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 2.2

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 **20** 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 shot-put ball is a solid metal sphere. It has a mass of 4.0 kg and a volume of 5.0×10^2 cm^3.

(a) Express the volume of the shot-put ball in m^3.

volume = ... m^3 [1]

(b)

(i) State what is meant by the mass of the shot-put ball.

.....

..... [1]

(ii) A technician cuts a spare shot-put ball of mass 4.0 kg into two equal halves. State the mass of each half and give a reason for your answer.

.....

..... [1]

(c) A second shot-put ball is made of the same metal. Its volume is 6.5×10^{-4} m^3. Calculate the mass of the second ball.

mass = ... kg [2]

[Total: 5]

2 A jogger runs along a straight path in a park. Fig. 2.1 is the distance-time graph for part of the run.

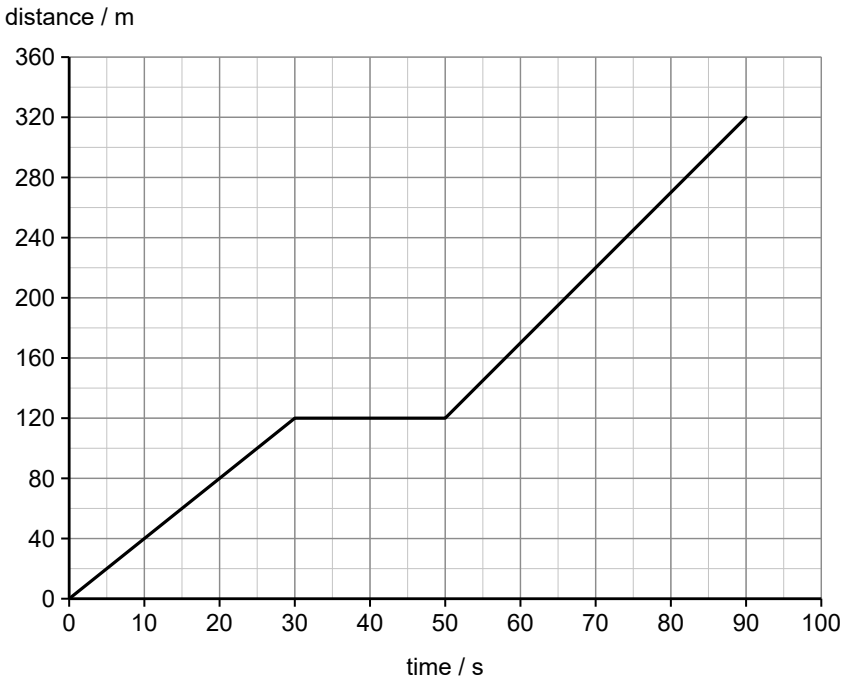


Fig. 2.1

(a) Another runner completes one lap of a circular track of length 400 m in 100 s and finishes at her starting point. State what is meant by speed and by velocity, and use these ideas to explain why her average speed for the lap is 4.0 m/s but her average velocity for the lap is zero.

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..... [2]

(b) Use Fig. 2.1 to decide whether the jogger ran faster during the first 30 s or during the last 40 s of the run. Show your working.

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..... [2]

[Total: 4]

3 A skateboard rider moves along a straight path. Fig. 3.1 is the speed-time graph for the rider. The graph has four sections, P, Q, R and S.

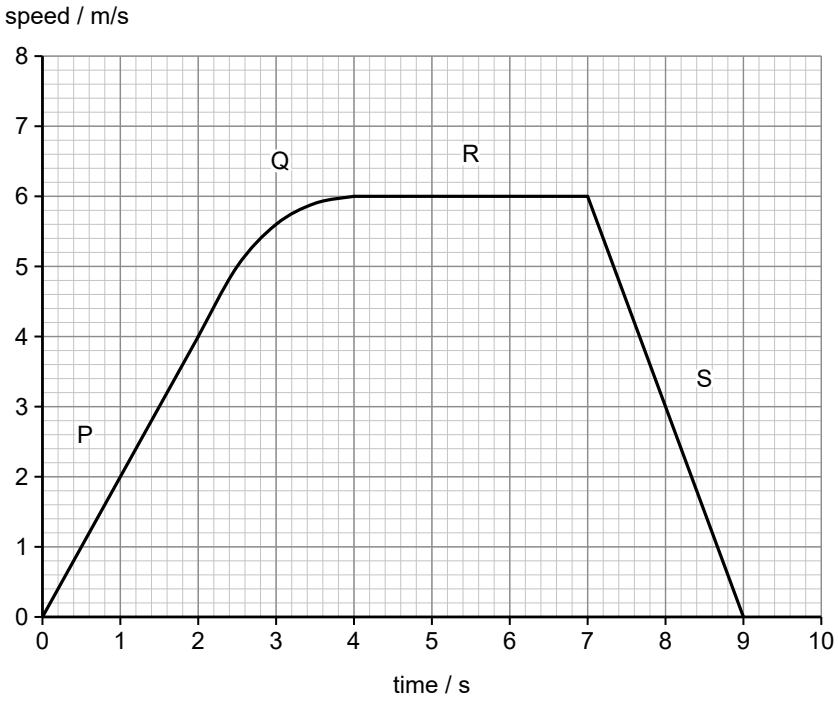


Fig. 3.1

(a) State which section of the graph, P, Q, R or S, shows the rider

(i) moving with uniform speed, and give the feature of the graph that shows this,

.....

..... [1]

(ii) moving with non-uniform acceleration, and give the feature of the graph that shows this.

.....

..... [1]

(b) The total weight of the rider and the skateboard is 720 N. Each wheel touches the ground over an area of 1.5 cm^2. The rider tilts the skateboard so that only the two rear wheels touch the ground. The weight is shared equally by these two wheels.
Calculate the pressure that the wheels exert on the ground.

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

[Total: 4]

4 A girl slides down a straight playground slide at a constant speed. In Fig. 4.1 the girl is represented by a dot.

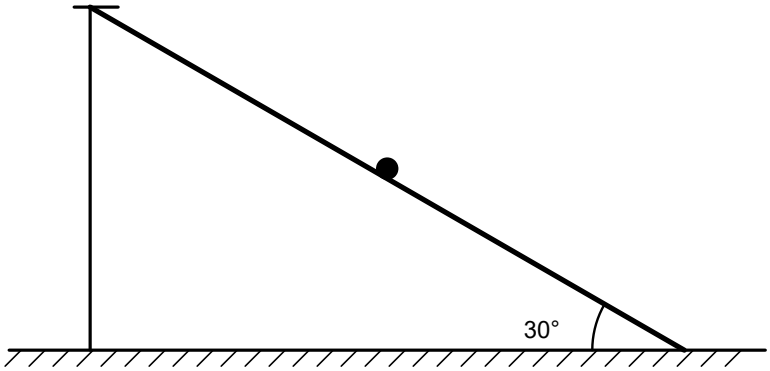


Fig. 4.1

(a) On Fig. 4.1, draw and label arrows from the dot to show the three forces acting on the girl.

[2]

(b)

(i) The slide exerts a normal contact force on the girl. State the force that forms an action-reaction pair with this normal contact force, and state the body on which that force acts.

.....

..... [1]

(ii) The friction on the girl is equal to the force of 120 N that pulls her down the slope. On a wet day the friction on the girl falls to 20 N. Calculate the resultant force on the girl on the wet slide and state the effect on the motion of the girl.

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..... [1]

[Total: 4]

5 A child pushes a playground roundabout, which turns about a vertical axle through its centre.

(a) State what is meant by the moment of a force about a pivot.

.....

..... [1]

(b) A second child pushes on the rim of the roundabout, 0.80 m from the axle, with a force of 25 N. The direction of her push is straight towards the axle. Calculate the moment of her force about the axle and explain why the roundabout does not turn.

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..... [1]

[Total: 2]

6 A high jumper of mass 65 kg clears the bar. His centre of gravity rises by 1.10 m from its position when he is standing.

(a) State what is meant by the centre of gravity of the high jumper.

.....

..... [1]

(b) Show that the gain in gravitational potential energy of the 65 kg high jumper is about 7.2×10^2 J. A second high jumper, of mass 55 kg, gains the same amount of gravitational potential energy. Calculate the height through which the centre of gravity of the second jumper rises. Take g = 10 N/kg.

height risen by the second jumper = ... m [2]

[Total: 3]

7 A weightlifter raises a barbell of mass 140 kg from the floor through a vertical distance of 0.55 m. The barbell moves at a constant speed. Take g = 10 N/kg.

(a) Calculate the work done by the weightlifter on the barbell.

work done = ... J [2]

(b) During the lift, the energy in the weightlifter's chemical store decreases by 2400 J. State the store of the barbell that gains energy and the amount of energy it gains. State also what happens to the rest of the energy transferred from the lifter's chemical store.

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.....

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..... [2]

[Total: 4]

8 An instant hot pack A is used to treat a sore muscle. It contains a liquid. When the pack is activated, the temperature of the liquid rises from 20 °C to 55 °C. Pack B is identical to pack A except that it contains twice the mass of the same liquid. Pack B is also activated and the temperature of its liquid rises from 20 °C to 55 °C.

(a) State and explain what happens to the speed of the particles of the liquid in pack A as its temperature rises. Then state how the average kinetic energy of the particles in pack B compares with that in pack A at 55 °C.

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..... [2]

(b) The liquid in each pack has an internal energy store. Describe what makes up the internal energy of the liquid. Hence explain why the internal energy of pack B is greater than that of pack A at 55 °C.

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..... [2]

[Total: 4]

9 Cans of sports drink are cooled in an insulated cool box. Fig. 9.1 shows the box, with ice in a tray at the top and cans of drink at the bottom. The cans are made of aluminium.

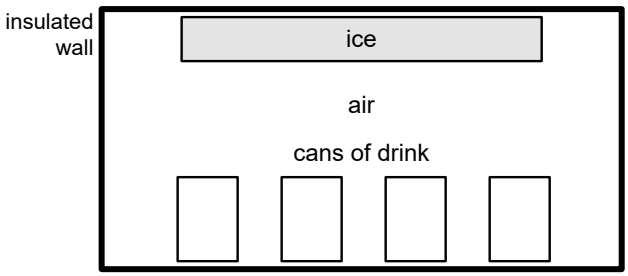


Fig. 9.1

(a) Energy is conducted through the aluminium wall of a warm can much faster than through the glass wall of a bottle of the same thickness. Describe, in terms of particles, how energy is conducted through the aluminium wall, and explain why the conduction is faster than in glass.

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..... [2]

(b) A student suggests putting the ice at the bottom of the box, with the cans on a shelf above the ice (not touching it), instead of at the top as shown in Fig. 9.1. Explain, in terms of density, why the cans are cooled more effectively when the ice is at the top.

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..... [2]

[Total: 4]

10 A football match in a stadium is broadcast by radio waves. The stadium is lit by floodlights.

(a) Radio waves and visible light are both electromagnetic waves. State the type of wave that all electromagnetic waves are, and compare the speeds of radio waves and visible light in a vacuum.

.....

..... [2]

(b) The floodlights are switched on at 18:30 and switched off at 21:00. In this time a charge of 2.25×10^5 C passes through the floodlights. Calculate the current in the floodlights.

current = ... A [2]

(c) A copper cable of length 60 m, connecting the floodlights to the supply, has a resistance of 0.30 Ω. A second cable is made of the same copper and is 150 m long. Its cross-sectional area is 1.5 times that of the first cable. Calculate the resistance of the second cable.

resistance = ... Ω [1]

[Total: 5]

11 A sports photographer uses a camera. Inside the camera, light from the scene is reflected by a plane mirror and focused by a converging lens.

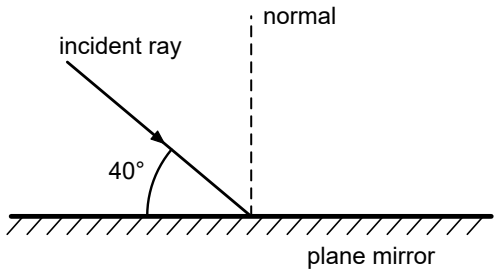


Fig. 11.1

(a) A ray of light strikes the plane mirror as shown in Fig. 11.1. Calculate the angle between the incident ray and the reflected ray.

angle between the rays = ... ° [1]

(b) Define the focal length of a converging lens.

.....

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..... [2]

(c) Fig. 11.2 shows the converging lens of the camera forming an image of a runner on the camera sensor. Describe the characteristics of the image.

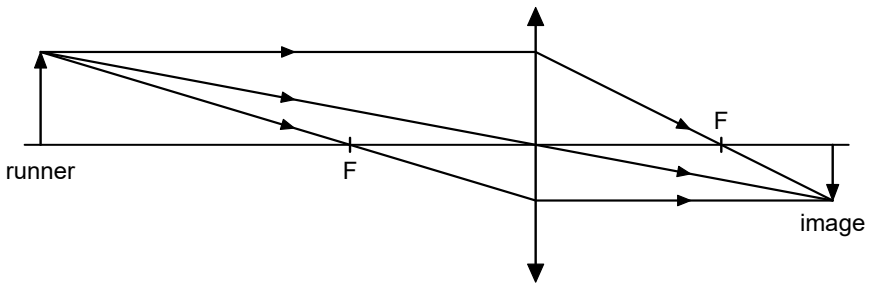


Fig. 11.2

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..... [2]

[Total: 5]

12 Fig. 12.1 shows part of the circuit in an electronic lap counter. The battery has an e.m.f. of 12 V.

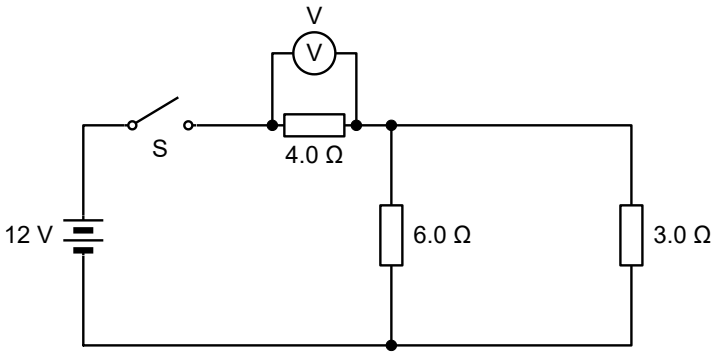


Fig. 12.1

(a) Calculate the current in the battery when the switch is closed.

current = ... A [2]

(b) The voltmeter across the 4.0 Ω resistor reads 8.0 V. Calculate the current in the 6.0 Ω resistor.

current = ... A [2]

[Total: 4]

13 The motor of a treadmill contains a rectangular coil that carries a current between the poles of a magnet. Fig. 13.1 shows a straight wire in a magnetic field between two poles. The current in the wire is into the paper.

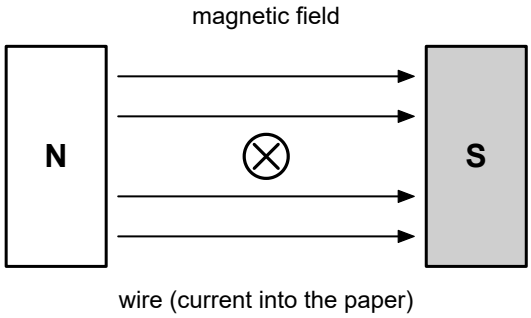


Fig. 13.1

(a)

(i) State the direction of the force on the wire in Fig. 13.1.

.....[1]

(ii) The poles of the magnet are now swapped round and the current in the wire is also reversed. State the direction of the force on the wire and explain your answer.

.....

.....

.....[1]

(b) The coil in the motor has two sides in the magnetic field, one on each side of the axle, carrying current in opposite directions. Explain why the coil turns about the axle instead of moving up or down.

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.....[2]

[Total: 4]

14 In a gym laboratory a sports scientist injects an athlete with a small amount of sodium-24, a radioactive tracer that is used to follow the flow of blood. A neutral atom of sodium-24 has 11 protons and 13 neutrons.

(a) Describe the composition of a neutral atom of sodium-24, stating where the protons, neutrons and electrons are found and the number of electrons. Explain why the atom has no overall electric charge.

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..... [2]

(b) State one hazard of the radiation from the sodium-24 to the athlete.

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..... [1]

[Total: 3]

Section B

Answer **one** question from this section.

15 The referee in a school sports hall blows a whistle during a match. Spectators watch from the stands. The hall has an old electric scoreboard rated 230 V, 1150 W and a new LED scoreboard marked 230 V, 1.5 A.

(a) Fig. 15.1 shows the positions of some air particles in part of the sound wave from the whistle at one instant. The wave travels to the right. Describe how the sound wave travels through the air, in terms of compressions and rarefactions. In your answer, state which region, X or Y, is a compression and give a reason, and describe the movement of the air particles.

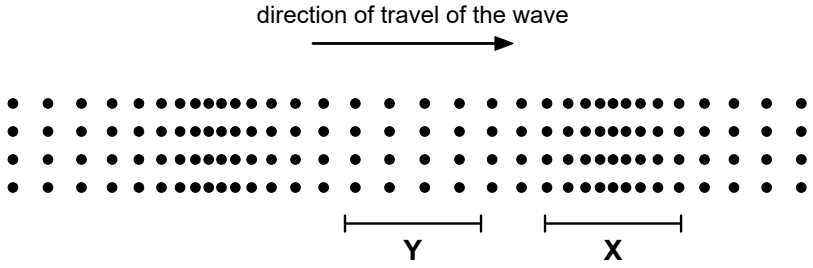


Fig. 15.1

[3]

(b) Spectators start a ‘Mexican wave’ in the stands. Each person in a row stands up and then sits down, one after another, so that the wave travels sideways along the row. State whether the Mexican wave is transverse or longitudinal, justifying your answer by comparing the direction in which each person moves with the direction in which the wave travels. State how the other type of wave differs, and give one example of it.

[2]

(c) The LED scoreboard is switched on for 2.0 hours. Calculate the electrical energy that it transfers, in joules, in this time.

energy = ... J [3]

(d) The hall uses one scoreboard for 4.0 hours each day for 30 days. The cost of electrical energy is $0.30 per kW h. By calculating the cost of using each scoreboard for the 30 days, state which scoreboard is cheaper to use and by how much.

difference in cost = ... $ [2]

[Total: 10]

16 Sports day: a helper uses balloons, a night-running headlamp and a cold sports drink.

(a) Two identical balloons P and Q are rubbed with the same cloth and hung side by side from thin threads. They swing apart. Balloon P is negatively charged. A third balloon R, which carries a charge, is attracted to balloon P. Balloon R is now brought close to balloon Q. State what happens, and explain your answer by stating the charge on Q and the charge on R.

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..... [2]

(b) Two lamps are tested one at a time with a battery.

(i) State what is meant by the potential difference across a lamp.

.....

..... [1]

(ii) In lamp P, 27 J of energy is transferred when a charge of 6.0 C passes through it. In lamp Q, 36 J of energy is transferred when a charge of 9.0 C passes through it. A student says, “Lamp Q has the greater potential difference because it transfers more energy.” Is the student correct? Show your working and give the unit of potential difference in your answers.

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.....

..... [2]

(c) Complete the table to explain each observation in terms of the particles of water.

observation	explanation in terms of the particles
A cube of ice keeps its shape when it is moved from the cool box to a plate.	
The drink takes the shape of the cup when it is poured into the cup.	
Water vapour can be squashed into a much smaller volume.	

[3]

(d) A sample of crushed ice from the cold sports drink is heated by a heater that is switched on throughout. Fig. 16.1 shows how the temperature of the sample changes. A student says, “Between 4 minutes and 14 minutes the heater is not transferring energy to the sample, because the temperature does not change.” Is the student correct? Use Fig. 16.1 and ideas about the particles to explain your answer.

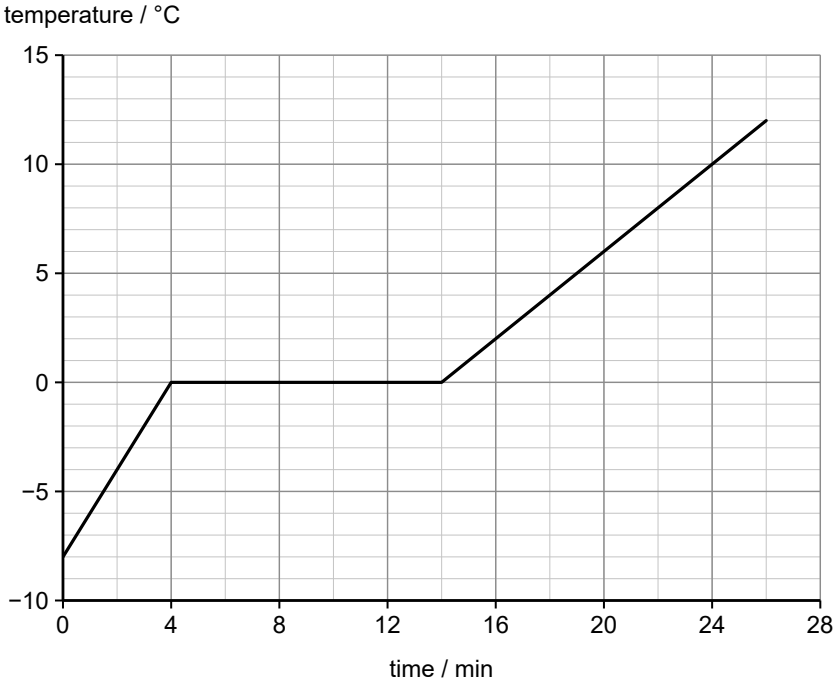


Fig. 16.1

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..... [2]

[Total: 10]