turbine. Calculate the decrease in the gravitational potential energy of this water. Take g = 10 N/kg.

decrease in energy = ... J [2]

(c) The generator transfers 5.4×10^9 J of electrical energy from this water. Calculate the efficiency of the energy transfer.

efficiency = ... % [2]

(d) Calculate the average electrical power output of the generator during the 10 minutes.

power = ... W [1]

(e) State one environmental disadvantage of building a dam for a hydroelectric power station.

.....

.....[1]

[Total: 7]

5 Fig. 5.1 shows a metal saucepan with a plastic handle and a loose-fitting lid. It contains 0.80 kg of water at 25 °C and is heated on a gas hob.

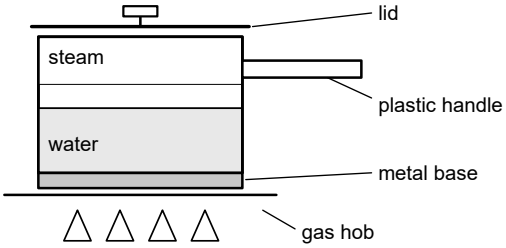


Fig. 5.1

(a) Describe, in terms of particles, how energy is transferred through the metal base of the saucepan to the water.

.....

.....

..... [2]

(b) The water is heated from 25 °C to 100 °C. State what happens to the average kinetic energy of the water molecules.

..... [1]

(c) The specific heat capacity of water is 4200 J/(kg °C). Calculate the energy transferred to the water to raise its temperature from 25 °C to 100 °C.

energy = ... J [2]

(d) The water then boils. The hob continues to supply energy, but the temperature of the boiling water stays at 100 °C. Explain this in terms of the behaviour of the water molecules.

.....

.....

..... [2]

(e) Steam collects under the lid and the lid lifts and rattles. Explain, in terms of the motion of the steam particles, how the steam exerts a force on the lid.

.....

.....

..... [2]

[Total: 9]

6 A drummer at a school concert strikes a drum. The drum skin vibrates and makes a sound wave in the air. Fig. 6.1 is a graph of the displacement of the air particles against distance from the drum at one instant.

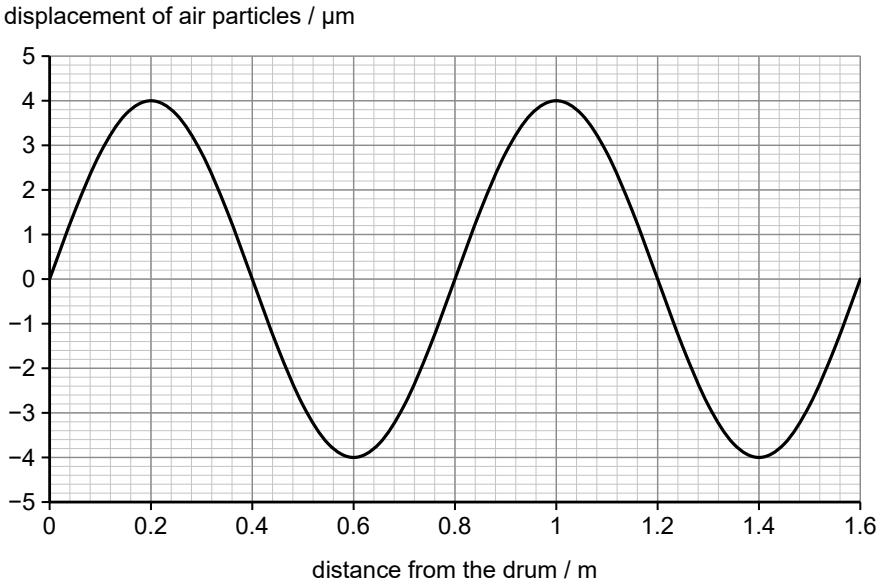


Fig. 6.1

(a) Use Fig. 6.1 to determine

(i) the amplitude of the wave,

amplitude = ... μm [1]

(ii) the wavelength of the wave.

wavelength = ... m [1]

(b) The frequency of the note is 425 Hz. Calculate the speed of the sound wave.

speed = ... m/s [2]

(c) The drummer now strikes the drum less hard and tightens the drum skin so that it vibrates at a higher frequency.
State what the audience hears change, and relate each change to a property of the sound wave.

.....

.....

..... [2]

(d) The concert is also broadcast live. A radio wave and a microwave leave a transmitter together and travel through space to a satellite. State which wave arrives first, or whether they arrive together, and give a reason.

.....

..... [1]

(e) Microwaves are used in satellite television. State one other use of microwaves.

..... [1]

(f) A technician works close to the aerial of a high-power microwave transmitter. State one danger to the technician's body cells.

.....

..... [1]

[Total: 9]

7 Fig. 7.1 shows part of a stage spotlight. A small lamp S is at the principal focus F of a thin converging lens of focal length 8.0 cm. Two rays from S reach the lens.

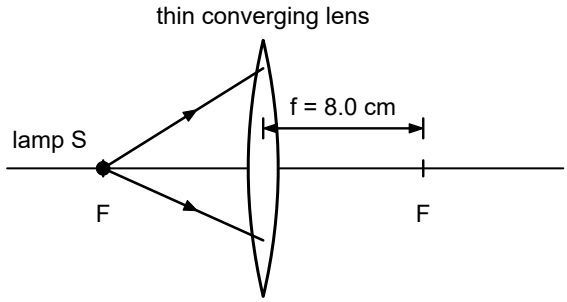


Fig. 7.1

(a) Complete Fig. 7.1 to show the paths of the two rays after they pass through the lens.

[2]

(b) The lamp is moved 3.0 cm towards the lens. Describe the characteristics of the image of the lamp that is now formed.

.....

..... [2]

(c) The lens is made of glass of refractive index 1.5.

(i) State what is meant by the refractive index of a medium.

.....

..... [1]

(ii) The speed of light in a vacuum is 3.0×10^8 m/s. Calculate the speed of light in the glass.

speed = ... m/s [1]

(d) A plane mirror above the stage turns the beam towards the actors. Fig. 7.2 shows the beam making an angle of 35° with the surface of the mirror.
Calculate the angle of reflection.

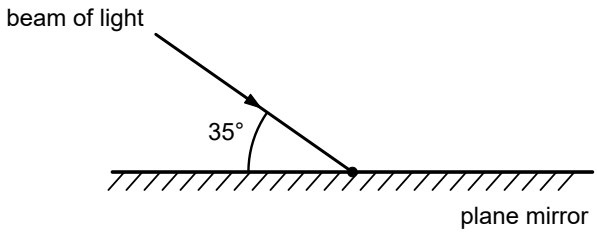


Fig. 7.2

angle of reflection = ... ° [1]

[Total: 7]

8 Fig. 8.1 shows the ionisation chamber of a smoke detector. A small source of americium-241, which emits alpha particles, is placed between two metal plates P and Q. The plates are connected to a 9.0 V battery. The alpha particles make the air between the plates conduct, so there is a very small current in the circuit. When smoke enters the chamber the current falls and an alarm sounds.

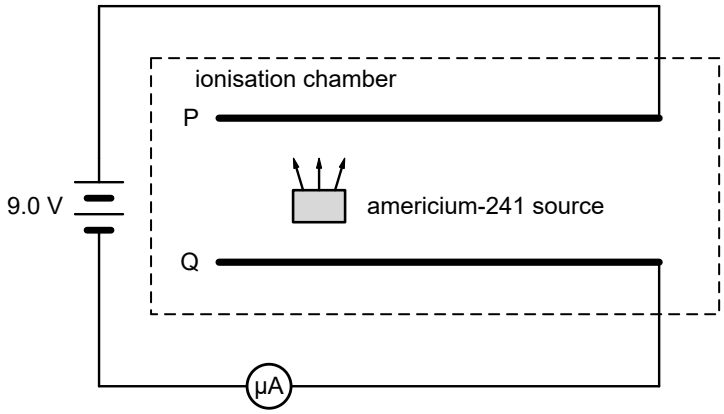


Fig. 8.1

(a) Explain how the alpha particles make the air between the plates able to conduct electricity.

.....

..... [1]

(b) The half-life of americium-241 is 430 years. The activity of the source in a new detector is 36 kBq. Calculate the activity of the source after 1290 years.

activity = ... kBq [2]

(c) Plate P is connected to the positive terminal of the battery. State the plate towards which the positive ions move, and give a reason.

.....

..... [1]

(d) Use the idea of an electric field to explain why the ions move.

.....

..... [1]

(e) Fig. 8.2 shows a positive ion X and a negative ion Y close together in the chamber. Draw the electric field pattern between X and Y.

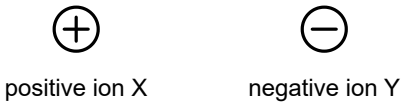


Fig. 8.2

[2]

(f) Smoke particles attach to ions and make them move more slowly. Explain, in terms of charge, why the current falls.

.....

..... [1]

(g) With no smoke the current is 0.80 μA. Calculate the charge that flows round the circuit in 30 s.

charge = ... C [2]

[Total: 10]

9 A moving-coil loudspeaker has a coil of wire attached to a paper cone. The coil is in the magnetic field of a permanent magnet. Fig. 9.1 is an end view of one wire XY of the coil between a N pole and a S pole. The current in XY is into the page.



Fig. 9.1

(a) Draw four magnetic field lines, with arrows, between the poles on Fig. 9.1.

[1]

(b) Use Fleming's left-hand rule to deduce the direction of the force on the wire XY.

.....

[1]

(c) The loudspeaker is joined to an amplifier that supplies an alternating current. Explain why the cone vibrates.

.....

.....

.....

[2]

(d) The loudspeaker is rated at 6.0 W when the p.d. across it is 4.0 V. Calculate the current in the coil at this rating.

current = ... A [1]

(e) The loudspeaker is now used as a microphone. A sound wave makes the cone and coil move to and fro in the magnetic field. Explain why an e.m.f. is induced in the coil.

.....

.....

[1]

(f) State two changes to the microphone that would increase the e.m.f. induced by the same sound.

.....

.....

[2]

(g) When the coil moves, the induced current produces a force on the coil. State how the direction of this force compares with the direction in which the coil moves.

.....

..... [1]

[Total: 9]

Section B

Answer **one** question from this section.

10 A terrarium for pet reptiles is kept warm and damp. A heater mat warms it and a sensor circuit measures its temperature.

(a) The sensor circuit has a 6.0 V battery, a fixed resistor R and an NTC thermistor, all in series. A voltmeter measures the p.d. across R.

(i) Draw the circuit diagram for the sensor circuit.

[2]

(ii) Explain why the p.d. across R rises when the temperature of the terrarium rises.

.....

.....

..... [2]

(iii) Fig. 10.1 shows how the resistance of the thermistor varies with temperature. R is 4.0 kΩ. The terrarium is at 20 °C.
Use Fig. 10.1 to calculate the p.d. across R.

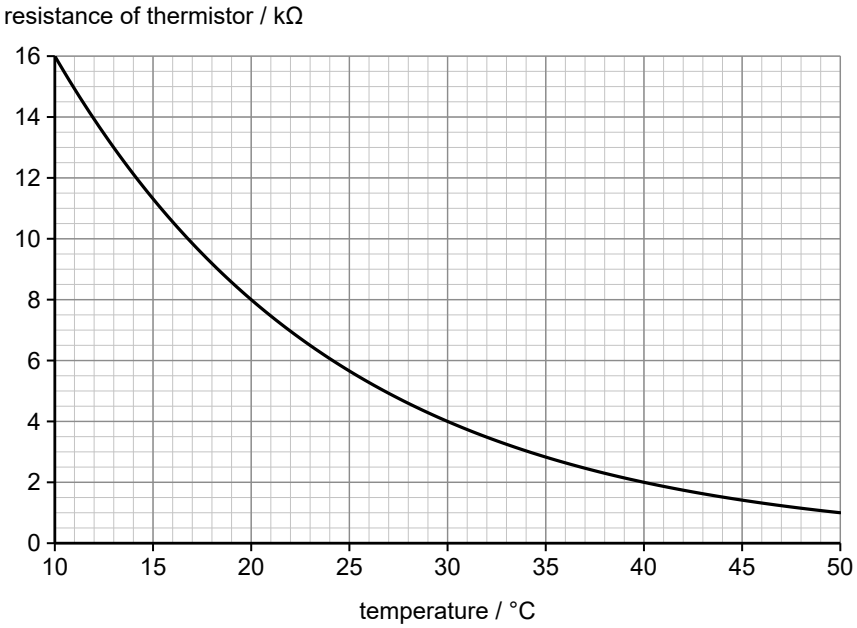


Fig. 10.1

p.d. = ... V [2]

(b) The heater mat has two identical heating elements joined in parallel to the 230 V mains supply, as shown in Fig. 10.2. Each element has a resistance of 1150 Ω.

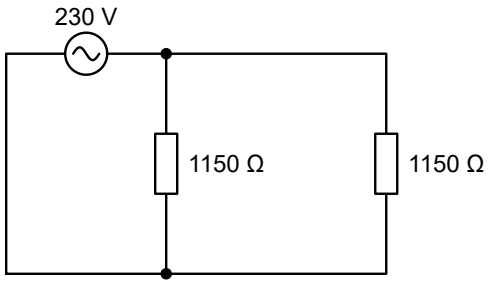


Fig. 10.2

(i) Show that the effective resistance of the two elements is 575 Ω.

[1]

(ii) The power of the heater mat is 92 W. It is switched on for 12 hours every day for 30 days. Electricity costs 25 cents per kW h.
Calculate the cost of using the heater mat for the 30 days.

cost = ... cents [2]

(c) State one electrical hazard of using the heater mat in a damp terrarium.

.....

..... [1]

[Total: 10]

11 Technetium-99m is a source of gamma rays used in hospitals to image organs. A small amount is injected into the patient and a gamma camera detects the rays leaving the body. Fig. 11.1 is the decay curve of a sample, for the count rate after the background count rate has been subtracted.

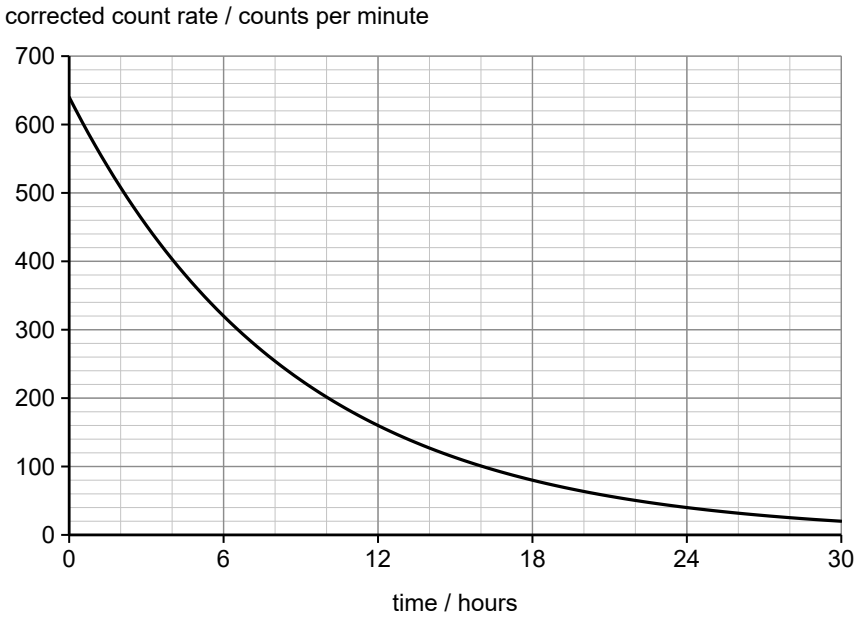


Fig. 11.1

(a) A detector with no sample present still records a count rate of 20 counts per minute. State what causes this.

.....

..... [1]

(b) Use Fig. 11.1 to determine the half-life of technetium-99m. Show your working on Fig. 11.1.

half-life = ... hours [1]

(c) Calculate the total count rate that the detector would record with the sample present 30 hours after the start.

count rate = ... counts per minute [2]

(d) Give two reasons why technetium-99m is suitable for imaging organs inside the body.

.....

.....

..... [2]

(e) Technetium-99m forms when molybdenum-99 (proton number 42) emits a beta particle. Complete the nuclide equation.

$$^{99}_{42}Mo \rightarrow \text{.....} Tc + \text{.....}$$

[2]

(f) Molybdenum-99 is made by the nuclear fission of uranium-235. State what is meant by nuclear fission and explain why energy is released.

.....

.....

..... [2]

[Total: 10]