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 2.10

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 planetarium show in an amusement park zooms from the inside of a guitar string out to the whole Earth. Table 1.1 lists four lengths shown in the show, each written with a unit prefix. The list below the table gives six orders of magnitude of length, in metres.

Table 1.1

object	length	order of magnitude / m
diameter of a carbon atom in the steel string	0.15 nm	
diameter of the head of a guitar tuning peg	1.5 cm	
diameter of the observation wheel of a large amusement-park ride	0.12 km	
diameter of the Earth	12 700 km	

10^{-14} m 10^{-10} m 10^{-6} m 10^{-2} m 10^{2} m 10^{7} m

(a) Change each length in Table 1.1 to metres, then complete the table by writing one order of magnitude from the list against each length. Each value may be used once or not at all.

[2]

2 A drop-tower ride lifts its passengers to the top of a tower. The cabin is then released and falls freely for the first 3.0 s. After that, magnetic brakes slow the cabin until it stops. Fig. 2.1 shows how the speed of the cabin changes. During the free fall the cabin falls 45 m. During the braking it falls a further 24 m. The whole descent takes 6.0 s.

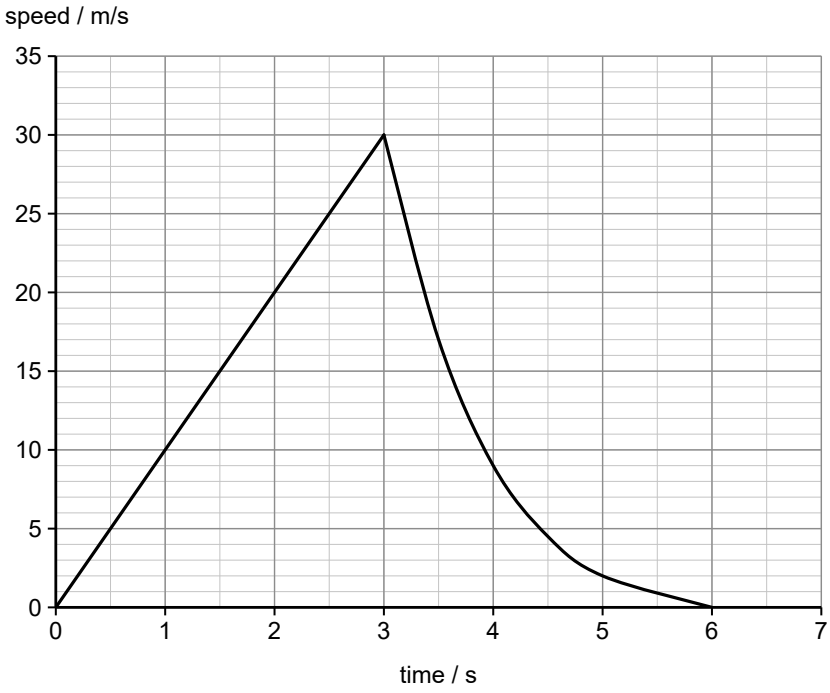


Fig. 2.1

(a) Calculate the average speed of the cabin for the whole descent.

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

(b) The cabin is in free fall for the first 3.0 s. Use Fig. 2.1 to show that this is consistent with the accepted value of the acceleration of free fall near the Earth, and state what the shape of the graph tells you about this acceleration.

.....

.....

.....

..... [2]

(c) Between 3.0 s and 6.0 s the cabin is slowed by the brakes. Describe how the acceleration changes during this time and explain how the graph shows this.

.....

.....

..... [1]

[Total: 5]

3 A bumper car and its driver have a total mass of 280 kg. The car moves along a straight, level floor.

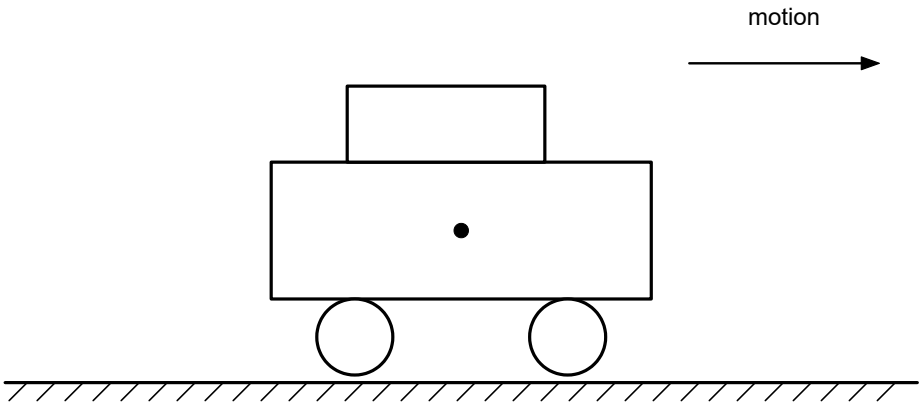


Fig. 3.1

(a) State what is meant by mass.

.....

..... [1]

(b) The car moves at constant speed in the direction shown. In Fig. 3.1 the car is represented by the dot. Draw and label arrows from the dot to show all the forces acting on the car. Make the lengths of the arrows show the sizes of the forces.

[2]

(c) The driver switches off the motor. The car slows down and stops. Explain, in terms of the forces on the car, why it stops.

.....

.....

.....

..... [2]

[Total: 5]

4 Fig. 4.1 shows a stage prop cut from a thin sheet of card of uniform thickness. It has two small holes A and B. The prop is hung freely from a pin through A, together with a plumb line (a string with a weight). When the prop is at rest, the plumb line is marked on the card as the dashed line from A to the point a on the edge. The prop is then hung from a pin through B. When it is at rest, the plumb line from B crosses the edge of the card at the point b. The prop is shown lying flat.

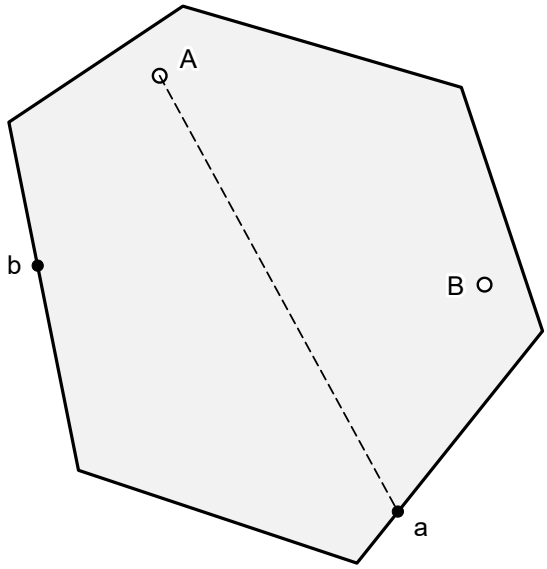


Fig. 4.1

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

.....

..... [1]

(b) Complete the statement of the principle of moments for a body in equilibrium by writing one word in each space.

When a body is in equilibrium, the sum of the _____ moments about a pivot is equal to the sum of the _____ moments about the same pivot.

[1]

(c) The centre of gravity of the prop lies on the plumb line from A. On Fig. 4.1, use a ruler to draw the line that the plumb line from B makes on the prop, and mark the position of the centre of gravity with a cross (X).

[1]

[Total: 3]

5 A pinball machine has a spring-loaded plunger. The player pulls back the plunger, compressing the spring, and releases it. The plunger pushes a steel ball of mass 0.080 kg. The ball leaves the spring and moves up the sloping table. It stops momentarily at its highest point, which is 0.20 m vertically above the point where it left the spring. Ignore friction. Take g = 10 N/kg.

(a) Describe the changes in the energy stores from the moment the spring is released until the ball stops momentarily at its highest point.

.....

.....

.....

..... [2]

(b) Show that the speed of the ball as it leaves the spring is 2.0 m/s.

[2]

[Total: 4]

6 Two cymbals X and Y are made of the same metal and stand under the stage lights. Cymbal X has a mass of 1.2 kg and a temperature of 25 °C. Cymbal Y has a mass of 0.60 kg and a temperature of 40 °C.

(a) State which cymbal has particles with the greater average kinetic energy and give a reason for your answer.

.....

.....

..... [2]

(b) A student says that cymbal X, although cooler, has more energy in its internal store than cymbal Y. Explain why the student may be correct.

.....

.....

..... [1]

[Total: 3]

7 A technician uses a soldering iron to repair an electric guitar. The tip is a copper rod. One end of the rod is heated to 350 °C. The other end, which is held in a plastic handle, is at 30 °C.

(a) State the direction in which energy is transferred along the rod and what happens when both ends of the rod reach the same temperature.

.....

.....

..... [1]

(b) Energy passes along the copper rod much faster than along the plastic handle. Explain this difference in terms of the particles in each material.

.....

.....

.....

.....

..... [2]

[Total: 3]

8 A microphone records the sound of a violin string. Fig. 8.1 shows the signal for note A. The speed of sound in air is 340 m/s.

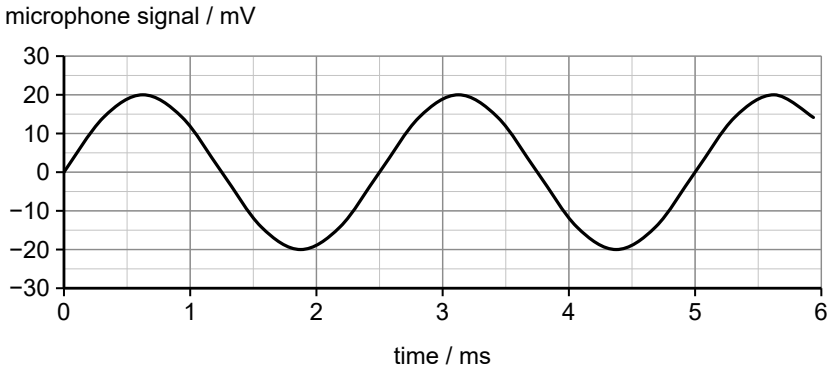


Fig. 8.1

(a) Use Fig. 8.1 to determine the period of the signal for note A.

period = ... ms [1]

(b) Calculate the wavelength of note A in air.

wavelength = ... m [2]

(c) Note B is played on the same violin. It is louder than note A and lower in pitch. Fig. 8.2 shows the same axes as Fig. 8.1. On Fig. 8.2, sketch a possible signal for note B, showing at least one complete cycle.

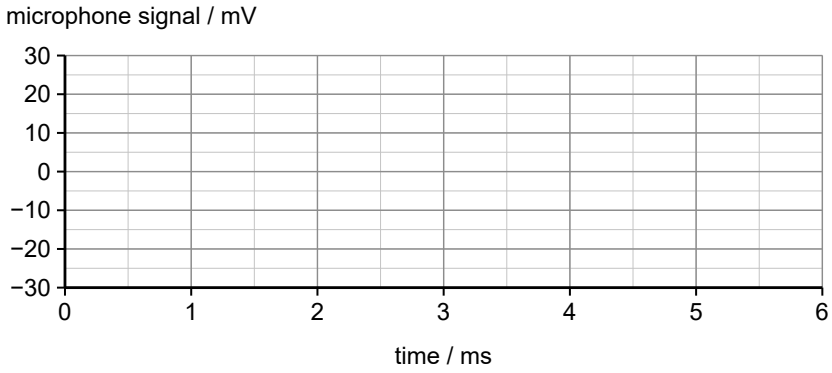


Fig. 8.2

[2]

[Total: 5]

9 Electromagnetic waves are used at an open-air music festival.

(a) State a typical use of each of the following at the festival or in everyday life.

(i) infra-red radiation

.....[1]

(ii) ultraviolet radiation

.....[1]

(b) A festival-goer stands in the strong midday sunshine for six hours without any protection. State a harmful effect of over-exposure to ultraviolet radiation.

.....

.....[1]

[Total: 3]

10 A light show uses a laser beam. Fig. 10.1 shows the beam entering a tank of water from the air. A plane mirror lies flat on the bottom of the tank. The beam strikes the water surface at an angle of incidence of 40°. The refractive index of the water is 1.33.

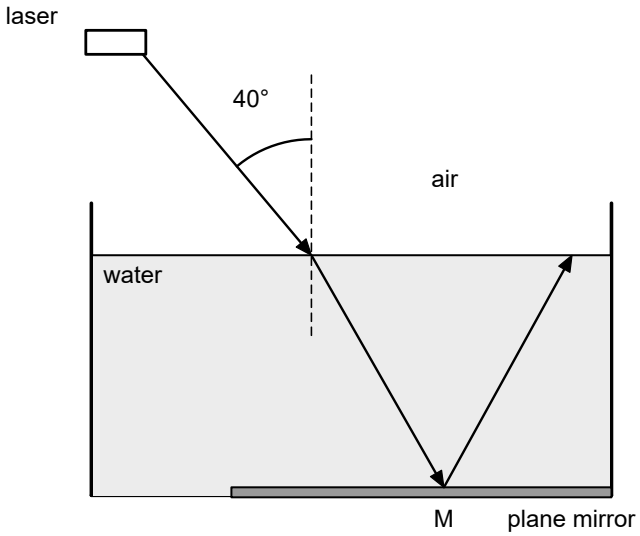


Fig. 10.1

(a) Calculate the angle of refraction of the beam in the water.

angle of refraction = ... ° [2]

(b) The beam strikes the mirror at M. State the angle of reflection at M. Give a reason for your answer.

.....

..... [1]

(c) A converging lens in the lamp of a follow-spot shines a narrow beam. Define the focal length of a converging lens.

.....

.....

..... [2]

[Total: 5]

11 This question is about two circuits in an amusement-park ride.

(a) Fig. 11.1 shows a 9.0 V battery connected in series with lamps L_1 and L_2 and a resistor *R*. Voltmeter V_1 reads 2.5 V and V_2 reads 3.5 V. State the relationship between the potential differences in a series circuit and the p.d. of the battery, and use it to find the p.d. across *R*.

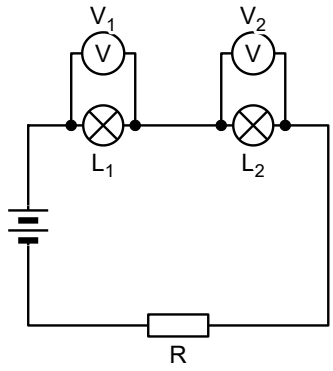


Fig. 11.1

.....

.....

..... [2]

(b) Fig. 11.2 shows the 20 Ω, 30 Ω and 60 Ω heaters of the ride's cabin connected in parallel and then in series with an 8.0 Ω resistor. Calculate the effective resistance of the circuit.

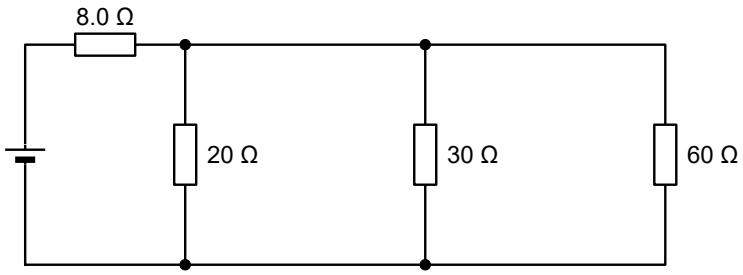


Fig. 11.2

effective resistance = ... Ω [2]

[Total: 4]

12 A technician sets up the lighting on a stage.

(a) State the hazard of using electricity in each situation.

(i) The technician wipes the metal casing of a lamp with a wet cloth while the lamp is plugged in and switched on.

.....

..... [1]

(ii) A cable reel is left fully coiled while it supplies several powerful lamps.

.....

..... [1]

(b) A faulty lamp has its switch connected in the neutral wire instead of the live wire. The lamp is switched off at this switch. Explain why a person who touches the metal casing of the lamp at this moment could receive an electric shock, and why a switch is fitted in the live wire.

.....

.....

.....

.....

..... [2]

[Total: 4]

13 This question is about magnets and currents in an electric guitar and its amplifier.

(a) The pickup of an electric guitar contains a magnet. The north pole of the magnet is just below a steel string. Explain why the string is attracted to the magnet.

.....

.....

.....

..... [2]

(b) The amplifier of the guitar contains a relay, which is an electromagnet with a core that must lose its magnetism when the current is switched off. State whether the core should be made of iron or of steel, and give a reason.

.....

.....

..... [1]

(c) Fig. 13.1 shows a card through which a vertical cable carries the current to a loudspeaker. The current is into the page. A plotting compass is placed on the card at each of the four positions shown.

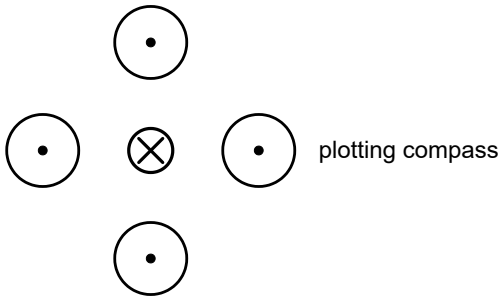


Fig. 13.1

(i) On Fig. 13.1 draw an arrow in each compass to show the direction in which its needle points.

[1]

(ii) The current in the cable is now reversed and made larger. State what happens to the directions of the needles and to the strength of the magnetic field.

.....

..... [1]

[Total: 5]

14 The luminous dial of a vintage radio in a museum of music is painted with a paint that contains a radioactive material. The nuclei of the material are unstable.

(a) A visitor says: "If the radio is warmed to 200 °C the paint will give out radiation faster, and a Geiger counter can tell us which nucleus will decay next." Use the ideas of random and spontaneous decay to comment on both parts of the statement.

.....

.....

.....

.....

..... [2]

(b) The paint may emit alpha, beta and gamma radiation. Complete Table 14.1 for the three radiations.

Table 14.1

radiation	nature	relative ionising effect (highest, medium, lowest)
alpha (α) particle		
beta (β) particle		
gamma (γ) ray		

[2]

[Total: 4]

Section B

Answer **one** question from this section.

15 This question is about a ballet performance.

(a) A dancer of mass 52 kg carries a prop of mass 4.0 kg. Calculate their combined weight. Take the gravitational field strength to be 10 N/kg.

weight = ... N [2]

(b) The dancer stands on the tip of one pointe shoe. The area of the tip in contact with the floor is 9.0 cm^2.

(i) Calculate the pressure that the tip exerts on the floor, in N/m^2.

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

(ii) The surface of the stage floor is damaged by a pressure greater than 3.0×10^5 N/m^2. Use your answer to (b)(i) to state, with a reason, whether the floor is damaged when the dancer stands on the tip of one pointe shoe.

.....

..... [1]

(c) Fig. 15.1 shows a circuit for a stage lamp *L*.

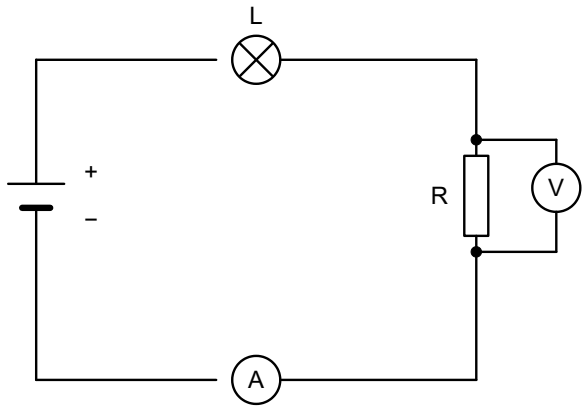


Fig. 15.1

(i) On Fig. 15.1 draw one arrow beside the circuit to show the direction of the conventional current and a second arrow, labelled *e*, to show the direction of the electron flow.

[2]

(ii) Explain why the two arrows point in opposite directions.

.....

.....

..... [1]

(d) In the circuit the voltmeter across the resistor *R* reads 3.6 V and the ammeter reads 300 mA. State the relationship between resistance, potential difference and current. The label on *R* says 12 Ω. Use the readings to decide whether the label is correct.

resistance = ... Ω [2]

[Total: 10]

16 This question is about a concert hall.

(a) Fig. 16.1 shows a long rope lying on the stage floor. A stagehand shakes one end up and down and a wave travels along the rope. A marker M is tied to the rope. Describe the motion of M as the wave passes and state what is transferred along the rope.

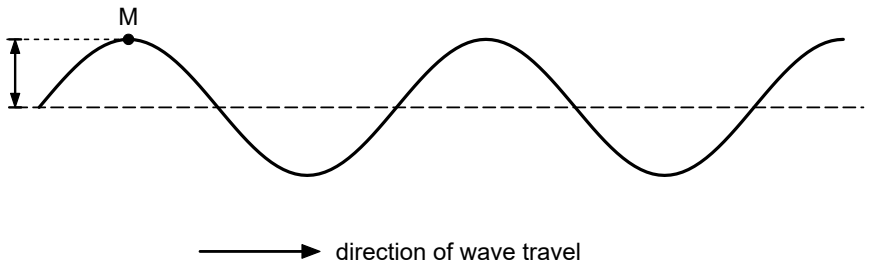


Fig. 16.1

.....

.....

.....

..... [2]

(b) A conductor stands on the podium and claps once. The sound is reflected by the wall of the upper gallery, which is 51 m from the podium, and the conductor hears the echo 0.30 s after the clap.

(i) Explain why the conductor hears a second sound after the clap.

.....

..... [1]

(ii) Calculate the speed of sound in the hall.

speed = ... m/s [2]

(c) The concert is also broadcast by radio. A student says: "Radio waves travel through the air at the speed of sound that you found in (b)(ii), but light travels faster than radio waves." Comment on both parts of the statement. Use a calculation for the first part, and state the type of wave that radio waves and light both are.

.....

.....

.....

.....

.....

..... [3]

(d) Table 16.1 compares three regions of the electromagnetic spectrum with visible light. For each region, write **longer** or **shorter** for its wavelength, and **higher** or **lower** for its frequency.

Table 16.1

region	wavelength compared with visible light	frequency compared with visible light
microwaves		
X-rays		
radio waves		

[2]

[Total: 10]