YISHUN INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CANDIDATE NAME			
CG		INDEX NO	

PHYSICS 8867/01

Paper 1 Multiple Choice **18 September 2020**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.
Write your name and class on the Answer Sheet in the spaces provided unless this has been done for you.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages.

Data

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

Formulae

uniformly accelerated motion,	s	=	$ut + \frac{1}{2}at^2$
	v^2	=	$u^2 + 2as$
resistors in series,	R	=	$R_1 + R_2 + \ldots\ldots$
resistors in parallel,	$\frac{1}{R}$	=	$\frac{1}{R_1} + \frac{1}{R_2}$

Answer **all** questions.

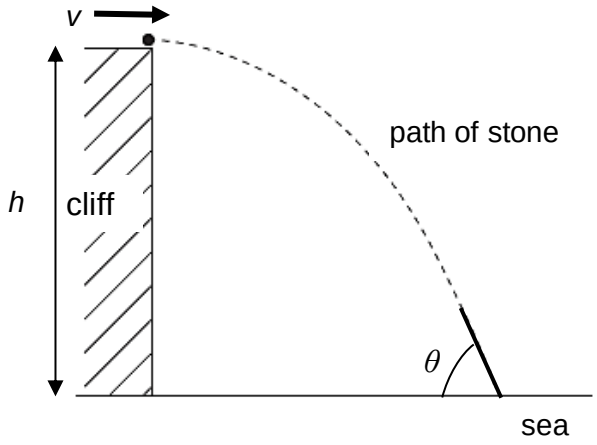
1 Which of the following quantities has a unit that can be expressed in terms of just two different SI base units?

A charge **B** force **C** resistance **D** power

2 Forces of 4 N and 6 N act at a point. Which one of the following could not be the magnitude of their resultant?

A 1 N **B** 4 N **C** 6 N **D** 8 N

3 The diagram shows the path of a projectile fired with a horizontal velocity v from the top of a cliff of height h.



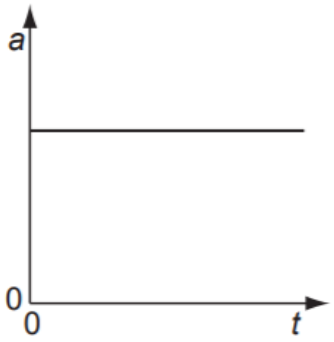
Which of the following values for v and h will give the greatest value of angle θ?

	v / m s^{-1}	h / m
A	10	30
B	30	30
C	10	50
D	30	50

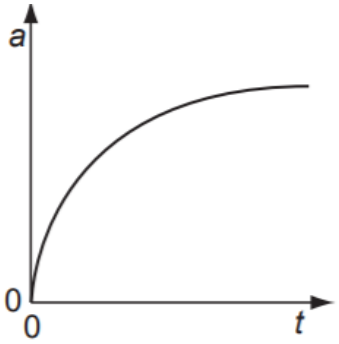
4 A volleyball is released from rest at the top of a tall building.

Which graph best represents the variation with time t of the acceleration a of the ball as it falls, assuming that the effect of air resistance is significant?

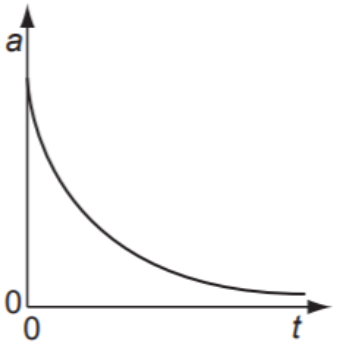
A



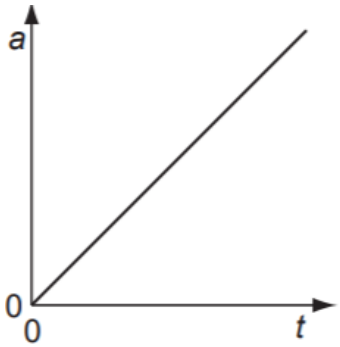
B



C

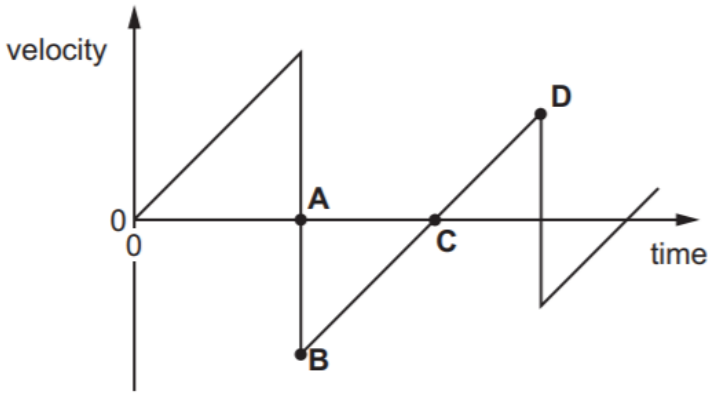


D

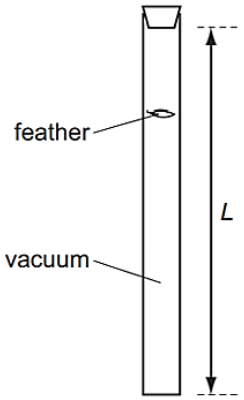


5 A ball is released from rest above the ground. The graph shows how the velocity of the bouncing ball varies with time.

At which point on the graph does the ball reach the ground for the second time?



6 The diagram shows a laboratory experiment in which a feather falls from rest in a long evacuated vertical tube of length *L*.



The feather takes time 10 s to fall from the top to the bottom of the tube.

How far would the feather have fallen from the top of the tube in time 5.0 s?

A 0.13 *L* **B** 0.25 *L* **C** 0.50 *L* **D** 0.80 *L*

7 There is no net external force acting on an isolated system during an inelastic collision.

For this system, which is row is correct about the conservation of kinetic energy and the conservation of linear momentum?

	kinetic energy	linear momentum
A	conserved	not conserved
B	conserved	conserved
C	not conserved	conserved
D	not conserved	not conserved

8 In a football match, a player kicks a stationary football of mass 440 g and gives it a speed of 32 m s^{-1}. The contact time between the football and the footballer's boot was 9.2 ms.

What is the average force of impact on the football?

A 1.5 N **B** 15 N **C** 1.5 kN **D** 1.5 MN

9 When a man is standing in an ascending lift, the magnitude of the force exerted on the man's feet by the floor is always

A equal to the magnitude of his weight.

B less than the magnitude of his weight.

C more than the magnitude of the force exerted on the lift floor by his feet.

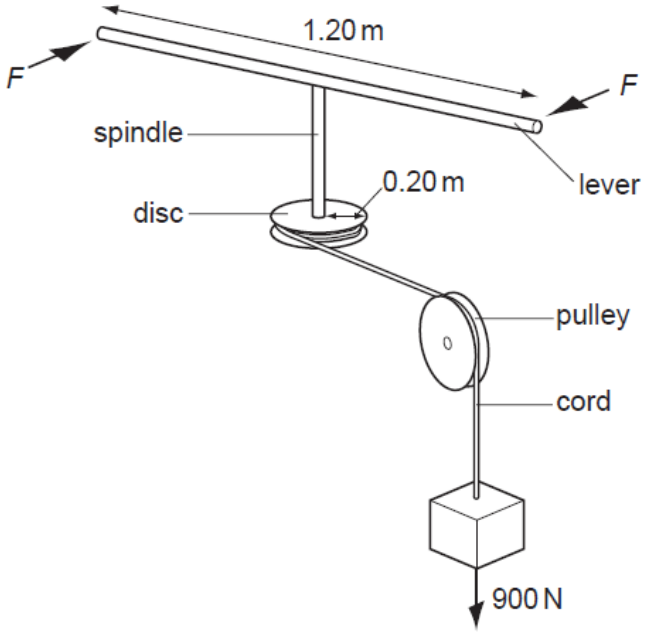
D equal to the magnitude of the force exerted on the lift floor by his feet.

10 Two cargo trucks of mass $2m$ and $3m$ move towards each other in opposite directions with speeds $4v$ and $2v$ respectively. These trucks collide and stick together.

What is the speed of the trucks after the collision?

A $\frac{5}{4}v$ **B** $\frac{2}{5}v$ **C** v **D** zero

11 One end of a spindle is attached to the centre of a lever of length 1.20 m and its other end is attached to the centre of a disc of radius 0.20 m as shown in the figure below.



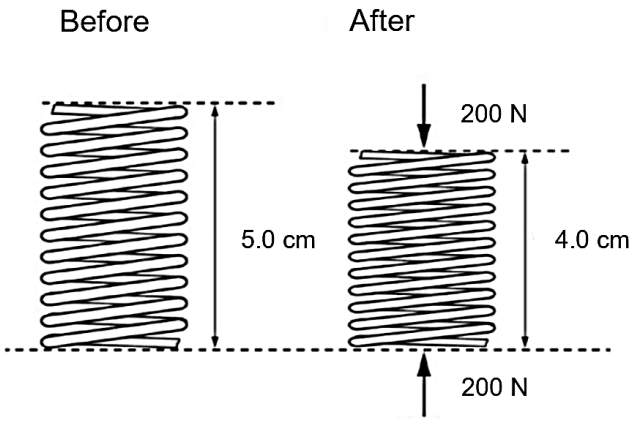
A cord is wrapped around the disc, passes over a pulley and is attached to a 900 N weight at one end.

The mass of the lever, spindle, disc, cord and pulley is assumed to be negligible. Equal and opposite forces of magnitude F is applied to each end of the lever.

Ignoring frictional forces, what is the minimum value of F needed to balance the 900 N weight?

A 75 N **B** 150 N **C** 300 N **D** 950 N

12 A compression spring is being tested in an engineering laboratory. The diagram shows the spring before and after forces are applied to its opposite ends.



The initial length of the spring is 5.0 cm and during the application of the forces its length is 4.0 cm.

What is the force constant of this spring?

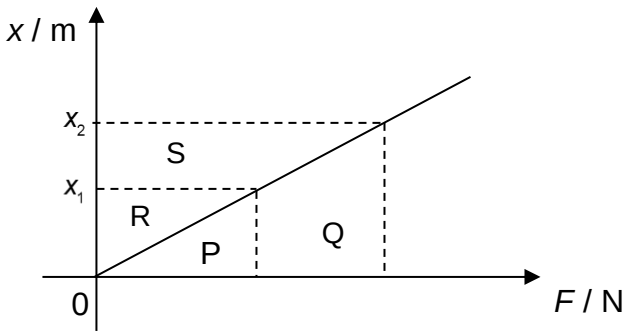
A 4.0×10^3 N m^{-1}

B 5.0×10^3 N m^{-1}

C 2.0×10^4 N m^{-1}

D 4.0×10^4 N m^{-1}

13 The variation with force F of the extension x of a spring is shown in the figure below.



The work done in stretching the spring from x_1 to x_2 is given by the area

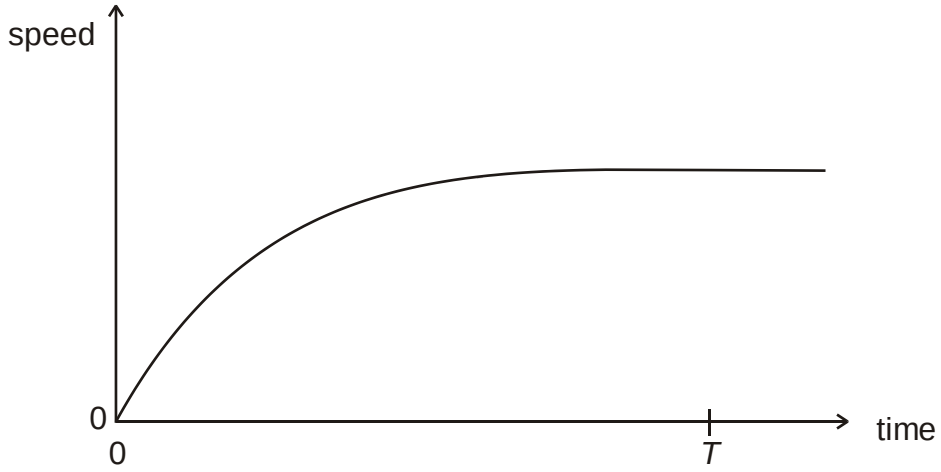
A P + Q

B S

C R + S

D Q

14 The variation with time of the vertical speed of a ball falling in air is shown below.



During the time from 0 to T, the ball gains kinetic energy and loses gravitational potential energy ΔE_p. Which of the following statements is true?

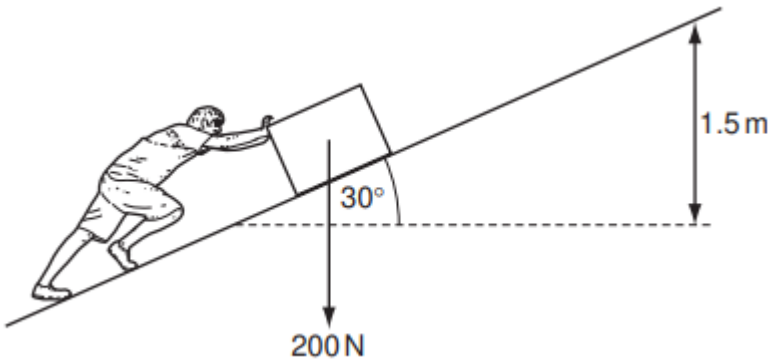
A ΔE_p is equal to the gain in kinetic energy.

B ΔE_p is greater than the gain in kinetic energy.

C ΔE_p is equal to the work done against air resistance.

D ΔE_p is less than the work done against air resistance.

15 A box of weight 200 N is pushed so that it moves at a steady speed along a ramp, through a height of 1.5 m. The ramp makes an angle 30° with the ground. The frictional force on the box is 150 N while the box is moving.



What is the work done by the person?

A 150 J **B** 300 J **C** 450 J **D** 750 J

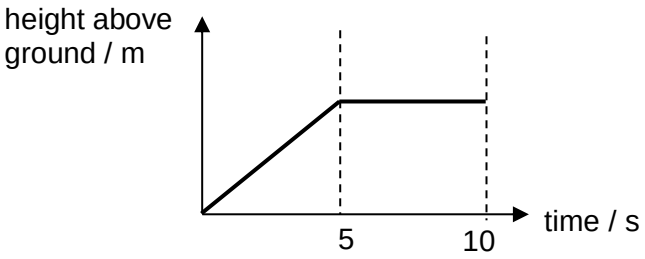
16 A car of mass 1.2×10^3 kg travels along a horizontal road at a speed of 10 m s^{-1}. It then accelerates at 0.20 m s^{-2}.

At the instant it begins to accelerate, the total resistive force acting on the car is 160 N.

What total output power is developed by the car as it begins the acceleration?

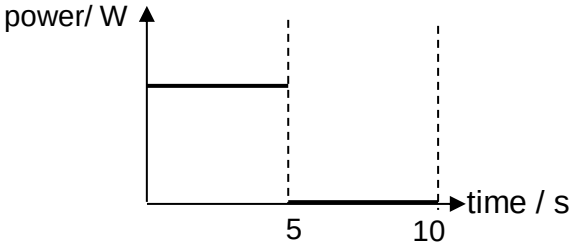
A 0.80 kW **B** 1.6 kW **C** 2.4 kW **D** 4.0 kW

17 A crane lifts a load at constant speed vertically for the first five seconds. It then holds it at a fixed height for another five seconds. The variation of the height of the load above the ground is shown in the graph below.

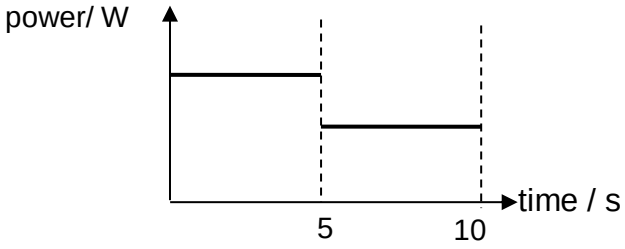


Which of the following shows the power supplied to lift the load in this process?

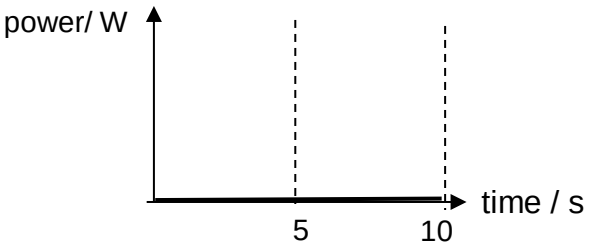
A



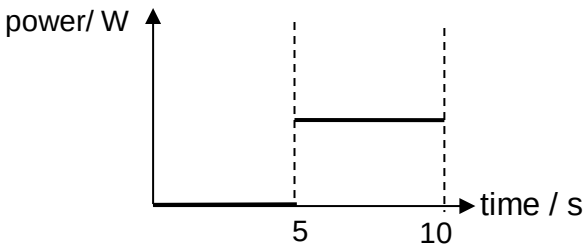
B



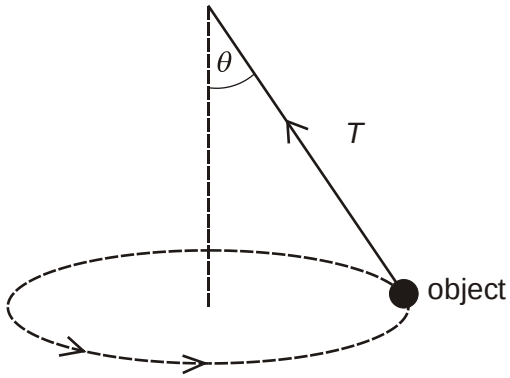
C



D



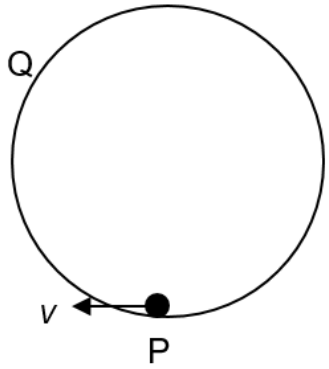
18 An object on the end of a light flexible string rotates in a circle as shown below.



The tension in the string is T when the string is at angle θ to the vertical. Which of the following is true?

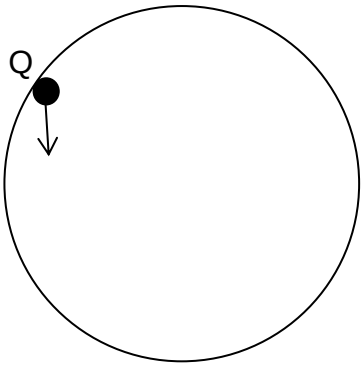
	state	resultant force
A	not in equilibrium	T
B	not in equilibrium	$T \sin \theta$
C	in equilibrium	T
D	in equilibrium	$T \sin \theta$

19 A small ball bearing is projected with a velocity v from the lowest position P of a vertical circular track which is not smooth. The ball bearing starts to leave the track at Q.

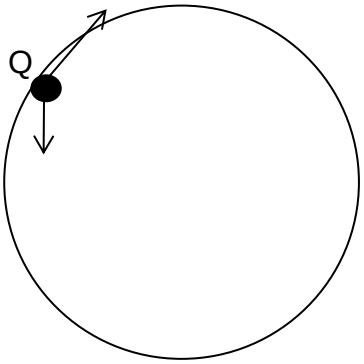


Which of the following represents all the forces acting on the ball-bearing at Q?

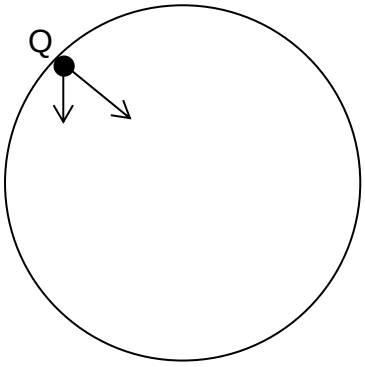
A



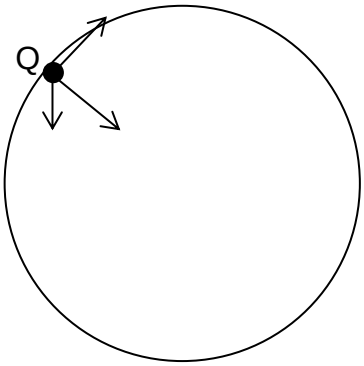
B



C



D

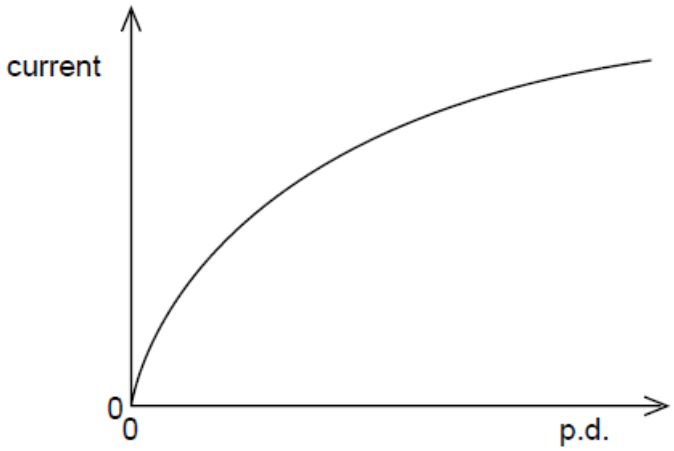


20 Two satellites, X and Y, move in circular orbits about the Earth. The orbital period of satellite X is eight times that of satellite Y.

The ratio $\frac{\text{orbital radius of satellite X}}{\text{orbital radius of satellite Y}}$ is

A 2 **B** 4 **C** 8 **D** 16

21 The graph shows how the current through a filament wire varies with the potential difference (p.d.) across it.



Which statement explains the shape of the graph?

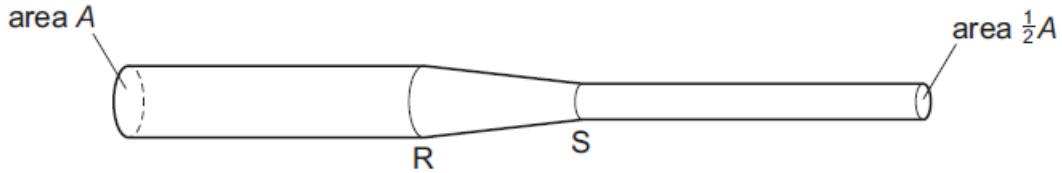
A As the filament temperature rises, electrons can pass more easily through the filament.

B It takes time for the filament to reach its working temperature.

C The power output of the filament is proportional to the square of the current through it.

D The resistance of the filament increases with a rise in temperature.

22 A length of wire is connected into a circuit.



The area of the cross-section of the wire changes from A at R to $\frac{1}{2}A$ at S.

Charge Q passes R in time t.

What is the charge passing point S in the same time t?

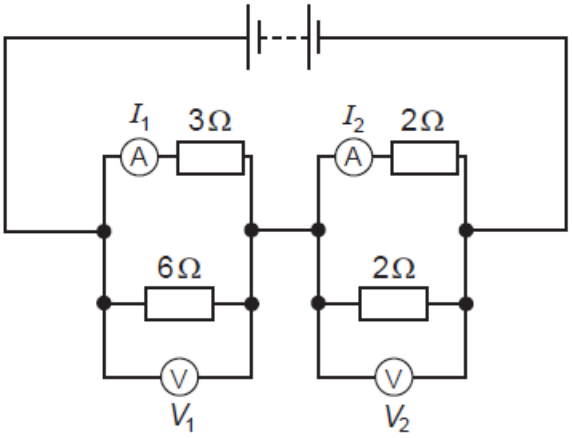
A $\frac{1}{2}Q$ **B** Q **C** $\sqrt{2}Q$ **D** $2Q$

23 Four wires are made of the same metal. The cross-sectional areas, length and thermodynamic temperatures of the wire are shown.

Which wire has the largest resistance?

	cross-sectional area	length	temperature
A	*A*	2*L*	2*T*
B	*A*	*L*	*T*
C	2*A*	2*L*	2*T*
D	2*A*	*L*	*T*

24 In the circuit shown, the ammeters have negligible resistance and the voltmeters have infinite resistance.



The readings on the meters are I_1, I_2, V_1 and V_2 as labelled on the diagram.

Which is correct?

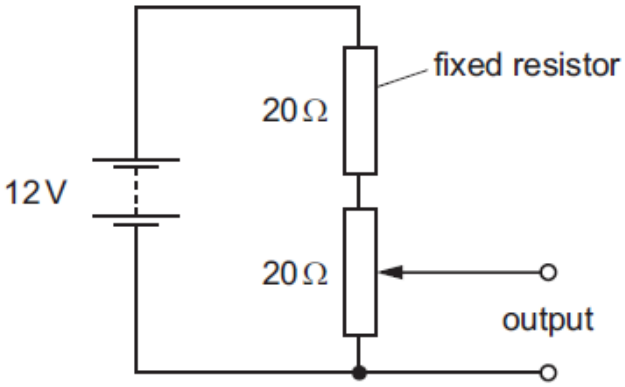
A $I_1 > I_2$ and $V_1 > V_2$

B $I_1 < I_2$ and $V_1 < V_2$

C $I_1 < I_2$ and $V_1 > V_2$

D $I_1 > I_2$ and $V_1 < V_2$

25 The diagram shows a potentiometer and a fixed resistor connected across a 12 V battery of negligible internal resistance.

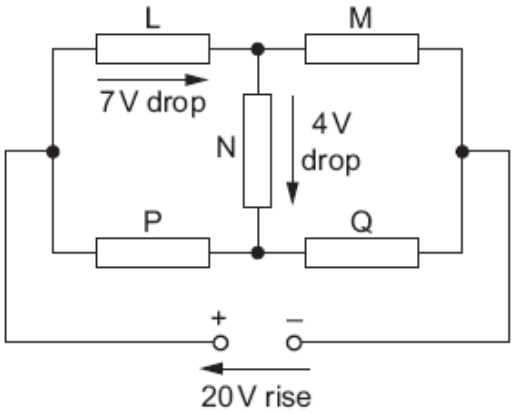


The fixed resistor and the potentiometer each have resistance 20 Ω. The circuit is designed to provide a variable output voltage.

What is the range of output voltages?

A 0 – 6 V **B** 0 – 12 V **C** 6 – 12 V **D** 12 – 20 V

26 A 20 V d.c. supply is connected to a circuit consisting of five resistors L, M, N, P and Q.

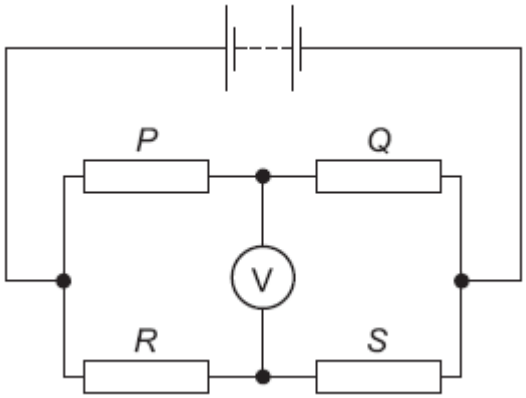


There is a potential drop of 7 V across L and a further 4 V potential drop across N.

What are the potential drops across M, P and Q?

	potential drop across M / V	potential drop across P / V	potential drop across Q / V
A	9	7	13
B	13	7	13
C	13	11	9
D	17	3	17

27 The circuit diagram shows four resistors of different resistances *P, Q, R* and *S* connected to a battery.



The voltmeter reading is zero.

Which equation is correct?

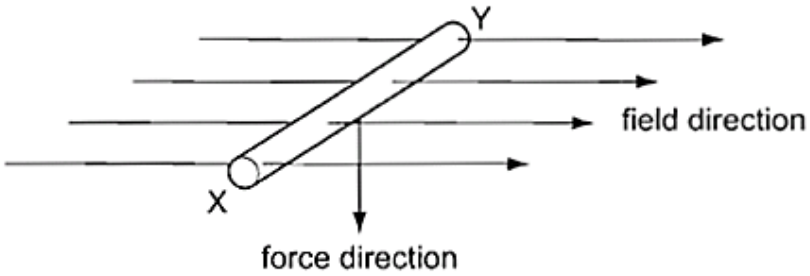
A $P - Q = R - S$

B $P - S = Q - R$

C $PQ = RS$

D $PS = RQ$

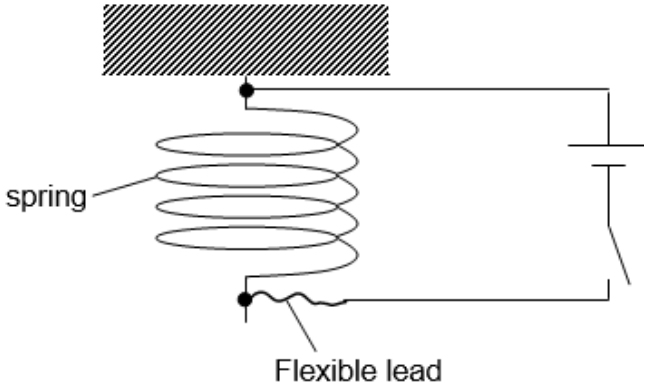
28 A current–carrying conductor is placed at right–angle to a uniform magnetic field of flux density 0.50 T. A 10 cm length of the conductor lies within the field and experiences a force of 2.4×10^{-2} N.



What is the magnitude and direction of the current in the conductor?

	magnitude / A	direction
A	0.0048	X to Y
B	0.0048	Y to X
C	0.48	X to Y
D	0.48	Y to X

29 A loosely–coiled light spring is suspended from a fixed point as shown below.



Electrical connections are made to the ends of the spring.

What happens when the switch is closed?

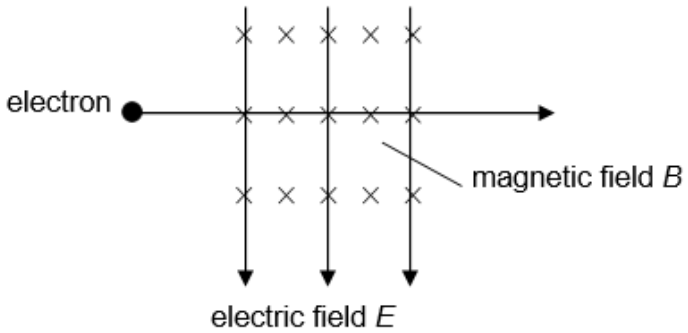
A The spring is compressed.

B The spring is stretched longer.

C The spring oscillates vertically.

D The spring remains unchanged.

30 A beam of electrons enters a region in which there are magnetic and electric fields directed at right angles to each other. It passes straight through without deflection.



A second beam of electrons travelling at half the speed of the first beam of electrons is then directed along the same line.

How is this second beam deviated?

A The second beam is deviated downwards in the plane of the paper.

B The second beam is deviated upwards in the plane of the paper.

C The second beam is deviated into the plane of the paper.

D The second beam is deviated out of the plane of the paper.