Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/12**

Paper 1 Multiple Choice **May/June 2023**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall = 9.8 m / s^2).

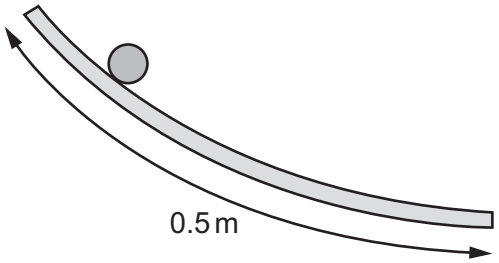
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

IB23 06_5054_12/3RP
© UCLES 2023

[Turn over

1 In an experiment, a ball is rolled down a curved track that is about half a metre long.



Which measuring device is used to measure the length accurately?

A metre rule

B micrometer

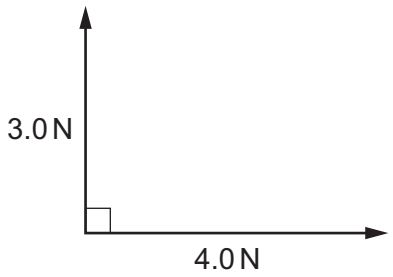
C stop-watch

D tape measure

2 Which row describes acceleration, displacement, distance and speed?

	acceleration	displacement	distance	speed
A	scalar	scalar	vector	scalar
B	scalar	vector	scalar	vector
C	vector	scalar	vector	vector
D	vector	vector	scalar	scalar

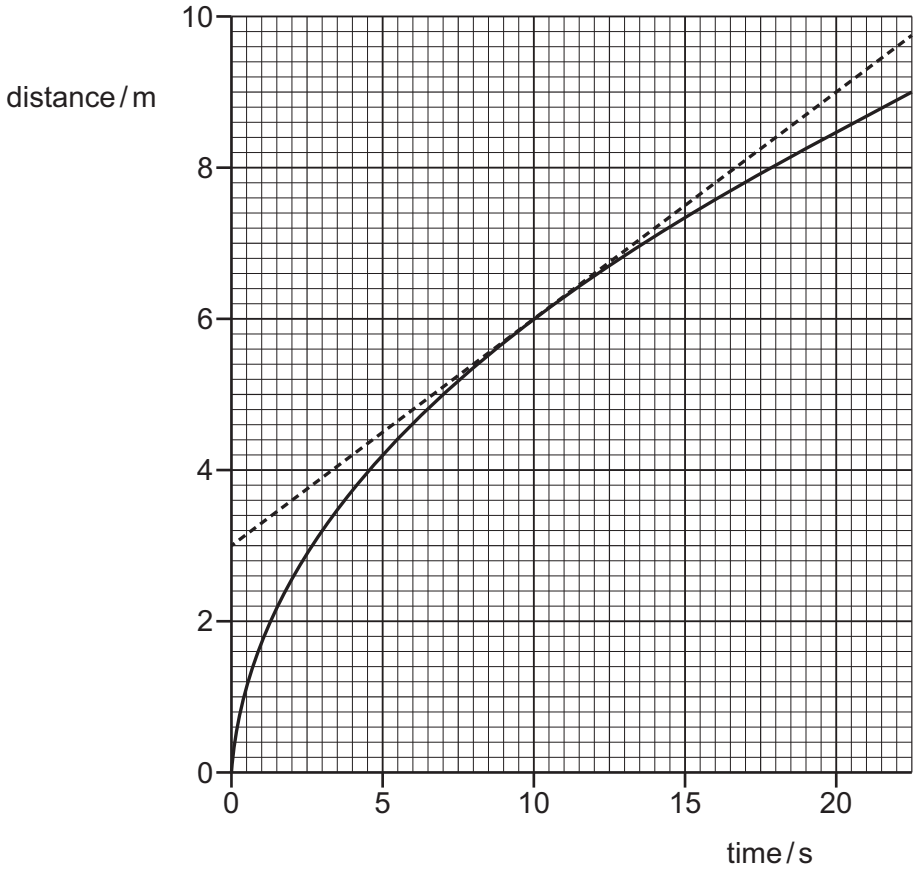
3 What is the size of the resultant of the two forces shown?



A 1.0 N **B** 3.5 N **C** 5.0 N **D** 7.0 N

© UCLES 2023

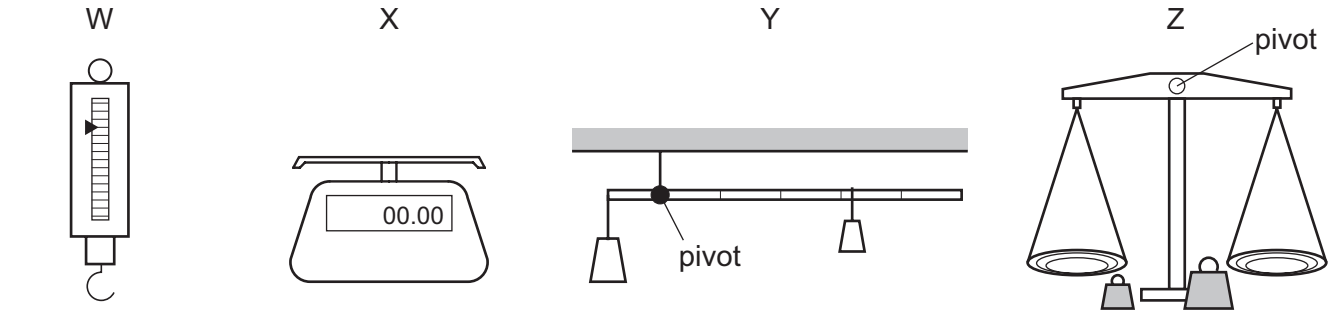
4 The curved line on the distance–time graph shows the motion of a toy car. The straight line is the tangent to the curve at 10 s.



What is the speed of the toy car at 10 s?

A 0.3 m / s **B** 0.6 m / s **C** 1.7 m / s **D** 3.3 m / s

5 The diagrams show four balances, W, X, Y and Z.



The scales of all the balances are calibrated on the Earth to measure mass.

Which balances also measure mass correctly when used on the Moon?

A W and X **B** W and Z **C** X and Y **D** Y and Z

6 A spacecraft carries a probe to Mars where the gravitational field strength is 3.7 N / kg. The weight of the probe on Mars is 370 N.

The gravitational field strength on Earth is 9.8 N / kg.

What are the mass and the weight of the probe on Earth?

	mass / kg	weight / N
A	100	370
B	100	980
C	370	98
D	370	3700

7 A student determines the density of a liquid.

Which equipment does the student use?

A a balance and a ruler

B a balance and a measuring cylinder

C a beaker and a measuring cylinder

D a ruler and a beaker

8 Newton's third law describes a pair of forces.

Which row shows whether the two forces are of the same type and whether they act on the same object?

	the types of forces in the pair	the objects on which they act
A	different	different
B	different	same
C	same	different
D	same	same

© UCLES 2023

9 The stopping distance of a car is the sum of the thinking distance and the braking distance.

Which factors affect the braking distance?

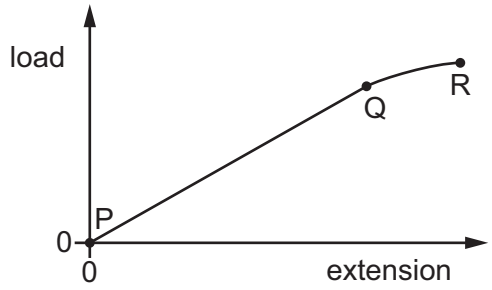
	speed of car	tiredness of driver	condition of road
A	✓	✗	✗
B	✓	✓	✓
C	✓	✗	✓
D	✗	✓	✓

key

✓ = affects braking distance

✗ = does not affect braking distance

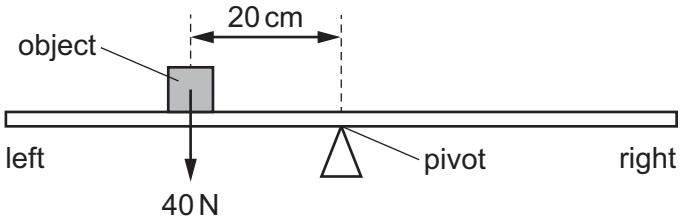
10 A load–extension graph for a spring is shown.



Which point is the limit of proportionality for the spring and what is the spring constant of the spring equal to?

	limit of proportionality	spring constant is equal to
A	Q	the gradient of PQ
B	Q	the gradient of QR
C	R	the gradient of PQ
D	R	the gradient of QR

11 A uniform beam is pivoted at its midpoint. An object weighing 40 N is placed on the beam 20 cm to the left of the pivot as shown.



Which force and position balances the system?

A 20 N acting downwards, 40 cm to the right of the pivot

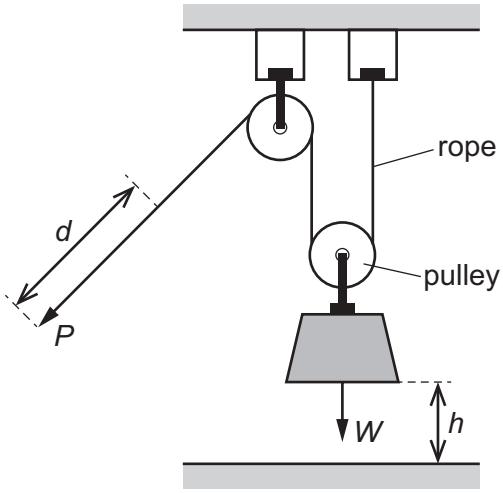
B 20 N acting upwards, 40 cm to the right of the pivot

C 50 N acting downwards, 10 cm to the left of the pivot

D 50 N acting upwards, 10 cm to the left of the pivot

12 A worker pulls a rope with a force *P* through a distance *d* in the direction of the force as shown.

This causes a block of weight *W* to move vertically upwards through a height *h*.



How much work is done by the worker?

A *Ph** **B** *Pd** **C** (*P* + *W*)*h** **D** (*P* + *W*)*d*

13 A battery is connected in a circuit to light a lamp.

What is the energy store in the battery?

A chemical

B electrostatic

C gravitational

D kinetic

© UCLES 2023

14 What is a property of both liquids and gases?

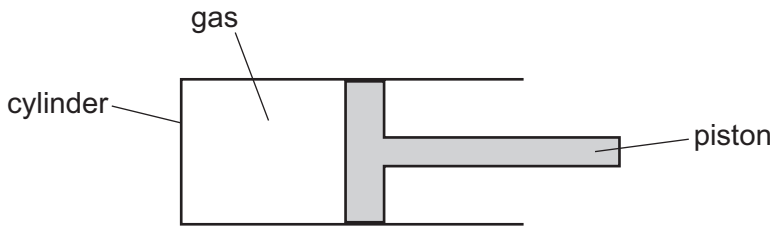
A They always fill their containers.

B They are incompressible.

C They can flow.

D They have particles in fixed positions.

15 In an experiment, the volume of a gas in a cylinder is measured as the pressure of the gas is increased.



The values obtained are shown.

pressure P/Pa	1.0×10^5	2.0×10^5	3.0×10^5	4.0×10^5
volume V/m^3	20×10^{-5}	10×10^{-5}	6.0×10^{-5}	4.0×10^{-5}

What is a possible explanation for these results?

A After the pressure is doubled, gas starts leaking into the cylinder.

B After the pressure is doubled, gas starts leaking out of the cylinder.

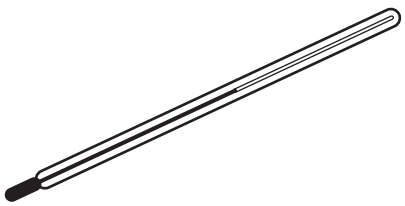
C The temperature of the gas is constant.

D The temperature of the gas is increasing.

© UCLES 2023

16 The diagrams show examples of thermal expansion.

P



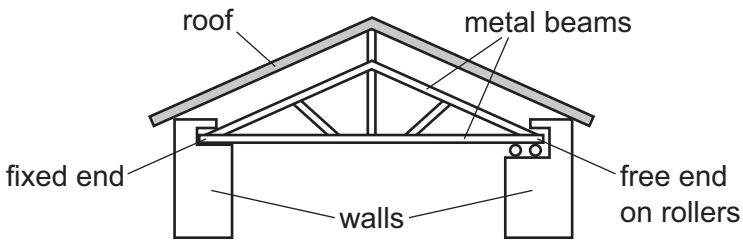
expansion of liquid in a thermometer

Q



expansion of a tight lid on a glass container

R



expansion of the long metal beams supporting a roof

In which diagrams is the thermal expansion useful?

A P, Q and R **B** P and Q only **C** P only **D** Q and R only

17 Which statement about copper explains why it is a better thermal conductor than glass?

A Atomic vibration is passed on to neighbouring copper atoms slowly.

B Atoms move through the copper and pass on kinetic energy.

C There are density changes within the copper.

D There are free electrons in the copper.

18 Which statement describes the transfer of thermal energy in a liquid by convection?

A A decrease in its density causes the heated liquid to rise.

B Free electrons carry energy large distances through the liquid.

C Infrared radiation passes through the liquid and transfers energy.

D Particles of the liquid vibrate and pass energy to neighbouring particles.

© UCLES 2023

19 Which characteristics describe the image formed by a vertical plane mirror?

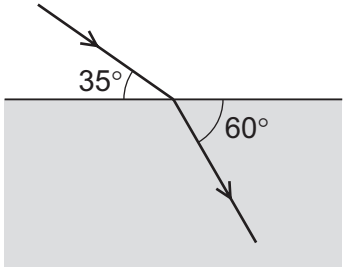
A real and upside down

B virtual and upright

C real and larger than the object

D virtual and smaller than the object

20 A ray of light passes into a block of transparent material as shown.



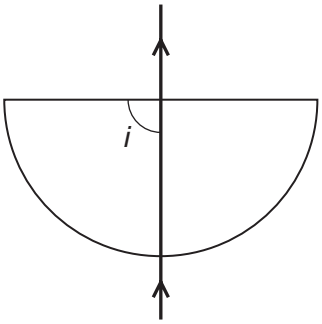
What is the refractive index of the transparent material?

A 0.66 **B** 1.15 **C** 1.64 **D** 1.83

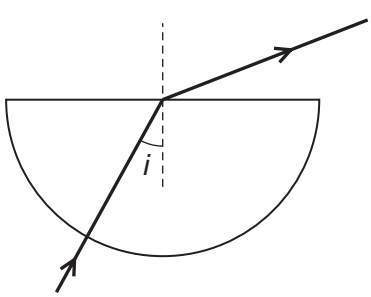
21 The diagrams show light incident on the straight edge of a semi-circular glass block after passing through it.

Which diagram shows refraction and an angle *i* equal to the critical angle of the glass?

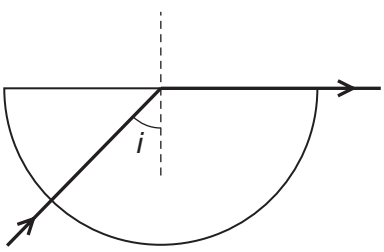
A



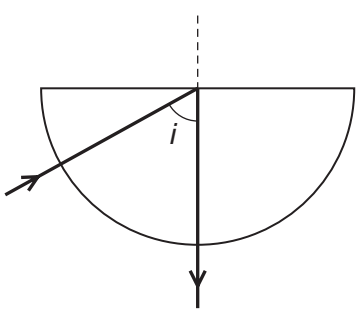
B



C



D



22 Which radioactive isotope can be used for measuring cracks or flaws in metal components?

A americium-241, an alpha emitter with a half-life of 432 years

B cobalt-60, a gamma emitter with a half-life of 5 years

C radium-223, an alpha emitter with a half-life of 11 days

D barium-137, a gamma emitter with a half-life of 3 minutes

23 Ultrasound is a type of sound wave that is not audible to a healthy human ear.

Which range of frequencies contains **only** ultrasound?

A 30 Hz–3.0 kHz

B 300 Hz–30 kHz

C 3.0 kHz–3.0 MHz

D 30 kHz–30 MHz

24 What proves that a metal bar is a permanent magnet?

A It attracts both ends of a compass needle.

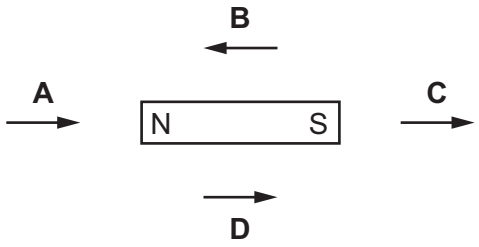
B It attracts one end of another magnet.

C It conducts electricity.

D It repels one end of another magnet.

25 The diagram shows a bar magnet and four labelled arrows.

Which arrow shows the direction of the magnetic field at the point where the arrow is shown?



26 A shoe becomes positively charged by friction when it rubs against a carpet.

What happens as the shoe becomes charged?

A Negative electrons are transferred to the carpet.

B Negative electrons are transferred to the shoe.

C Positive electrons are transferred to the carpet.

D Positive electrons are transferred to the shoe.

© UCLES 2023

27 A metal conductor is connected between the positive and negative terminals of a battery.

Which row gives the direction of movement of the particles that flow in the conductor and their name?

	direction of movement	name of particles
A	from positive terminal to negative terminal	protons
B	from positive terminal to negative terminal	electrons
C	from negative terminal to positive terminal	protons
D	from negative terminal to positive terminal	electrons

28 Three identical cells are connected in parallel to a resistor.

What is the advantage of using three cells in parallel rather than using a single cell?

A Each cell produces more energy.

B Each cell supplies more charge.

C Each cell takes longer to discharge.

D The e.m.f. is greater than that of a single cell.

29 A student has three 15 Ω resistors.

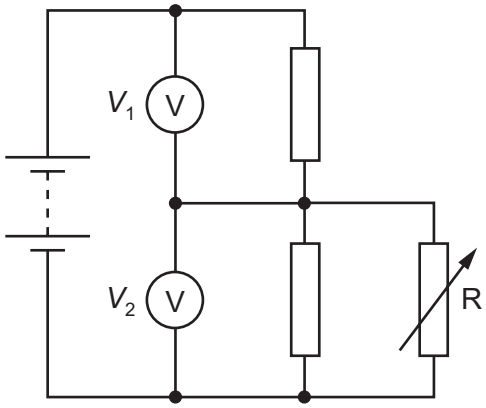
She connects the resistors together in different arrangements.

What is the minimum resistance and what is the maximum resistance of the arrangements that the student can produce?

	minimum resistance / Ω	maximum resistance / Ω
A	5.0	15
B	5.0	45
C	15	30
D	15	45

© UCLES 2023

30 The circuit diagram shows a variable resistor R connected in parallel to the lower section of a potential divider.



The resistance of R increases.

What happens to the two voltmeter readings V_1 and V_2?

	V_1	V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

31 The power consumption of a microwave oven is 1500 W.

The cost of 1.0 kW h of electrical energy is 24 cents.

What is the cost of using the microwave oven for 10 minutes?

A 6 cents

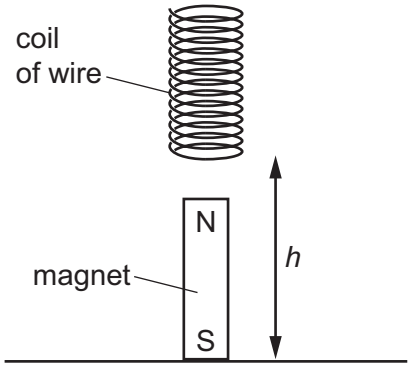
B 36 cents

C 60 cents

D 360 cents

© UCLES 2023

32 A coil of wire above a magnet is dropped. As the coil falls over the magnet, an e.m.f. is induced across the coil.



What does **not** affect the magnitude of the e.m.f. induced across the coil?

A changing the number of turns of wire in the coil

B changing the height *h* from which the coil is dropped

C changing the direction of the magnet, so the north pole is at the bottom

D changing the strength of the magnetic field from the magnet

33 The results of the alpha-particle scattering experiment give evidence for which of the following?

A nuclear fusion

B radioactive decay

C the existence of isotopes

D the size of the nucleus

34 A nucleus of an isotope of cobalt is represented by the symbol $^{59}_{27}\text{Co}$.

What is the composition of this nucleus?

	number of protons	number of neutrons
A	27	32
B	27	59
C	59	27
D	59	32

35 The only stable isotope of gold, Au, has 79 protons and 118 neutrons in a nucleus of an atom.

How many elecrons are there in a neutral atom of this isotope?

A 39 **B** 79 **C** 118 **D** 197

36 A sample of a radioactive isotope with a very long half-life is placed next to a detector. Sheets of different materials are inserted, one at a time, between the radioactive sample and the detector.

The background count rate is subtracted from the readings on the detector and the corrected count rates are recorded in the table.

type of material	corrected count rate / counts / s
no sheet inserted	450
thin aluminium sheet	381
thin lead sheet	285
thin paper sheet	452

Which types of radiation are emitted by the radioactive sample?

A alpha-particles and beta-particles only

B alpha-particles only

C beta-particles and gamma radiation only

D gamma radiation only

37 In a fission reactor, which particle causes a uranium-235 nucleus to split?

A alpha-particle

B gamma ray

C neutron

D proton

38 What is the purpose of moderators in nuclear reactors?

A to absorb all the neutrons in order to stop the chain reaction

B to produce more neutrons in order to create a chain reaction

C to remove thermal energy in order to control the chain reaction

D to slow down neutrons in order to continue the chain reaction

39 In which region of the electromagnetic spectrum does the Sun radiate the most energy?

A infrared region

B microwave region

C radio wave region

D X-ray region

© UCLES 2023

40 Four of the stages in the life cycle of a star, until it becomes a red giant, are shown.

W Inward force of gravitational attraction is balanced by an outward force from its centre.

X Internal gravitational collapse produces an increase in temperature.

Y It expands.

Z Most of the hydrogen has been converted to helium.

In which order do these stages occur, starting with the earliest?

A W → X → Y → Z

B W → X → Z → Y

C X → W → Y → Z

D X → W → Z → Y

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2023