Cambridge Assessment International Education

Cambridge International AS & A Level

PHYSICS **9702/14**

Paper 1 Multiple Choice **May/June 2025**

1 hour 15 minutes

You must answer on the multiple choice answer sheet.

9127341068

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.

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.

This document has **20** pages. Any blank pages are indicated.

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Data

acceleration of free fall	$g = 9.81\,\text{m s}^{-2}$
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 unit	$1\,\text{u} = 1.66 \times 10^{-27}\,\text{kg}$
rest mass of proton	$m_\text{p} = 1.67 \times 10^{-27}\,\text{kg}$
rest mass of electron	$m_\text{e} = 9.11 \times 10^{-31}\,\text{kg}$
Avogadro constant	$N_\text{A} = 6.02 \times 10^{23}\,\text{mol}^{-1}$
molar gas constant	$R = 8.31\,\text{J K}^{-1}\,\text{mol}^{-1}$
Boltzmann constant	$k = 1.38 \times 10^{-23}\,\text{J K}^{-1}$
gravitational constant	$G = 6.67 \times 10^{-11}\,\text{N m}^2\,\text{kg}^{-2}$
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}\,\text{F m}^{-1}$ $\left(\frac{1}{4\pi\varepsilon_0} = 8.99 \times 10^{9}\,\text{m F}^{-1}\right)$
Planck constant	$h = 6.63 \times 10^{-34}\,\text{J s}$
Stefan–Boltzmann constant	$\sigma = 5.67 \times 10^{-8}\,\text{W m}^{-2}\,\text{K}^{-4}$

Formulae

uniformly accelerated motion	$s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
hydrostatic pressure	$\Delta p = \rho g \Delta h$
upthrust	$F = \rho g V$
Doppler effect for sound waves	$f_\text{o} = \frac{f_\text{s} v}{v \pm v_\text{s}}$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + \ldots$
resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

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1 The number of atoms in a mobile phone handset may be estimated by dividing the approximate volume of the handset by the approximate volume of an atom.

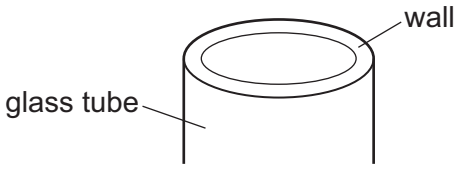
What is a reasonable estimate of the number of atoms in a mobile phone handset?

A 10^{17} **B** 10^{26} **C** 10^{32} **D** 10^{37}

2 Which unit is **not** equivalent to a unit of energy?

A N m **B** V C **C** W s **D** kg m s^{-2}

3 Calipers are used to determine the thickness of the wall of a glass tube.



The following measurements are made.

internal diameter of the tube = (10.0 ± 0.1) mm

external diameter of the tube = (12.0 ± 0.1) mm

What is the thickness of the wall of the tube?

A (1.0 ± 0.1) mm

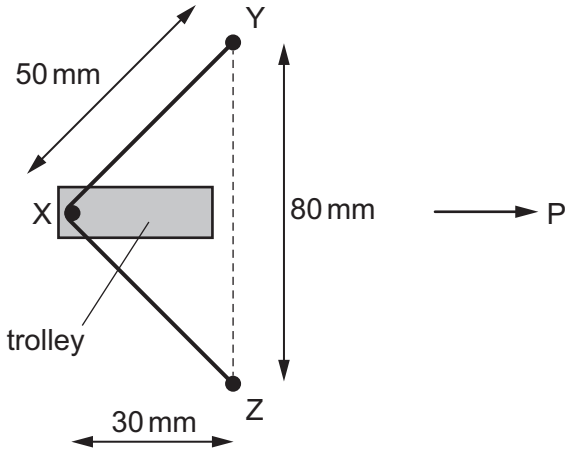
B (1.0 ± 0.2) mm

C (2.0 ± 0.1) mm

D (2.0 ± 0.2) mm

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4 The diagram shows two fixed pins, Y and Z. A length of elastic is stretched between Y and Z and around pin X, which is attached to a trolley.



X is at the centre of the elastic and the trolley is to be propelled in the direction P at right angles to YZ. The tension in the elastic is 4.0 N.

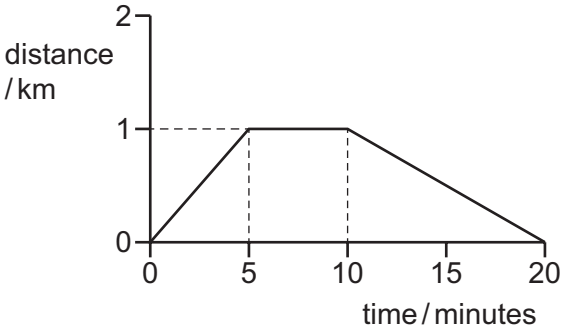
What is the force accelerating the trolley in the direction P when the trolley is released?

A 2.4 N **B** 3.2 N **C** 4.8 N **D** 6.4 N

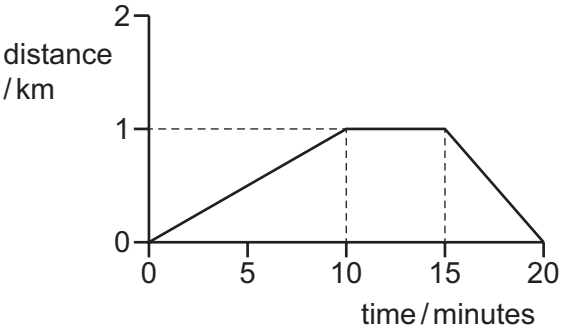
5 A student cycles uphill from home to a shop, taking 10 minutes. The student then spends 5 minutes in the shop before cycling home downhill at twice the initial speed.

Which graph could show the variation with time of the distance travelled by the student?

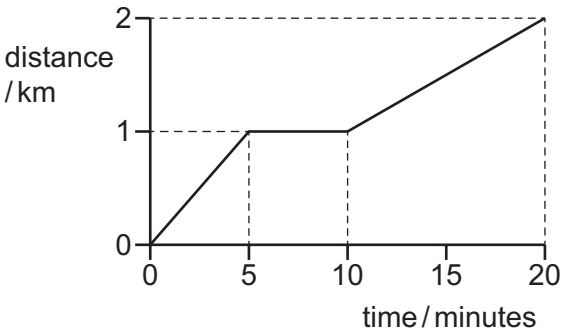
A



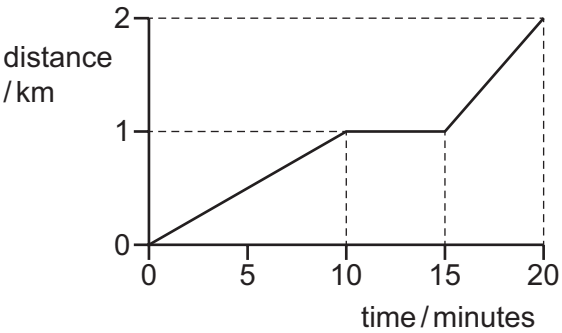
B



C



D



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6 A ball is released from rest from a window at a height of 12 m above the ground. Air resistance is negligible.

What is the time taken after release for the ball to reach the ground?

A 1.1 s **B** 1.2 s **C** 1.6 s **D** 2.4 s

7 Which word equation is **not** correct?

A force = change of momentum

B force = mass × acceleration

C force = $\frac{\text{moment}}{\text{perpendicular distance from the pivot}}$

D force = $\frac{\text{work done}}{\text{displacement in the direction of the force}}$

8 A skydiver is falling vertically with terminal velocity when their parachute opens fully.

Which statement describes the motion of the skydiver for the first few seconds after the parachute opens fully?

A falling with non-uniform acceleration and increasing speed

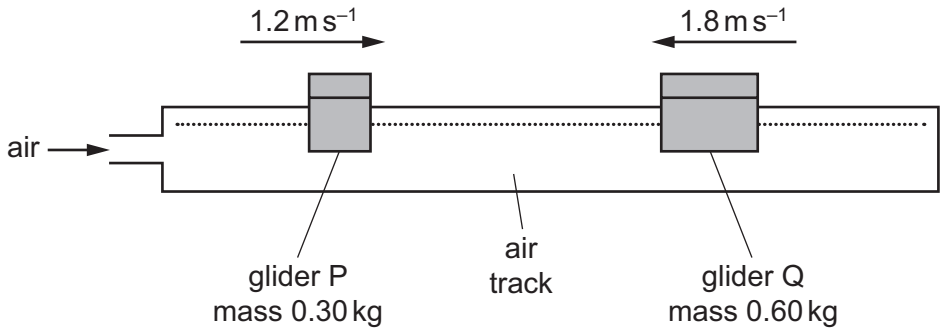
B falling with non-uniform acceleration and decreasing speed

C falling with uniform acceleration and increasing speed

D falling with uniform acceleration and decreasing speed

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9 Two gliders are travelling towards each other on a horizontal air track. Glider P has mass 0.30 kg and is moving with a constant speed of 1.2 m s^{-1}. Glider Q has mass 0.60 kg and is moving with a constant speed of 1.8 m s^{-1}.



The gliders have a perfectly elastic collision.

What are the speeds of the two gliders after the collision?

	speed of P / m s^{-1}	speed of Q / m s^{-1}
A	1.2	0.6
B	2.0	1.4
C	2.8	0.2
D	3.6	0.6

10 Which statement about a couple is correct?

A It acts to produce both translational motion and rotation.

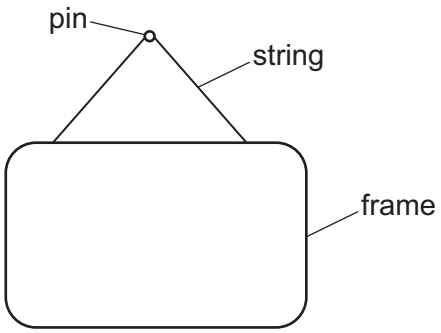
B It acts to produce rotation only.

C It acts to produce translational motion only.

D It acts to produce neither rotation nor translational motion.

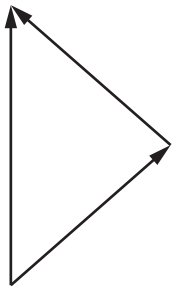
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11 A picture frame hangs from a string. The string is supported by a pin. The frame is in equilibrium.

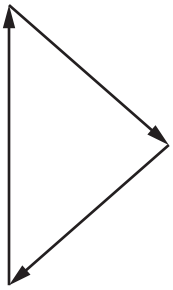


Which diagram shows the vector triangle of forces acting on the picture frame?

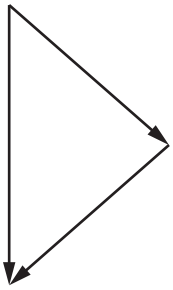
A



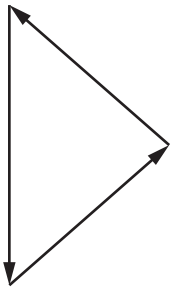
B



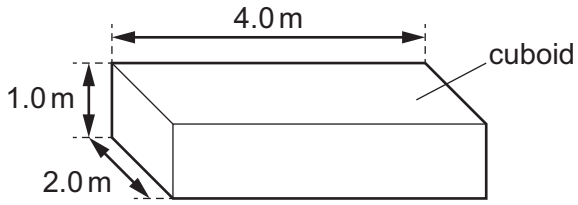
C



D



12 A solid metal cuboid of density 2700 kg m^{-3} has sides of lengths 1.0 m, 2.0 m and 4.0 m.

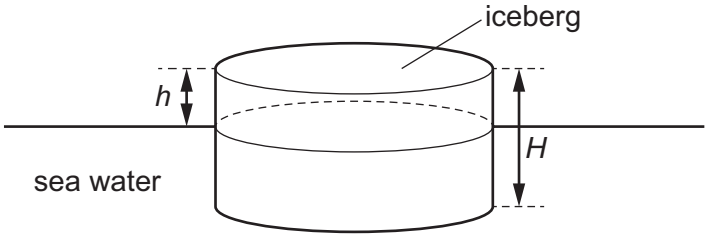


The cuboid can be placed on a horizontal surface so that it rests on any one of its six faces.

What is the largest pressure that the cuboid can exert on the surface due to its weight when it rests on one of its six faces?

A 11 kPa **B** 26 kPa **C** 53 kPa **D** 110 kPa

13 A cylindrical iceberg of height H floats in sea water. The top of the iceberg is at height h above the surface of the water.



The density of ice is ρ_i and the density of sea water is ρ_w.

What is the height h of the iceberg above the sea water?

A $\left(1-\frac{\rho_i}{\rho_w}\right)H$ **B** $\left(\frac{\rho_i}{\rho_w}-1\right)H$ **C** $\frac{\rho_w}{\rho_i}H$ **D** $\frac{\rho_i}{\rho_w}H$

14 In which situation is work done on an object?

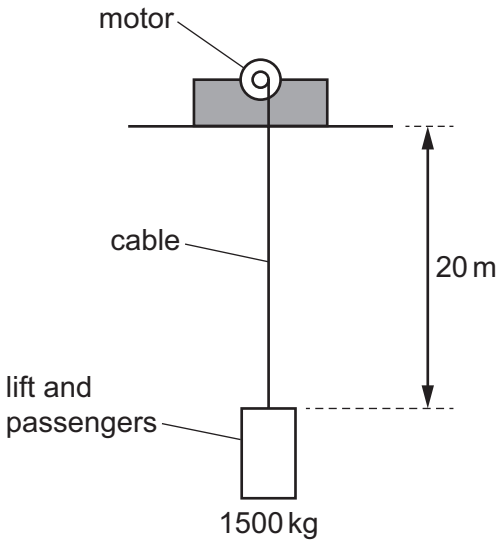
A The object slides with a constant velocity along a horizontal frictionless surface in a vacuum.

B A person holds the object at arm's length and at a fixed height above the ground.

C A person pushes the object up a frictionless ramp.

D The stationary object floats partially submerged in water.

15 An electric motor operating a lift has an output power of 20 kW.



The lift and passengers have a combined mass of 1500 kg. The motor raises the lift at constant speed through a distance of 20 m.

How long does it take?

A 6 s **B** 15 s **C** 30 s **D** 60 s

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16 In which situation is the least amount of energy transferred?

A A student and a motorcycle of total mass 80 kg come to rest from a speed of 2.0 m s^{-1}.

B A student of mass 50 kg falls a vertical distance of 2.0 m.

C A student pushes a car with a horizontal force of 70 N for a horizontal distance of 2.0 m.

D A student switches on a 70 W lamp for 20 s.

17 What is the definition of strain?

A extension per unit cross-sectional area

B extension per unit original length

C force per unit cross-sectional area

D force per unit extension

18 A spring of unstretched length 0.10 m is suspended vertically from a support.

A weight of 2.0 N is attached to the bottom of the spring and its length increases to 0.15 m.

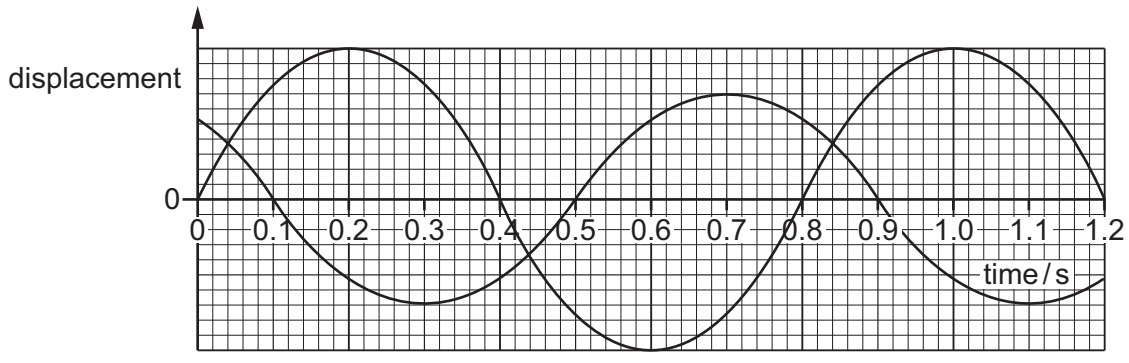
An additional weight of 4.0 N is then added to the bottom of the spring.

The spring obeys Hooke's law.

How much extra elastic potential energy is stored in the spring due to the addition of the 4.0 N weight?

A 0.067 J **B** 0.13 J **C** 0.20 J **D** 0.40 J

19 Two progressive waves meet at a fixed point P. The variation with time of the displacement of each wave at point P is shown in the graph.

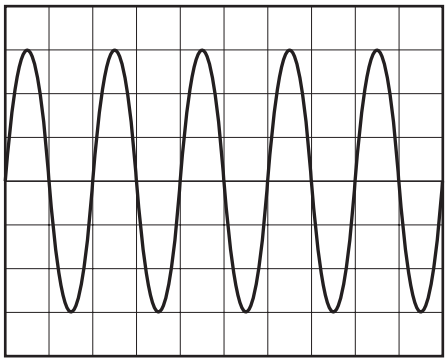


What is the phase difference between the two waves at point P?

A 45° **B** 90° **C** 135° **D** 180°

20 A microphone is connected to a cathode-ray oscilloscope (CRO). The diagram shows the waveform on the display of the CRO when the microphone detects a sound.

The *y*-gain is set to 1 V div^{-1}. The time-base is set to 2.0 ms div^{-1}.



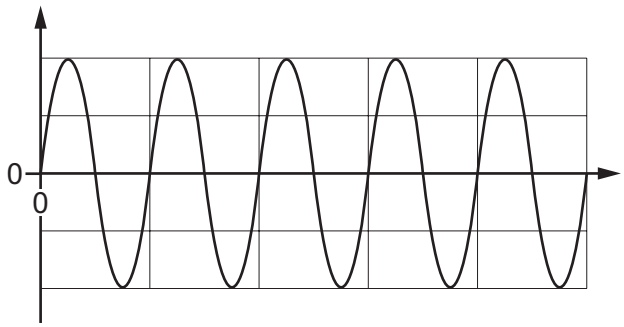
Which row gives the amplitude and frequency of the waveform?

	amplitude / V	frequency / Hz
A	3	125
B	3	250
C	6	125
D	6	250

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21 A progressive longitudinal wave is travelling horizontally from left to right.

A graphical representation of the wave at one instant in time is shown.



Which row could give the correct labels for the *x*-axis and *y*-axis of this graph?

	x-axis	*y*-axis
A	distance	displacement of particles to the right
B	distance	displacement of particles upwards
C	time	displacement of particles to the right
D	time	displacement of particles upwards

22 A vehicle is moving with a speed of $30.0\,m\,s^{-1}$ directly towards a stationary observer. The horn of the vehicle emits sound of frequency 440 Hz. The speed of sound in air is $340\,m\,s^{-1}$.

What is the frequency of the sound heard by the observer?

A 401 Hz **B** 404 Hz **C** 479 Hz **D** 483 Hz

23 Which row could describe electromagnetic waves?

	type of wave	speed in free space
A	longitudinal	faster for shorter wavelengths
B	longitudinal	the same for all wavelengths
C	transverse	faster for shorter wavelengths
D	transverse	the same for all wavelengths

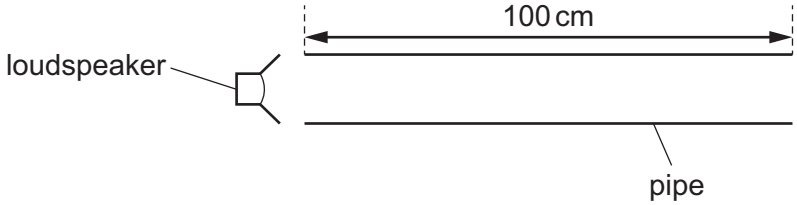
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24 A horizontal beam of light is incident normally on a polarising filter. The incident light is vertically polarised and has an intensity of $24\,W\,m^{-2}$. The direction of the transmission axis of the filter is at an angle of 30° to the vertical.

What is the intensity of the light in the transmitted beam?

A $18\,W\,m^{-2}$ **B** $21\,W\,m^{-2}$ **C** $28\,W\,m^{-2}$ **D** $32\,W\,m^{-2}$

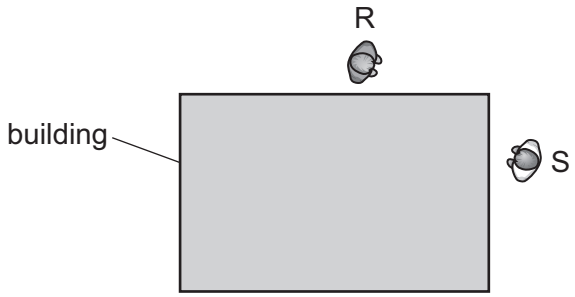
25 A pipe of length 100 cm is open at both ends. A loudspeaker situated at one end of the pipe can emit sound of different wavelengths.



Which wavelength can produce a stationary wave in the pipe?

A 50 cm **B** 75 cm **C** 150 cm **D** 300 cm

26 A student makes a sound at point R near a building. A second student, standing at point S around the corner of the building, hears the sound. The building is a solid structure and there are no other structures nearby.



Which effect best explains how the student at point S is able to hear the student at point R?

A diffraction

B interference

C polarisation

D reflection

27 Red light of a single wavelength from a laser is incident on a double slit.

A pattern of interference fringes is observed on a flat screen that is placed parallel to the double slit.

Which change increases the separation of the interference fringes on the screen?

A Decrease the distance from the double slit to the screen.

B Decrease the separation of the slits.

C Replace the red light with blue light.

D Replace the red light with green light.

28 An electromagnetic wave is incident normally on a diffraction grating.

A second-order maximum is produced at an angle of 30° to the direction of the incident light.

The grating has 5000 lines per cm.

What is the wavelength of the wave?

A $2.5 \times 10^{-7}\,\text{m}$ **B** $5.0 \times 10^{-7}\,\text{m}$ **C** $1.0 \times 10^{-6}\,\text{m}$ **D** $5.0 \times 10^{-5}\,\text{m}$

29 The resistance of a lamp is $10\,\Omega$ and the potential difference across it is 6.0 V.

How many electrons pass through the lamp in a time of 24 hours?

A 5.2×10^{4} **B** 9.0×10^{19} **C** 5.4×10^{21} **D** 3.2×10^{23}

30 What is equivalent to one volt?

A one coulomb per second

B one joule per coulomb

C one joule per second

D one joule second per coulomb squared

31 The resistance of some electrical components may change with changing conditions.

Which component's resistance increases?

A a filament lamp as the potential difference (p.d.) across it increases

B a light-dependent resistor (LDR) as the intensity of the light incident on it increases

C a metallic conductor at constant temperature as the current through it increases

D a thermistor as its temperature increases

32 Gold is sometimes used to make very small connecting wires in electronic circuits.

A particular gold wire has length 2.50×10^{-3} m and cross-sectional area 6.25×10^{-8} m^2. Gold has resistivity $2.3 \times 10^{-8}\,\Omega$m.

What is the resistance of the wire?

A $3.6 \times 10^{-18}\,\Omega$

B $5.8 \times 10^{-13}\,\Omega$

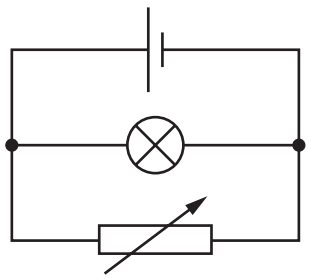
C $9.2 \times 10^{-4}\,\Omega$

D $6.8 \times 10^{-3}\,\Omega$

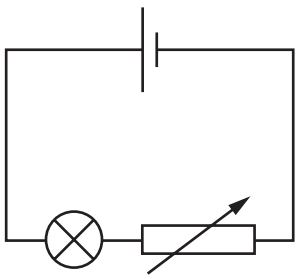
33 A cell of constant electromotive force (e.m.f.) and negligible internal resistance is separately connected into four different circuits.

In which circuit does the power dissipated by the lamp stay the same as the variable resistor is adjusted?

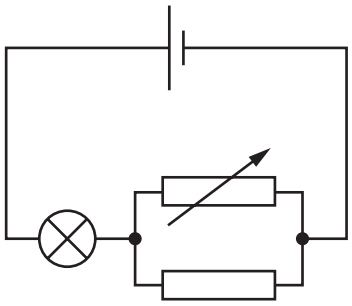
A



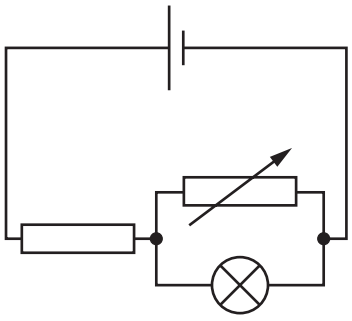
B



C



D



34 The sum of the electrical currents into a point in a circuit is equal to the sum of the currents out of the point.

Which statement is correct?

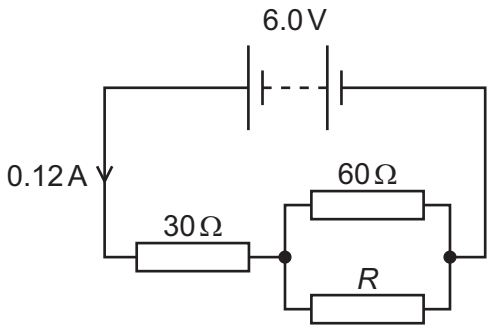
A This is Kirchhoff's first law, which results from the conservation of charge.

B This is Kirchhoff's first law, which results from the conservation of energy.

C This is Kirchhoff's second law, which results from the conservation of charge.

D This is Kirchhoff's second law, which results from the conservation of energy.

35 A battery of electromotive force (e.m.f.) 6.0 V and negligible internal resistance is connected to three resistors, as shown.



The current in the battery is 0.12 A.

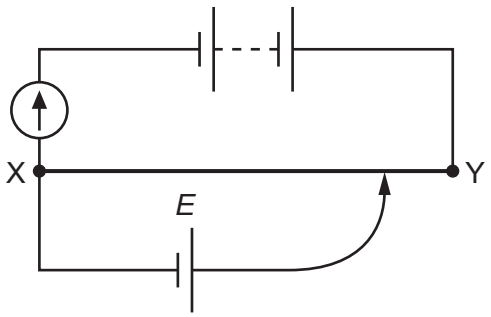
What is resistance *R*?

A 12 Ω **B** 30 Ω **C** 50 Ω **D** 60 Ω

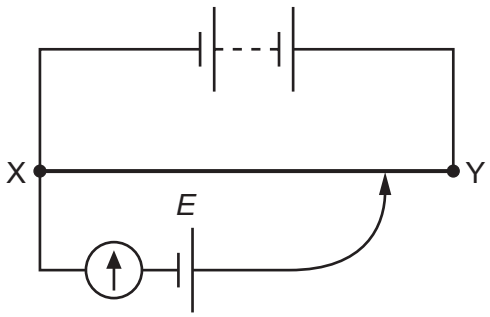
36 A potentiometer circuit may be used to determine the unknown electromotive force (e.m.f.) *E* of a cell. The circuit diagrams shown include a battery of known e.m.f. and negligible internal resistance, a uniform resistance wire XY and a galvanometer.

Which circuit diagram shows a suitable arrangement for determining *E*?

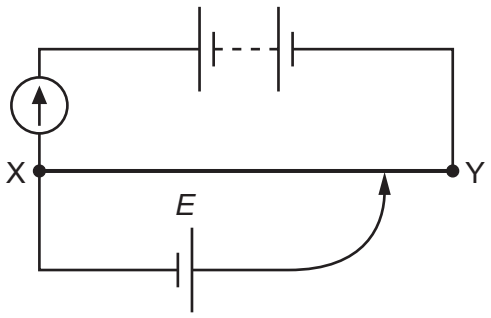
A



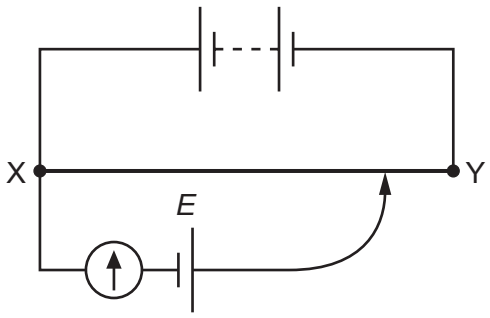
B



C



D



37 A uranium atom with a charge of +2*e* has a nucleon number of 235 and a proton number of 92.

e is the elementary charge.

What is the total number of protons, neutrons and electrons in this charged atom?

A 235 **B** 325 **C** 327 **D** 329

38 A nucleus W of a radioactive isotope emits a β^- particle and forms nucleus X.

Nucleus X emits an α-particle to form nucleus Y.

Nucleus Y emits a β^- particle to form nucleus Z.

Which statement about Z is correct?

A Z is a nucleus of a different element from W and has a higher nucleon number.

B Z is a nucleus of a different element from W and has a lower nucleon number.

C Z is a nucleus of the same element as W and has a higher nucleon number.

D Z is a nucleus of the same element as W and has a lower nucleon number.

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39 Which particle is **not** a lepton?

A electron

B neutrino

C neutron

D positron

40 How many flavours (types) of antiquark are there?

A 3 **B** 4 **C** 5 **D** 6

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