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 2.8

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 **21** 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 supply capsule approaches a space station in a straight line. Fig. 1.1 shows the speed-time graph of the capsule for the first 10 s. After 10 s the capsule slows down at a uniform rate and stops 14 s after the start.

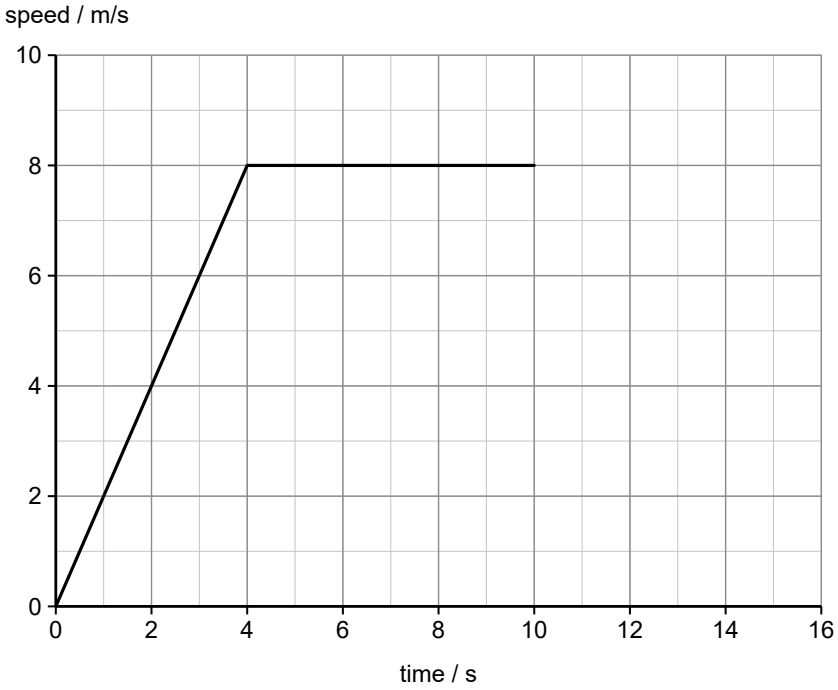


Fig. 1.1

(a) State what is meant by uniform acceleration. Use Fig. 1.1 to show that the acceleration of the capsule during the first 4.0 s is uniform, and calculate its value.

.....

.....

.....

..... [2]

(b) On Fig. 1.1, complete the graph from 10 s to 14 s.

[1]

(c) The docking port is 90 m from the point where the capsule started. Use the completed graph to calculate the distance the capsule travels in 14 s, and hence state whether the capsule reaches the docking port.

distance = ... m [2]

[Total: 5]

2 A lander has come to rest on the surface of Mars.

(a) The table lists four forces that act on or near the lander. Put a tick (✓) in one box in each row to show whether the force is a contact force or a non-contact force.

force	contact force	non-contact force
friction between a wheel of the lander and the ground		
the normal force of the ground on the lander		
the gravitational force of Mars on the lander		
the electrostatic force that makes dust cling to the lander's solar panel		

[2]

(b) State what is meant by a gravitational field.

.....

.....

..... [2]

(c) The gravitational field strength is 10 N/kg on Earth and 3.7 N/kg on Mars. The lander has a mass of 900 kg on Earth. Complete the table to show the mass and the weight of the lander on Earth and on Mars.

	on Earth	on Mars
mass / kg	900	
weight / N		

[2]

[Total: 6]

3 A crate of satellite parts is dragged at a constant speed along the level floor of an assembly hall by a horizontal rope. In Fig. 3.1 the crate is shown as a box with a dot at its centre.

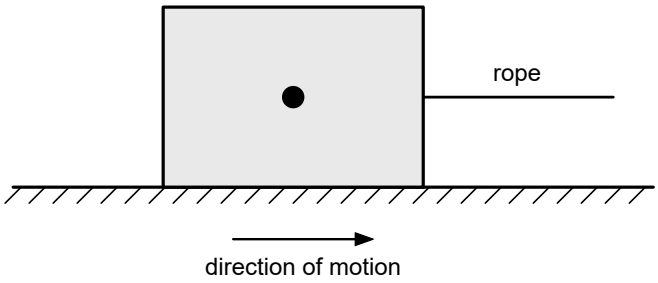


Fig. 3.1

(a) On Fig. 3.1, draw and label arrows from the dot to show the four forces acting on the crate.

[2]

(b) The rope breaks while the crate is moving. Describe what happens to the motion of the crate and explain this in terms of friction.

.....

.....

..... [1]

[Total: 3]

4 A telescope is mounted on a uniform plank of length 1.2 m and weight 30 N. The plank is pivoted at a point 0.40 m from its end A. An instrument of weight 60 N hangs from end A. A counterweight of 45 N hangs from the plank at a distance *d* from the pivot, on the other side, so that the plank balances horizontally, as shown in Fig. 4.1.

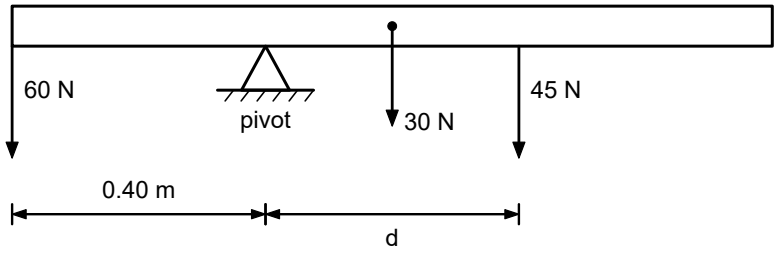


Fig. 4.1

(a) State the principle of moments.

.....

.....

..... [1]

(b) The weight of the plank acts at its centre. Calculate the distance *d*.

d = ... m [1]

(c) Calculate the upward force of the pivot on the plank.

force = ... N [1]

[Total: 3]

5 A model water rocket of mass 0.50 kg is launched vertically upwards at a speed of 20 m/s. Ignore air resistance. Take g = 10 N/kg.

(a) State the principle of conservation of energy.

.....

..... [1]

(b) Calculate the maximum height that the rocket reaches.

height = ... m [2]

[Total: 3]

6 The Earth has a solid rock crust, liquid oceans and a gaseous atmosphere.

(a) Put a tick (✓) in one box in each row of the table to show the volume and shape of each material.

material	fixed volume and fixed shape	fixed volume but no fixed shape	no fixed volume and no fixed shape
a block of rock			
sea water			
air in the atmosphere			

[1]

(b) Use the kinetic particle model to explain why a block of rock keeps its shape but sea water flows and takes the shape of its container.

.....

.....

.....

.....

..... [2]

[Total: 3]

7 Energy is transferred in space and on Earth.

(a) An instrument on a satellite is at 55 °C. It is clamped to a metal panel at 15 °C. State the direction in which energy is transferred, and describe how the temperatures of the instrument and the panel change.

.....

.....

.....

..... [2]

(b)

(i) The satellite loses thermal energy to the cold vacuum of space through a radiator panel that is painted matt black. Name the process by which the panel loses energy to space and explain why matt black paint makes the panel lose energy faster than a shiny surface would.

.....

.....

.....

..... [1]

(ii) Glider pilots on Earth look for warm air rising from sunlit fields. Explain, in terms of density, why the air rises.

.....

.....

..... [1]

[Total: 4]

8 A rocket carries an observatory satellite into orbit at a height of 540 km. The observatory has a camera with a row of 4000 pixels, each 6.5 μm wide, and it sends its pictures to a ground station using microwaves.

(a) The roar of the rocket engine at the launch is a longitudinal sound wave. Describe how the air particles move in the sound wave, using the words compression and rarefaction.

.....

..... [1]

(b) Express the height of the orbit in metres.

height = ... m [1]

(c) Calculate the width of the whole row of pixels. Give your answer in millimetres.

width = ... mm [1]

(d) Fig. 8.1 shows the regions of the electromagnetic spectrum in order of increasing wavelength. Two regions are missing.

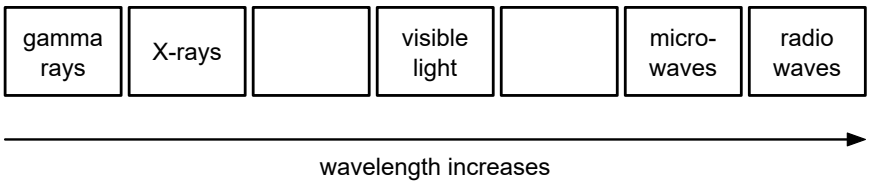


Fig. 8.1

(i) Write the names of the two missing regions in the empty boxes in Fig. 8.1.

..... [1]

(ii) State how the frequency of the waves changes from the gamma rays to the radio waves.

..... [1]

(e) Technicians must not stand in the beam of microwaves from the ground-station antenna. State one harmful effect on the body of too much exposure to microwaves.

.....

..... [1]

[Total: 6]

9 Reflection and refraction of light in space science.

(a) A plane mirror on a satellite reflects sunlight onto a solar cell. In Fig. 9.1 a ray of sunlight strikes the mirror at O. The incident ray makes an angle of 50° with the normal.

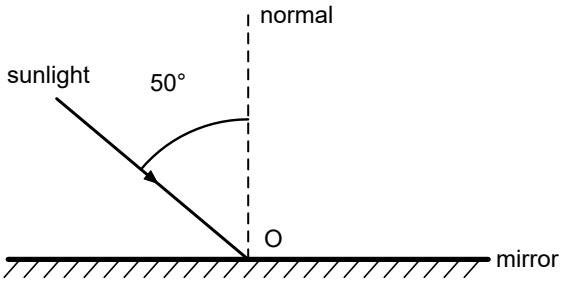


Fig. 9.1

(i) State the relationship between the angle of incidence and the angle of reflection.

.....

..... [1]

(ii) Calculate the angle between the reflected ray and the surface of the mirror.

angle = ... ° [1]

(b) In Fig. 9.2 a ray of light from a lamp passes from air into a quartz window at P. Only one of the rays A, B and C is drawn correctly inside the glass. Put a tick (✓) in the box under the correct ray and name the angle between that ray and the normal.

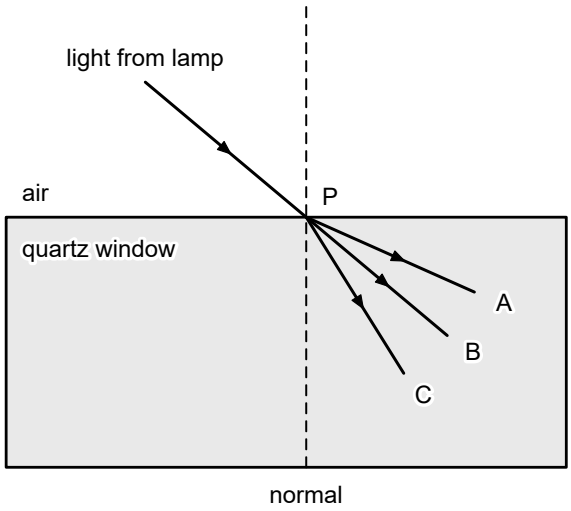


Fig. 9.2

ray A	ray B	ray C

[1]

(c) The speed of light in a vacuum is 3.00×10^8 m/s and the speed of light in the quartz is 2.05×10^8 m/s. Define the refractive index of a medium and calculate the refractive index of the quartz.

.....

.....

.....

.....

..... [2]

[Total: 5]

10 An ion thruster pushes a spacecraft by firing a beam of charged xenon ions out of the back of the engine.

(a) The current in the ion beam is 1.5 A. Calculate the charge carried by the ions in the beam in 30 minutes.

charge = ... C [2]

(b) The ions are accelerated through a potential difference of 1200 V. State what this means.

.....

.....

..... [1]

(c) A valve that controls the flow of xenon contains a coil of wire. A voltmeter across the coil reads 5.0 V and an ammeter in series with it reads 250 mA. Calculate the resistance of the coil.

resistance = ... Ω [2]

[Total: 5]

11 An experiment module on a space station is powered by a 12 V battery.

(a) Draw a circuit diagram of a battery, a switch and a fuse connected in series with a light-emitting diode (LED) and a fixed resistor. Include a voltmeter that measures the potential difference across the LED only.

[2]

(b) Fig. 11.1 shows the battery connected to a heater H and a motor M in parallel branches. The resistance of the heater is 8.0 Ω.

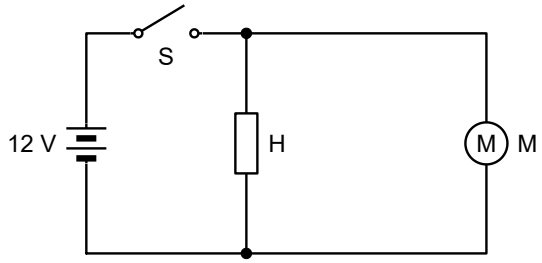


Fig. 11.1

(i) State the potential difference across the motor.

p.d. = ... V [1]

(ii) Calculate the current in the heater.

current = ... A [1]

[Total: 4]

12 A heater wrapped round a water pipe stops the water in a space station freezing. It is connected to a 28 V supply and carries a current of 2.5 A.

(a) Describe how the heater produces thermal energy when it is switched on.

.....

.....

.....

..... [2]

(b) The pipe needs 42 000 J of energy from the heater.

(i) Calculate the power of the heater.

power = ... W [1]

(ii) Use your answer to (i) to calculate the time in minutes for which the heater must be switched on.

time = ... min [1]

[Total: 4]

13 A space probe is powered by a radioactive nuclide of plutonium, whose nucleus has 94 protons. A neutral atom of plutonium has the symbol Pu.

(a)

(i) The nucleus of the nuclide that powers the probe contains 94 protons and 144 neutrons. State its nucleon number.

nucleon number = ... [1]

(ii) Another isotope of plutonium has 146 neutrons in its nucleus. Write the nuclide notation for this isotope.

.....

..... [1]

(b) A detector on the probe measures the count rate from a sample of this plutonium nuclide in the fuel pellet. Fig. 13.1 shows how the count rate changes with the time after launch.

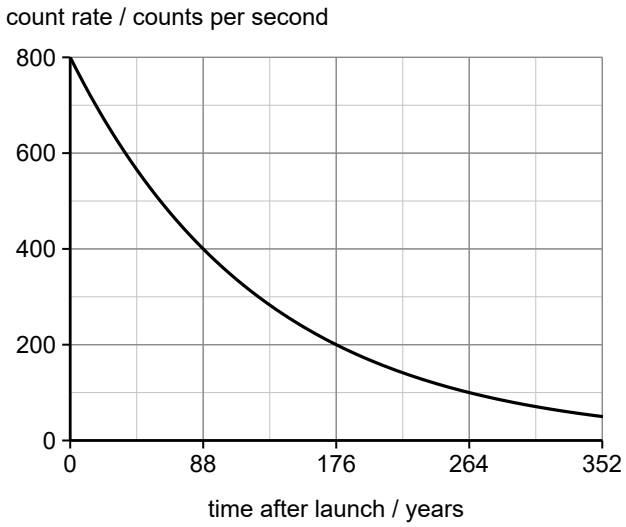


Fig. 13.1

(i) Use Fig. 13.1 to deduce the half-life of this plutonium nuclide.

half-life = ... years [1]

(ii) The generator that uses the pellet stops working when the count rate falls below 60 counts per second. Calculate the count rate 264 years after launch and state whether the generator is still working.

count rate = ... counts per second [1]

[Total: 4]

Section B

Answer **one** question from this section.

14 A rocket launch site uses magnets and an intercom system.

(a) A technician places two identical rods, one made of iron and one made of steel, inside a coil and counts the paper clips that each rod picks up. Table 14.1 shows the results. The crane at the launch site has an electromagnet with a soft iron core, and a surveyor's compass has a steel needle.

Table 14.1

rod	clips picked up while the current is on	clips picked up after the current is switched off
P	14	0
Q	8	7

(i) State which rod, P or Q, is a temporary magnet and which is a permanent magnet. Give a reason from the table.

.....

..... [1]

(ii) Explain why iron is used for the core of the crane's electromagnet.

.....

..... [1]

(iii) Explain why steel is used for the needle of the compass.

.....

..... [1]

(b) Fig. 14.1 shows a bar magnet with its poles X and Y not marked. A plotting compass is placed at P.

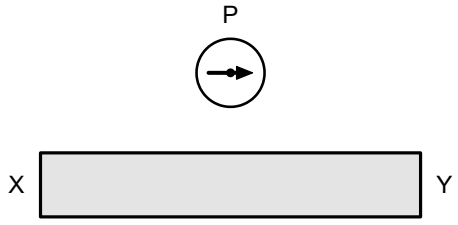


Fig. 14.1

(i) Describe how a plotting compass can be used to find the direction of the magnetic field at P.

.....

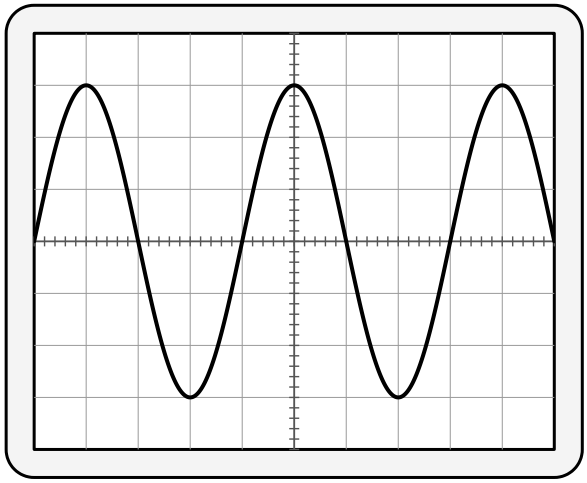
..... [1]

(ii) The north end of the needle at P points towards Y, as shown in Fig. 14.1. Deduce whether Y is a north pole or a south pole. Give a reason for your answer.

.....

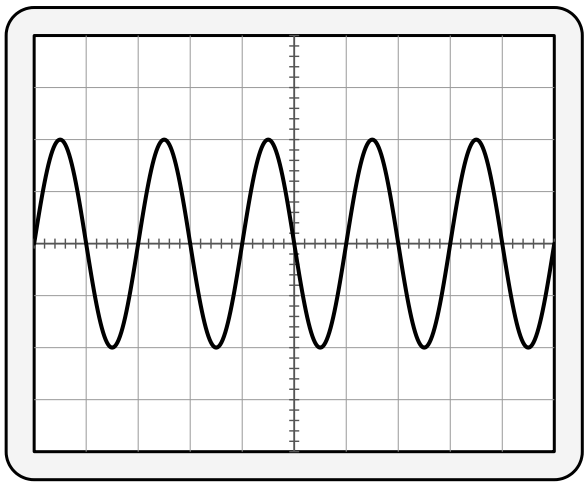
..... [1]

(c) A technician tests the intercom loudspeaker with two tones, A and B. Fig. 14.2 and Fig. 14.3 show the traces of the two tones on a display screen, drawn with the same scales.



vertical scale: 1.0 V/div
horizontal scale: 0.50 ms/div

Fig. 14.2 (tone A)



vertical scale: 1.0 V/div
horizontal scale: 0.50 ms/div

Fig. 14.3 (tone B)

(i) State which tone is louder, and give a reason for your answer.

.....

.....

..... [2]

(ii) State which tone has the higher pitch and explain how you can tell from the traces.

.....

.....

..... [1]

(d) The speed of sound in air is 340 m/s. Use Fig. 14.3 to calculate the frequency and then the wavelength of tone B.

frequency = ... Hz

wavelength = ... m [2]

[Total: 10]

15 A telescope on a satellite uses a lens, and its electronics are powered by a 28 V supply.

(a) The objective lens of the telescope is a converging lens of focal length 0.80 m. State what is meant by the focal length of a converging lens, and state how far from the lens the detector must be placed to receive a sharp image of a very distant star.

.....

.....

.....

..... [2]

(b) A ray of light in air enters the glass of the lens at an angle of incidence of 50°. The angle of refraction is 30°. Another ray enters the glass at an angle of incidence of 70°. Calculate the angle of refraction of the second ray.

angle of refraction = ... ° [3]

(c) Fig. 15.1 shows the 28 V supply connected to a lamp L in series with a heater H and a motor Z, which are in parallel with each other. Voltmeter V, across the lamp, reads 12.0 V.

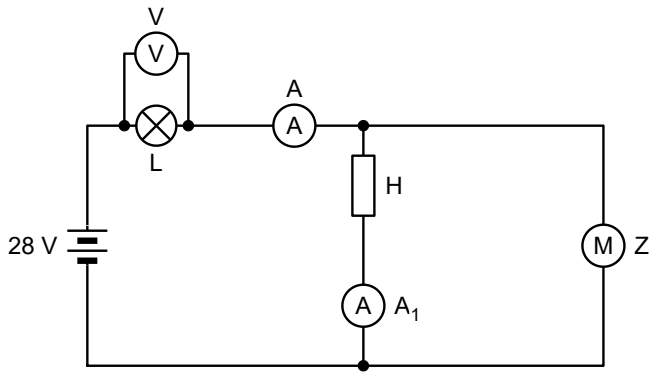


Fig. 15.1

(i) State the relationship between the potential differences across the components in a series circuit and the potential difference across the whole circuit.

.....

..... [1]

(ii) A student says that the potential difference across the heater H is 12.0 V because that is the reading of the voltmeter. Calculate the potential difference across H and use your answer to explain why the student is wrong.

.....

.....

.....

.....

..... [2]

(d) In Fig. 15.1 ammeter A reads 2.00 A and ammeter A_1 reads 0.85 A.

(i) State how the current from the supply is related to the currents in the separate branches of a parallel circuit.

.....

..... [1]

(ii) Calculate the current in the motor Z.

current = ... A [1]

[Total: 10]