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 2.1

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 cook needs to measure 35 cm^3 of cooking oil for a recipe. Table 1.1 shows the four containers she can use.

Table 1.1

container	range / cm^3	smallest division / cm^3
beaker	0 to 250	50
measuring cylinder A	0 to 25	1
measuring cylinder B	0 to 50	1
measuring jug	0 to 1000	100

(a) Which container should she use to measure the oil as accurately as possible? Give two reasons for your choice.

.....

.....

..... [1]

(b) Measuring cylinder B has a mass of 84.0 g when empty. With the 35 cm^3 of oil in it, the total mass is 116.2 g. Calculate the density of the oil in kg/m^3.

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

[Total: 3]

2 A robot vacuum cleaner moves in a straight line across a kitchen floor. Fig. 2.1 is the speed-time graph for its motion.

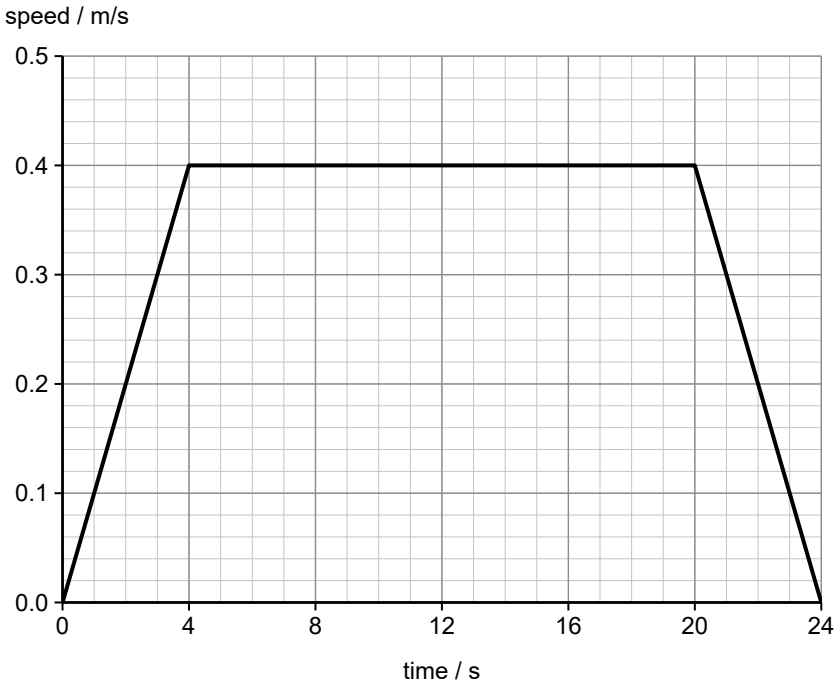


Fig. 2.1

(a) State what is meant by uniform acceleration.

.....

..... [1]

(b) Calculate the total distance travelled by the robot vacuum cleaner in the 24 s.

distance = ... m [2]

(c) Show that the average speed of this robot over the 24 s is 0.33 m/s. A second robot cleans the same distance at a constant speed of 0.40 m/s. Use the two speeds to state whether the second robot finishes before the first robot.

[2]

[Total: 5]

3 An empty fridge of mass 64 kg stands on four feet, as shown in Fig. 3.1. Each foot is a rectangle 2.0 cm by 2.5 cm. The fridge is then filled with food of total mass 8.0 kg. Take the gravitational field strength to be 10 N/kg.

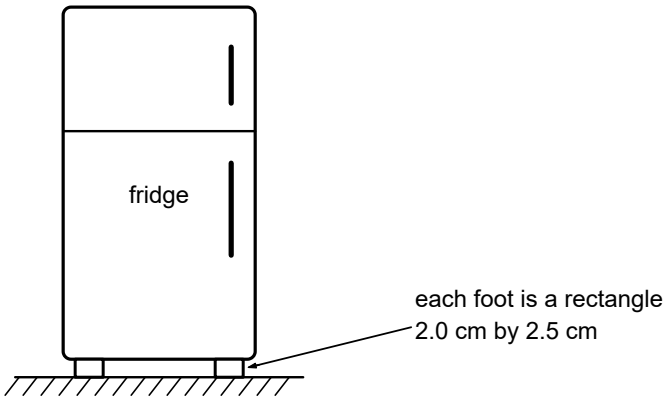


Fig. 3.1 (not to scale)

(a) Calculate the total weight of the fridge and the food.

weight = ... N [1]

(b) Calculate the pressure that the four feet exert on the floor.

pressure = ... Pa [2]

[Total: 3]

4 A person pushes a washing machine of mass 60 kg along a level floor. The push is a horizontal force. The friction between the washing machine and the floor is 150 N.

(a) The washing machine moves at a constant velocity. Explain why the push must be 150 N.

.....

.....

..... [2]

(b) The person now pushes with a horizontal force of 210 N. The friction is still 150 N. Calculate the acceleration of the washing machine.

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

[Total: 4]

5 Fig. 5.1 shows a kitchen scale. A bag of flour hangs from a light beam that has a centimetre scale. A weight of 3.0 N is moved along the right-hand side until the beam is balanced and horizontal. The weight of the beam can be ignored.

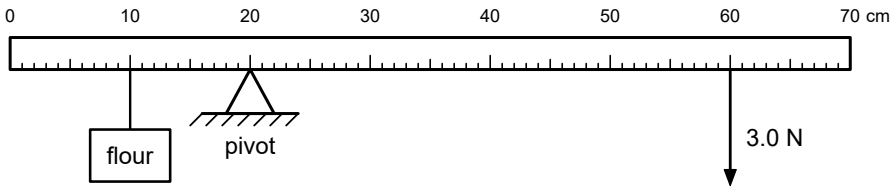


Fig. 5.1

(a) Use the scale in Fig. 5.1 to find the perpendicular distance of the 3.0 N weight from the pivot. Hence calculate the moment of the 3.0 N weight about the pivot.

moment = ... N m [1]

(b) Use the principle of moments to calculate the weight of the bag of flour.

weight of flour = ... N [2]

[Total: 3]

6 A restaurant uses a small lift to carry food from the kitchen up to the dining room. The lift and the food have a total mass of 8.0 kg. An electric motor raises them through a height of 4.5 m in 12 s. Take the gravitational field strength to be 10 N/kg.

(a) Calculate the increase in the gravitational potential energy of the lift and the food.

increase in energy = ... J [2]

(b) Calculate the useful power output of the motor.

power = ... W [1]

(c) State the principle of the conservation of energy.

.....

..... [1]

(d) The motor receives 480 J of electrical energy while it raises the lift. Use the principle of conservation of energy to calculate the energy wasted as thermal energy and sound.

wasted energy = ... J [1]

[Total: 5]

7 Water in a pan is heated on a hob until it boils. Steam rises from the pan.

(a) State one physical property in which steam (a gas) differs from the liquid water.

.....

..... [1]

(b) The temperature of the water rises from 25 °C to 90 °C. Explain, in terms of the water molecules, why the temperature rises.

.....

.....

..... [2]

(c) Describe what is meant by the internal energy of the water.

.....

.....

..... [2]

[Total: 5]

8 Fig. 8.1 shows a vacuum flask used to keep soup hot. The soup is held in a glass container with two walls. There is a vacuum between the two walls, and the surfaces facing the vacuum are coated with shiny silver.

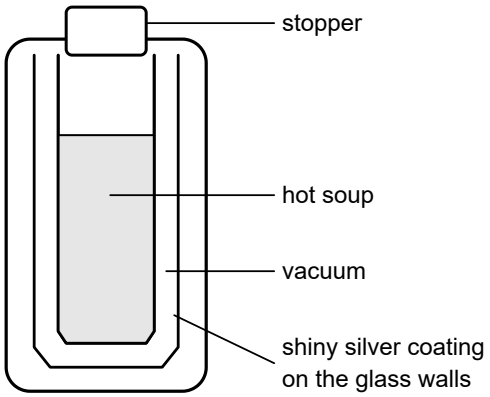


Fig. 8.1

(a) Explain how the vacuum reduces the energy lost from the soup by conduction and by convection.

.....

.....

..... [2]

(b) Energy can still cross the vacuum.

(i) State how energy crosses the vacuum.

..... [1]

(ii) Explain how the shiny silver coating reduces the energy lost from the soup in this way.

.....

..... [1]

[Total: 4]

9 A student makes water waves in a long, shallow baking tray. Fig. 9.1 shows the displacement-distance graph of the waves at one instant. The first crest is not at the start of the tray.

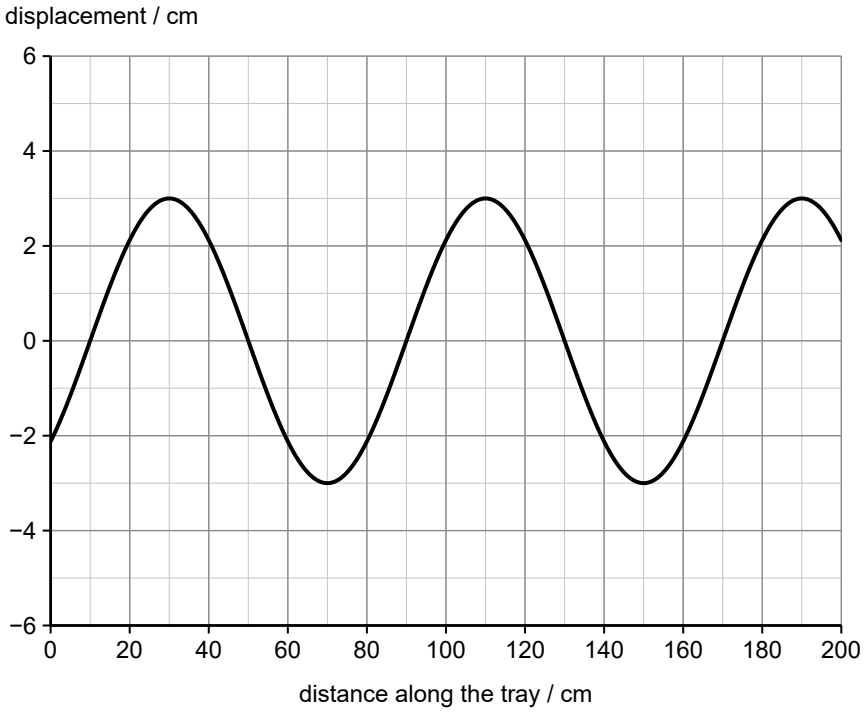


Fig. 9.1

(a) Use Fig. 9.1 to determine the wavelength and the amplitude of the waves.

wavelength = ... cm

amplitude = ... cm [1]

10 Different types of electromagnetic wave are used by devices in a kitchen and living room.

(a) Complete Table 10.1 by naming the type of electromagnetic wave used in each device. Choose from: radio waves, microwaves, infra-red, ultraviolet, X-rays.

Table 10.1

use of the device	type of electromagnetic wave used
oven that heats a bowl of soup by making the water in it vibrate	
remote controller switching off the television	
cupboard that kills bacteria on baby bottles	
kitchen set tuned to a music station	

[2]

11 A smart fridge has a small camera. A thin converging lens in the camera forms an image of the food on a sensor.

(a) Fig. 11.1 shows three rays of a parallel beam of light that is about to pass through a thin converging lens. The marks on the principal axis are a distance *f* from the lens, where *f* is the focal length. Complete Fig. 11.1 to show the paths of the three rays after they pass through the lens. Label the focal point F.

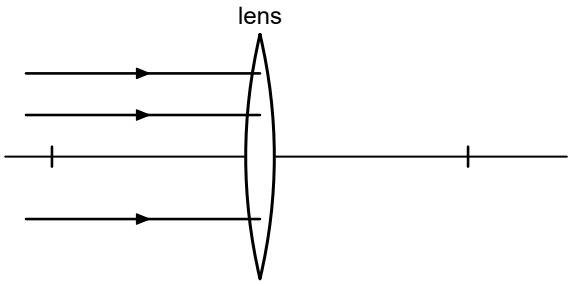


Fig. 11.1

[2]

(b) Fig. 11.2 shows how the lens forms an image of a carton of milk on the sensor. Underline one word in each pair to describe the image.

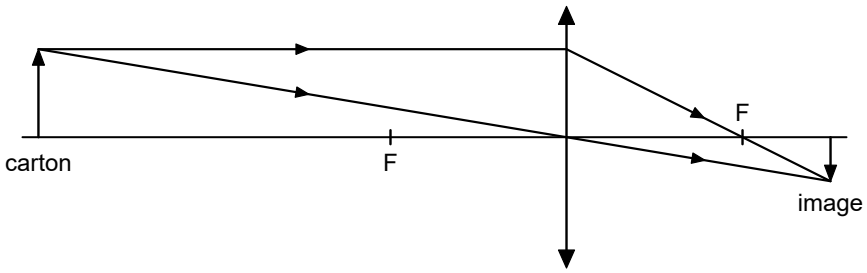


Fig. 11.2 (drawn to scale)

real / virtual **upright / inverted** **magnified / diminished**

[2]

(c) The lens is made of glass for which sin *i* / sin *r* = 1.5. A ray of light in air meets the glass at an angle of incidence of 48°. Calculate sin *r*, where *r* is the angle of refraction.

sin *r* = ... [1]

[Total: 5]

12 The heating element of a hair dryer is connected to the 230 V mains supply. There is a current of 5.0 A in the element.

(a) Calculate the charge that passes through the heating element in 6.0 minutes.

charge = ... C [2]

(b) The potential difference across the element is 230 V. Calculate the resistance of the element.

resistance = ... Ω [2]

[Total: 4]

13 Fig. 13.1 shows three resistors connected to a 12 V battery. The resistors model the heating circuit of a bread maker.

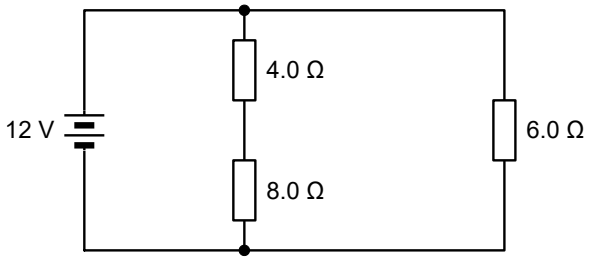


Fig. 13.1

(a) Calculate the effective resistance of the three resistors.

resistance = ... Ω [2]

(b) Calculate the potential difference across the 8.0 Ω resistor.

potential difference = ... V [2]

[Total: 4]

14 A kitchen cupboard door has a magnetic catch. The catch contains a magnet made of steel. Fig. 14.1 shows the magnet and a point P near it.

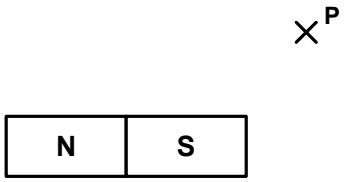


Fig. 14.1

(a) Explain why the magnet in the catch is made of steel and not of iron.

.....

.....

..... [2]

(b) A student has a plotting compass. Describe how she can use it to find the direction of the magnetic field of the magnet at P.

.....

.....

..... [2]

[Total: 4]

15 A smoke alarm contains a small source of americium-241, $^{241}_{95}Am$. The nuclide americium-241 is radioactive and has a half-life of 432 years.

(a) Determine the number of neutrons in one nucleus of americium-241.

number of neutrons = ... [1]

(b) The activity of a new source is 4.8×10^4 Bq. Calculate the time taken for the activity to fall to 1.5×10^3 Bq.

time = ... years [2]

[Total: 3]

Section B

Answer **one** question from this section.

16 An air fryer is connected to the 230 V mains supply. Its label says 1.84 kW. The plug of the air fryer contains a 13 A fuse. The air fryer sounds a beep when the food is cooked.

(a) The air fryer is switched on for 15 minutes. Calculate the current in the air fryer and the energy transferred in this time.

current = ... A

energy = ... J [3]

(b) A person plugs the air fryer and a 2.3 kW kettle into the same adaptor, which has a 13 A fuse and is connected to the 230 V mains, and switches both on. Use your answer to (a) to deduce what happens to the fuse in the adaptor. Explain why this protects the user.

.....

.....

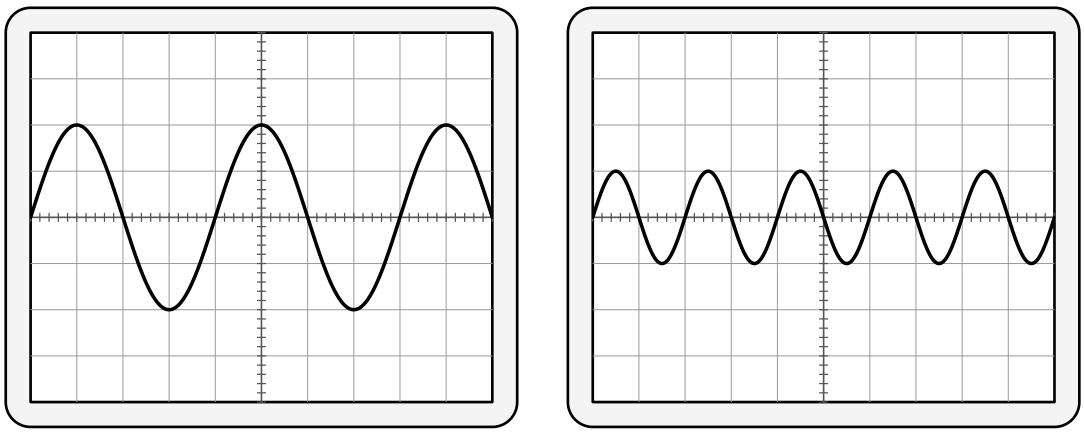
.....

..... [2]

(c) The beep has a frequency of 2.5 kHz. A microphone 10.2 m from the air fryer receives the sound 0.030 s after it is produced. Calculate the wavelength of the sound.

wavelength = ... m [3]

(d) Fig. 16.1 shows oscilloscope traces for two other sounds, A and B, made by the air fryer and detected by the same microphone. The settings of the oscilloscope are different for the two traces. State which sound is louder and which has the higher pitch. Support each answer with a calculation or a reading from Fig. 16.1.



sound A
Y-gain: 0.5 V/div
time-base: 0.2 ms/div

sound B
Y-gain: 2 V/div
time-base: 0.5 ms/div

Fig. 16.1

.....

.....

.....

..... [2]

[Total: 10]

17 A freezer has an automatic ice maker. Water flows into a tray through a valve and freezes into ice cubes.

(a) A student says: "Steam can be squashed into a smaller volume, but liquid water cannot." Use the kinetic particle model to explain this. Refer to the distances between the particles and the forces between them.

.....

.....

.....

.....

..... [3]

(b) A student measures the temperature of water in a tray in the freezer. Table 17.1 shows her results.

Table 17.1

time / min	temperature of the water / °C
0	22
5	11
10	0
15	0
20	0
25	0
30	0
35	−6
40	−12

(i) Use Table 17.1 to state the freezing point of water and to calculate for how long the water was freezing.

.....

..... [1]

(ii) The freezer removes energy from the water all the time. Explain, in terms of the particles, why the temperature does not fall while the water is freezing.

.....

.....

..... [1]

(c) Fig. 17.1 shows the valve that lets water into the tray. It contains a solenoid and an iron plunger. When there is a current in the solenoid, the plunger is pulled towards it and the valve opens.

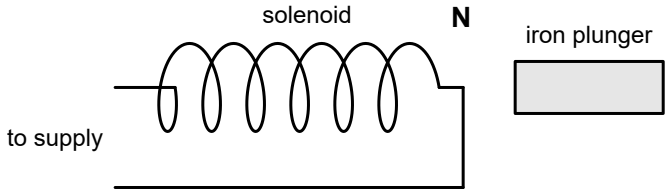


Fig. 17.1

(i) The plunger becomes a magnet when there is a current in the solenoid. Describe how this happens.

.....

.....

..... [2]

(ii) The right-hand end of the solenoid is a north pole. State the polarity of the end of the plunger that is nearest to the solenoid and use it to explain why the plunger is pulled towards the solenoid.

.....

..... [1]

(d) Fig. 17.2 shows a solenoid with its north and south ends marked.

(i) Draw, on Fig. 17.2, the pattern of the magnetic field of the solenoid. Draw at least four field lines, with arrows to show the direction of the field.

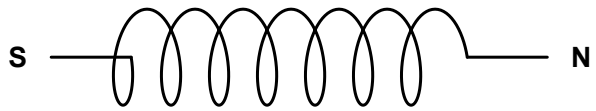


Fig. 17.2

[1]

(ii) The current in the solenoid is increased and its direction is reversed. State the effect of this on the magnetic field.

.....

..... [1]

[Total: 10]