



PHYSICS

8867/01

Paper 1 Multiple Choice

For examination from 2026

SPECIMEN PAPER

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet

INSTRUCTIONS

- There are **thirty** 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 index number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use an approved calculator.

INFORMATION

- The total mark for this paper is 30.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.

This document has **14** pages. Any blank pages are indicated.



Data

speed of light in free space	$c = 3.00 \times 10^8 \text{ m s}^{-1}$
elementary charge	$e = 1.60 \times 10^{-19} \text{ C}$
unified atomic mass constant	$u = 1.66 \times 10^{-27} \text{ kg}$
rest mass of electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$
rest mass of proton	$m_p = 1.67 \times 10^{-27} \text{ kg}$
the Avogadro constant	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$
gravitational constant	$G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$
acceleration of free fall	$g = 9.81 \text{ m s}^{-2}$

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$
	$v^2 = u^2 + 2as$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \dots$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + \dots$

- 1 A voltmeter connected across a resistor in a circuit gives readings that have high precision but low accuracy.

Which row describes the likely error in readings taken with this voltmeter?

	random error	systematic error
A	large	large
B	large	small
C	small	small
D	small	large

- 2 An astronomical event in a nova (new star) was estimated to have an energy of 100 TJ and a duration of $10\ \mu\text{s}$.

What power was produced in this event?

- A** 10^{12} MW **B** 10^{13} MW **C** 10^{18} MW **D** 10^{19} MW

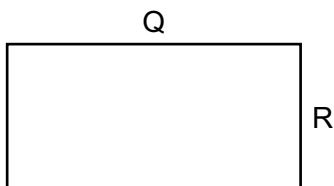
- 3 Two vectors, P and Q, have equal components in the x-direction, but the magnitude of P is smaller than the magnitude of Q.

How do the angles that Q and P make with the y-axis, and the magnitudes of Q and P in the y-direction, compare?

	angle	magnitude in y-direction
A	Q greater than P	Q greater than P
B	Q greater than P	Q smaller than P
C	Q smaller than P	Q greater than P
D	Q smaller than P	Q smaller than P

- 4 The diagram shows a rectangle with perimeter P.

The sides of the rectangle, measured with an uncertainty of 0.1 cm, are $Q = 20.0\text{ cm}$ and $R = 10.0\text{ cm}$.



What is the increasing order of the percentage uncertainty of Q, R and P, starting with the smallest?

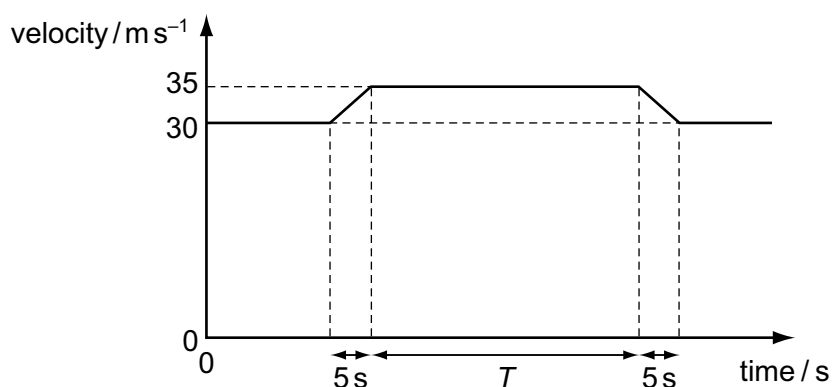
- A** $Q \rightarrow P \rightarrow R$ **B** $Q \rightarrow R \rightarrow P$ **C** $R \rightarrow P \rightarrow Q$ **D** $R \rightarrow Q \rightarrow P$

- 5 An astronaut is working on the surface of the Moon. The gravitational field strength g is 1.6 ms^{-2} .
He drops a hammer from rest and catches it when it has a speed of 1.8 ms^{-1} and is 0.50 m above the ground.

From which height above the ground did he drop the hammer?

- A** 1.0 m **B** 1.4 m **C** 1.5 m **D** 1.6 m
- 6 Two cars X and Y are initially travelling at 30 ms^{-1} on a straight motorway.
X overtakes Y by accelerating for 5 s to 35 ms^{-1} , remaining at 35 ms^{-1} for a time T and then decelerating for 5 s to 30 ms^{-1} .
X advances by 100 m relative to Y during overtaking.

The diagram shows the velocity-time graph for X.



What is the value of T ?

- A** 10 s **B** 15 s **C** 20 s **D** 25 s
- 7 A ball is projected horizontally and falls under gravity. After time t it has travelled a horizontal distance x and fallen a vertical distance y . Air resistance is negligible.

Which row correctly states the distance travelled horizontally and vertically after time $2t$?

	horizontally	vertically
A	$2x$	$2y$
B	$2x$	$4y$
C	$4x$	$2y$
D	$4x$	$4y$

- 8 A firework explodes into many parts after being fired high into the air.

At the time when the explosion takes place, what happens to the total momentum and the total kinetic energy of the system?

	total momentum	total kinetic energy
A	increased	increased
B	increased	unchanged
C	unchanged	increased
D	unchanged	unchanged

- 9 A train consisting of six wagons each of mass 6.0×10^4 kg is pulled at a constant speed by a locomotive of mass 24×10^4 kg along a straight horizontal track.

The horizontal force resisting the motion of each wagon is 4000 N.



The link between wagons 2 and 3 breaks.

What is the acceleration of the locomotive immediately after the link breaks?

- A** 0.022 ms^{-2} **B** 0.044 ms^{-2} **C** 0.067 ms^{-2} **D** 0.133 ms^{-2}
- 10 The elastic potential energy stored in a stretched wire can be calculated from a suitable straight-line graph which has force plotted on the y -axis.

Which measurement of the wire is plotted on the x -axis, and which property of the graph is equal to the elastic potential energy stored in the wire?

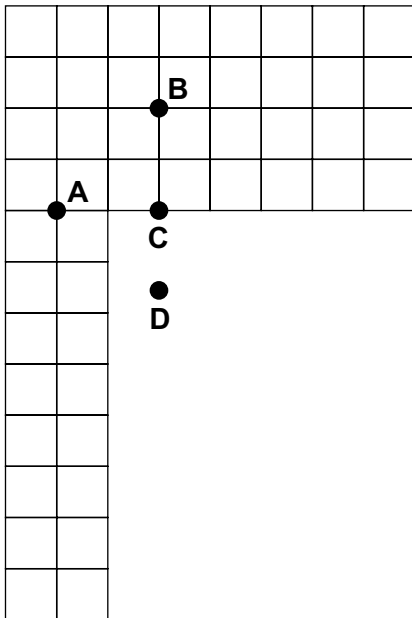
	measurement plotted	property of graph used
A	extension	area under graph
B	extension	gradient
C	length	x -intercept
D	length	gradient

- 11 Three non-parallel forces act on a body so that it is in equilibrium.

Which condition is **not** correct?

- A** The lines of action of the forces pass through a point.
B The forces are represented in magnitude and direction by three sides of a triangle taken in order.
C The vector sum of the moments of the three forces about any point is zero.
D The resultant of any two of the forces equals the third in magnitude and direction.
- 12 A flat piece of card of uniform thickness is cut out and marked into squares.

Which labelled point is the centre of gravity of the card?



- 13 A small coin of mass 10 g is placed on a horizontal rotating disc at a distance of 5 cm from the centre of the disc. The maximum frictional force between the coin and the disc is 0.2 N.

What is the largest angular velocity that the disc can have without the coin slipping?

- A** 0.06 rad s^{-1} **B** 1 rad s^{-1} **C** 20 rad s^{-1} **D** 400 rad s^{-1}

14 Which statement about work done is correct?

- A More work is done to change the speed of an object from 2 m s^{-1} to 3 m s^{-1} than to change the speed of the same object from 1 m s^{-1} to 2 m s^{-1} .
- B No work is done by a force that slows a moving object.
- C The same amount of work is done lifting an object 1 m at a constant velocity as that done by the same object moving 1 m at constant velocity across a smooth horizontal surface.
- D When an object is dropped, the force of gravity does no work.

15 The function of many machines is to transfer energy from one store to another as efficiently as possible.

Which machine is the most efficient?

- A a car engine as it transfers energy from chemical potential energy to kinetic energy
- B an electric heater as it transfers energy via the flow of an electric current to internal energy
- C a lamp as it transfers energy via the flow of an electric current to produce light
- D a rocket as it transfers energy from chemical potential energy to gravitational potential energy

16 For an electron beam, the following quantities are known or are easily measured.

- area A , when the beam hits a target
- beam current I
- accelerating potential difference V
- elementary charge e

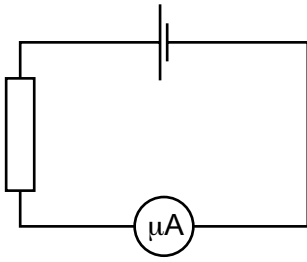
Which expression gives the rate of arrival of electrons per unit area on the target?

- A $\frac{I}{eA}$ B $\frac{IA}{e}$ C $\frac{V}{eA}$ D $\frac{Ve}{A}$

17 What is the definition of the electromotive force (e.m.f.) of a power supply?

- A the energy transferred from the electric circuit per unit charge which passes through it
- B the energy transferred to the electric circuit per unit charge which passes through it
- C the force needed to move unit charge through the power supply
- D the potential difference across the terminals of the power supply

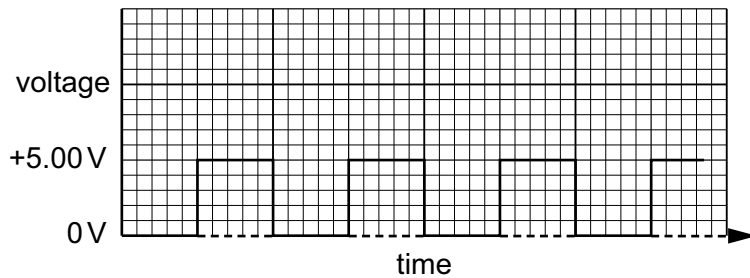
- 18 The diagram shows a circuit in which a microammeter records a current of $0.8\ \mu\text{A}$.



Which row gives the direction of movement of electrons through the microammeter shown in the circuit and the number of these electrons passing through the microammeter in 1 second?

	direction of movement	number of electrons per second
A	left to right	5×10^{15}
B	right to left	5×10^{15}
C	left to right	5×10^{12}
D	right to left	5×10^{12}

- 19 A voltage with the square waveform shown in the diagram is applied across a $100\ \Omega$ resistor.



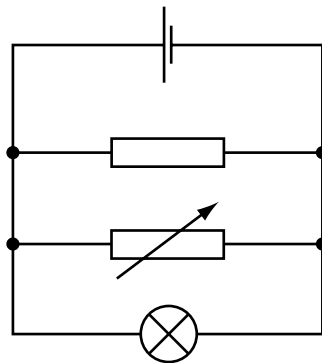
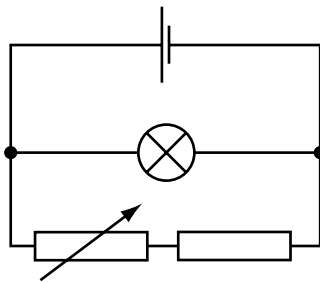
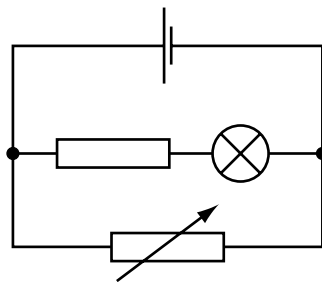
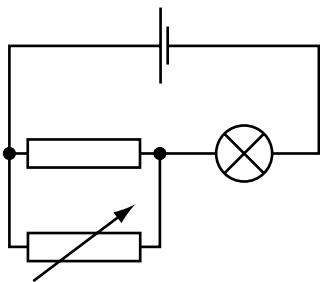
What is the mean power dissipated in the resistor?

- A** 0.0625W **B** 0.125W **C** 0.250W **D** 0.500W

- 20 A resistor with a value of resistance much greater than R is placed in parallel with a resistor of resistance R .

What is the resistance of the combination?

- A much less than R
 B just a bit less than R
 C just a bit more than R
 D much greater than R
- 21 A fixed resistor, a variable resistor, a filament lamp and a cell with negligible internal resistance are arranged in four different circuits.



In how many of these circuits is the brightness of the lamp changed by adjusting the resistance of the variable resistor?

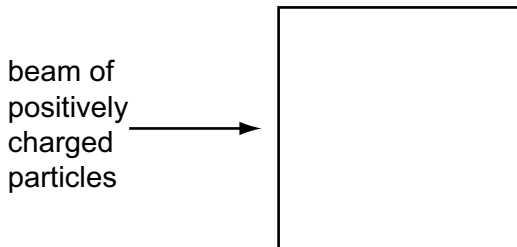
- A 1 B 2 C 3 D 4

- 22 A beam of positively charged particles is directed towards one side of a square region that contains a uniform magnetic field.

The magnetic field is perpendicular to the velocity of the particles and the plane of the square.

The field can be varied to any magnitude but is constant in direction.

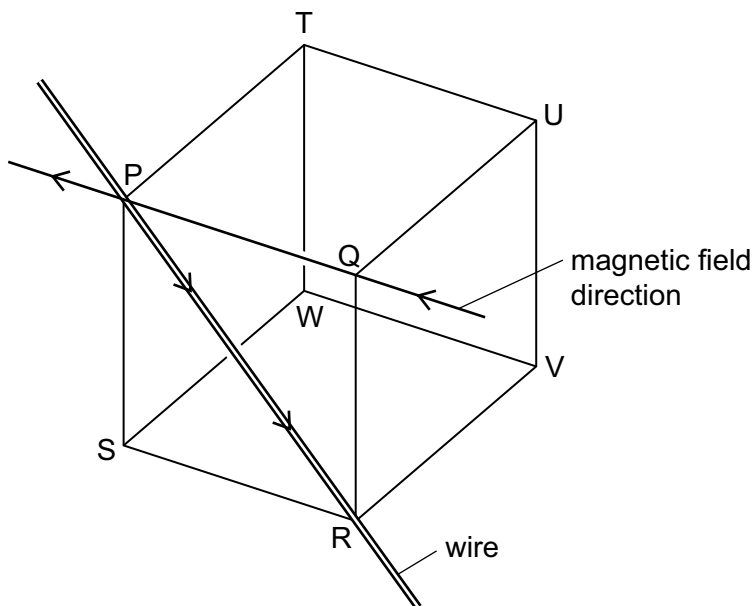
The region of the magnetic field contains a vacuum.



After travelling through the magnetic field, through how many sides of the square region can the positively charged particles possibly pass?

- A** 1 **B** 2 **C** 3 **D** 4
- 23 There is a current in a straight wire in the direction PR, as shown in the diagram.

P and R are two corners of an imaginary cube, with other corners Q, S, T, U, V and W.

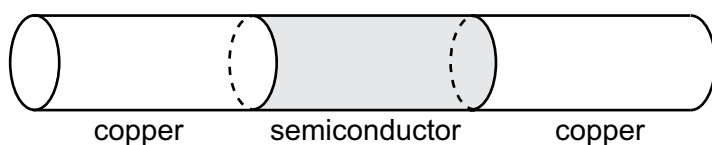


A uniform magnetic field is applied through the cube in direction QP.

What is the direction of the magnetic force on PR?

- A** PT **B** QS **C** SQ **D** TP

- 24 The electric current through a cylinder of semiconductor material is supplied by copper wires, as shown in the diagram.



The charge carriers in the semiconductor material are electrons. The semiconductor material and the copper have the same cross-sectional area.

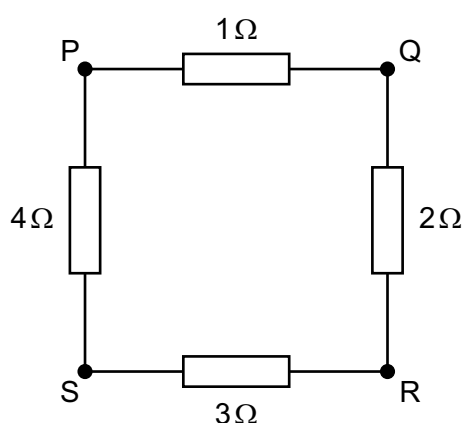
The table gives details of the number of free electrons per cubic metre in each material.

	copper	semiconductor
number of free electrons per cubic metre	8.6×10^{28}	4.3×10^{21}

The drift velocity of electrons through the copper wire is 0.58 mm s^{-1} .

What is the drift velocity of electrons through the semiconductor material?

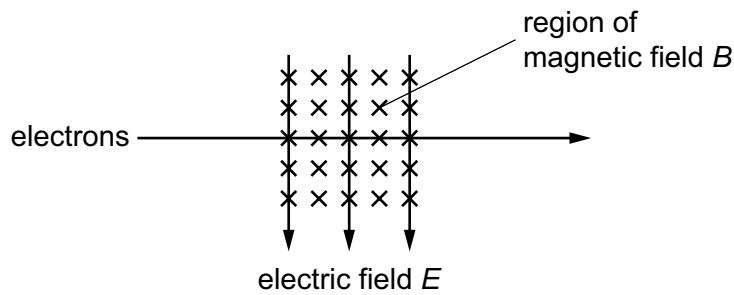
- A $2.9 \times 10^{-6} \text{ m s}^{-1}$
 B $2.9 \times 10^{-3} \text{ m s}^{-1}$
 C $1.16 \times 10^4 \text{ m s}^{-1}$
 D $1.16 \times 10^7 \text{ m s}^{-1}$
- 25 Four resistors are connected as shown.



Between which points is the resistance of the combination a maximum?

- A P and Q B Q and S C R and S D S and P

- 26 A beam of electrons enters a region in which there are magnetic and electric fields directed at right angles. It passes straight through without deviation.



A second beam of electrons, travelling twice as fast as the first, is then directed along the same line.

How is this second beam deviated?

- A downwards in the plane of the paper
 - B upwards in the plane of the paper
 - C out of the plane of the paper
 - D into the plane of the paper
- 27 A nucleus, ${}_{12}^{27}\text{Mg}$, decays by emitting a β -particle.

What are the proton number and the neutron number of the new nucleus that is formed by the decay?

	proton number	neutron number
A	10	13
B	10	17
C	12	15
D	13	14

28 The mass of a nucleus is X . The total mass of its constituent protons and neutrons is Y .

What is the binding energy of the nucleus?

- A** $X - Y$ **B** $Y - X$ **C** $(X - Y) c^2$ **D** $(Y - X) c^2$

29 The table shows three properties of different types of ionising radiation.

	X	Y	Z
charge	0	$-1e$	$+2e$
mass	0	$1/1840u$	$4u$
speed	c	$\sim 0.9c$	$\sim 0.1c$

What are the radiations X, Y and Z?

	X	Y	Z
A	alpha	beta	X-rays
B	beta	alpha	gamma
C	gamma	alpha	beta
D	X-rays	beta	alpha

30 A ${}_{92}^{238}\text{U}$ nucleus decays in two stages to a ${}_{91}^{234}\text{Pa}$ nucleus.

What is emitted in these two stages?

- A** $\alpha + \beta$ **B** $\alpha + \gamma$ **C** $\beta + \beta$ **D** $\beta + \gamma$

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