EUNOIA JUNIOR COLLEGE
JC2 June Common Test 2020
General Certificate of Education Advanced Level
Higher 1

PHYSICS

Paper 1 Multiple Choice

8867/01

June/July 2020

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use paper clips, glue or correction fluid.
Write your name, civics group and registration number on the Answer Sheet in the spaces provided.

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 **14** printed pages and **0** blank page.

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	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$

1 An athlete of mass 80 kg completes in a 100 m race.

What is the best estimate of his mean kinetic energy during the race?

A 4×10^2 J **B** 4×10^3 J **C** 4×10^4 J **D** 4×10^5 J

2 In the following equation, P is pressure, h is height, x is density and g is acceleration:

$$\frac{1}{2}xy^2 + xhg + P = \text{ constant}$$

What is the base unit of y?

A $m\ s^{-1}$

B $m^2\ s^{-2}$

C $N\ kg^{-1}\ m$

D $N^{1/2}\ kg^{-1/2}\ m^{1/2}$

3 A student measured the diameter of a ping pong ball as 3.40 cm using a pair of vernier calipers. The uncertainty in the measurement is 0.01 cm.

How should the total volume of the ping pong ball be expressed?

A $(20.579 \pm 0.009)\ cm^3$

B $(20.58 \pm 0.03)\ cm^3$

C $(20.6 \pm 0.1)\ cm^3$

D $(20.6 \pm 0.2)\ cm^3$

4 A force F is exerted on a freely moving object. At one instant in time, the object has velocity v and acceleration a.

Which of the three quantities must be directed in the same direction?

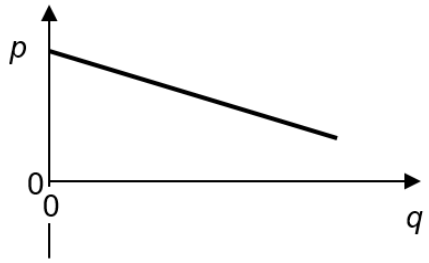
A a and v only

B a and F only

C v and F only

D a, v and F

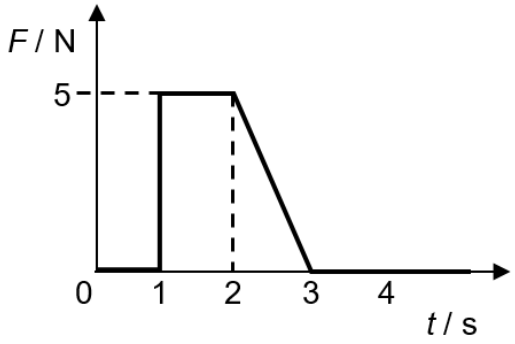
5 The graph shows how a certain quantity p varies with another quantity q for a parachutist falling at terminal speed.



What are the quantities p and q, and what is represented by the magnitude of the gradient of the graph?

	quantity p	quantity q	magnitude of gradient
A	height	time	terminal speed
B	momentum	time	weight of parachutist
C	height	potential energy	mass of parachutist
D	velocity	time	acceleration of free fall

6 The variation of force F on a body of mass 2.0 kg with time t is shown in the diagram below.
At time t = 2.0 s, the velocity of the object is 5.0 m s^{-1}.



What is the velocity of the body at time t = 4.0 s?

A 4.1 m s^{-1}

B 6.3 m s^{-1}

C 7.5 m s^{-1}

D 11 m s^{-1}

7 Two stones, X and Y, of different mass are dropped from the top of a cliff. Stone Y is dropped a short time after stone X. Air resistance is negligible.

Which of the following statement is true?

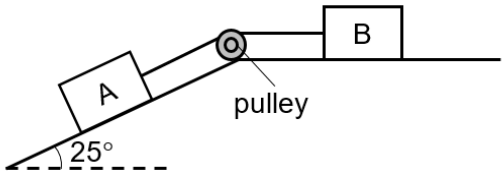
A The distance between them will decrease if the mass of Y is more than the mass of X.

B The distance between them will increase if the mass of X is more than the mass of Y.

C The distance between them will decrease regardless of the mass of X and Y.

D The distance between them will increase regardless of the mass of X and Y.

8 Two blocks A and B of masses 4.0 kg and 2.0 kg respectively are connected by an inextensible string across a smooth pulley as shown in the diagram. The frictional forces between the surface and the two blocks are negligible.



What is the acceleration of block B when block A is released?

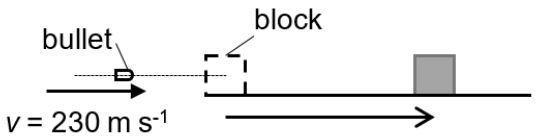
A 0.43 m s^{-2}

B 2.8 m s^{-2}

C 5.9 m s^{-2}

D 6.6 m s^{-2}

9 A bullet of mass 20 g is fired horizontally from a rifle at a stationary lead block of mass 500 g. The bullet hits the centre of the block with a velocity of 230 m s^{-1}. The lead block with the embedded bullet slides after impact with a constant frictional force of 30 N throughout the sliding.



How far did the block slide before it stops?

A 0.27 m

B 0.41 m

C 0.53 m

D 0.68 m

10 A man of mass *M* is standing on a weighing scale in an elevator. The elevator undergoes several different motions as described below.

Elevator's motion	Weighing scale reading
Moving downwards and coming to rest with uniform deceleration	N_1
Moving downwards and speeding up with constant acceleration	N_2
Moving downwards with constant speed	N_3

Which of the following is correct?

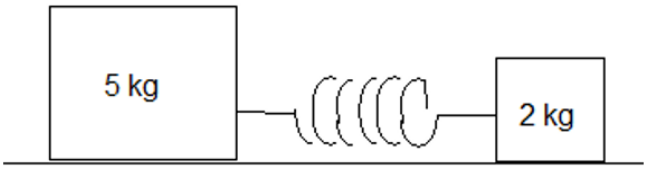
A $N_1 = N_2 = N_3$

B $N_1 < N_2 < N_3$.

C $N_1 < N_3 < N_2$

D $N_2 < N_3 < N_1$

11 A light spring is permanently connected between two blocks of wood on a frictionless surface. The mass of the blocks are 2.0 kg and 5.0 kg and they can move freely along a straight horizontal track. The spring is compressed and then the blocks are released simultaneously from rest.



What is the acceleration of the lighter block when the acceleration of the heavier block is 10 m s^{-2}?

A 5 m s^{-2}

B 10 m s^{-2}

C 20 m s^{-2}

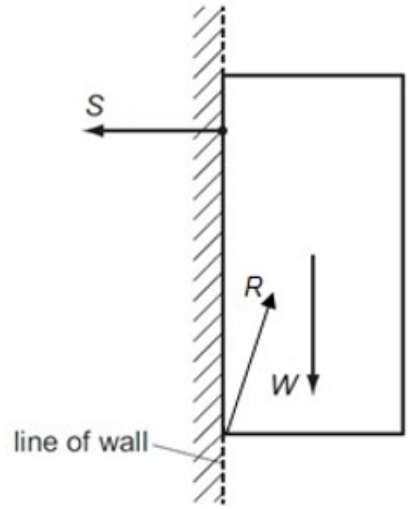
D 25 m s^{-2}

12 A cupboard is attached to a wall by a screw.

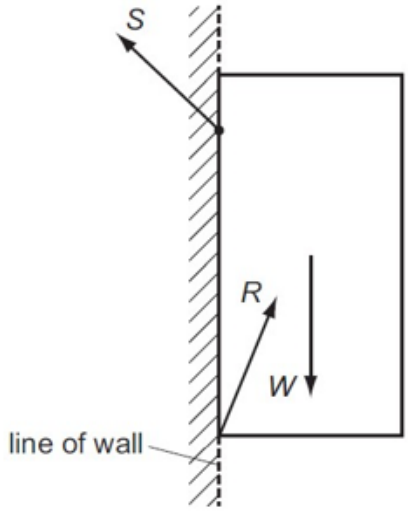
Which force diagram shows the cupboard in equilibrium, with the weight W of the cupboard, the force S that the screw exerts on the cupboard and the force R that the wall exerts on the cupboard?

The magnitude of the forces are not drawn to scale.

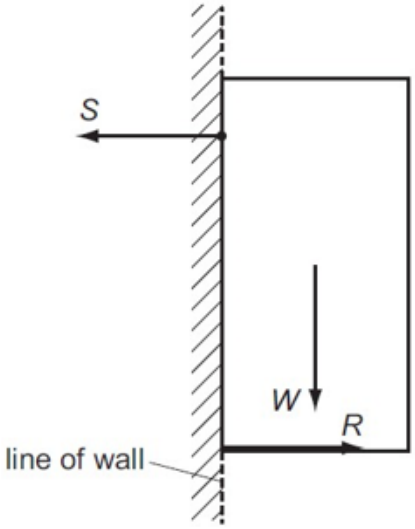
A



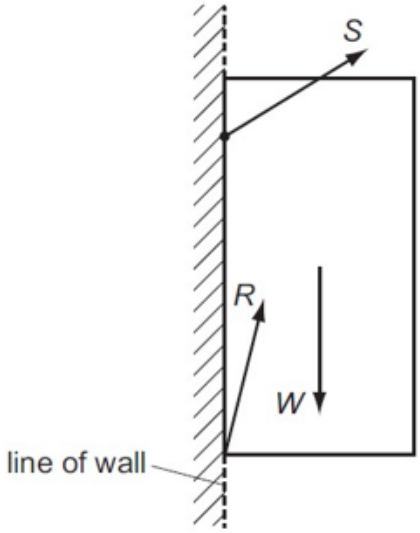
B



C



D



13 What is *not true* of two forces that give rise to a couple?

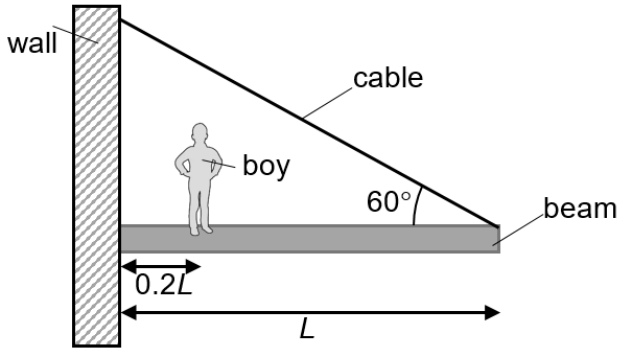
A They act in opposite directions.

B They both act at the same point.

C They both act on the same body.

D They both have the same magnitude.

14 A uniform horizontal beam of length *L* and weight 200 N is attached to the wall by means of a cable as shown in the figure below. A boy weighing 500 N, stands 0.2*L* away from the wall.



What is the tension in the cable?

A 200 N

B 231 N

C 500 N

D 808 N

15 A spring obeying Hooke's law possesses elastic potential energy of 15 J when stretched by 60 mm.

How much more elastic potential energy does it have when it is further stretched by another 30 mm?

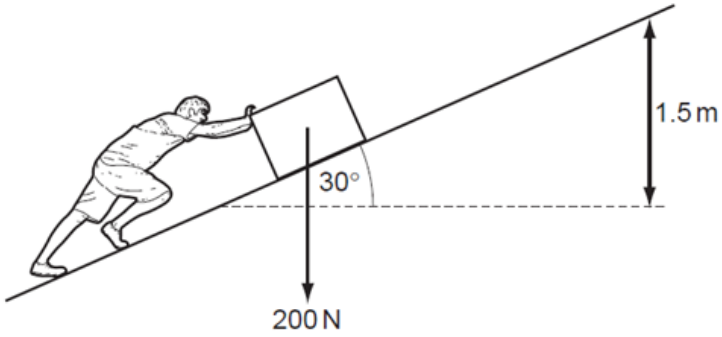
A 3.75 J

B 18.8 J

C 21.9 J

D 33.8 J

16 A person pushes a box of weight 200 N so that it moves at a steady speed along a ramp, through a height of 1.5 m. The ramp makes an angle of 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 170 J **B** 300 J **C** 450 J **D** 750 J

17 An armoured tank of mass of 26.5×10^3 kg is outfitted with an engine capable of 370 kW power output. It travels at a constant speed of 14.7 m s^{-1} on level ground. As it moves up a particular slope, its speed falls to a constant 10.0 m s^{-1}.
Assuming that the total resistive force acting on the tank is constant, what is the angle of the slope?

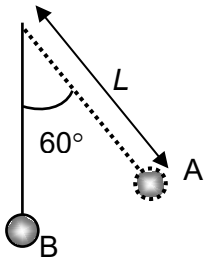
A 2.6°

B 5.6°

C 84.4°

D 87.4°

18 A pendulum bob of mass *m* is attached to a string of length *L*. With the string taut, it is released from rest at A.



What is the tension in the string when the pendulum reaches position B?

A 0.87 *mg*

B *mg*

C 1.27 *mg*

D 2 *mg*

19 A satellite of mass *m* is in circular orbit with radius *r* around the Earth with a period of *T*. The satellite is moved to a new orbit with radius 4*r* around the Earth.

What is the new period in terms of *T*?

A ¼*T*

B 2*T*

C 4*T*

D 8*T*

20 A mass m_1 is attached to one end of an elastic spring of an unstretched length L. When the mass is rotating with a linear speed v on a smooth table in a horizontal circle, an extension e is obtained.

Which of the following shows the correct expression for mass m_2, if it is rotated with the same linear speed v but rotates at twice the radius as that produced by m_1?

A $m_2 = \dfrac{2m_1(L+2e)}{e}$

B $m_2 = \dfrac{2m_1(L+e)}{e}$

C $m_2 = \dfrac{2m_1(2L+e)}{e}$

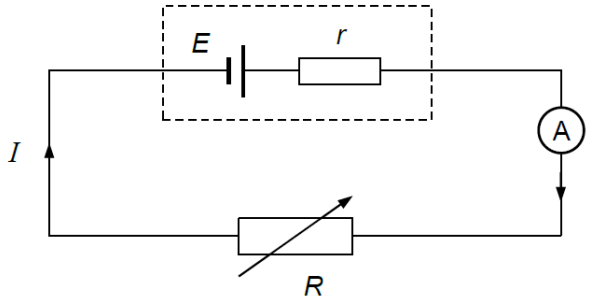
D $m_2 = \dfrac{2m_1(2L+2e)}{e}$

21 The gravitational force on an object at the top of Mount Fuji, with an elevation of 3776 m, is 40 N.

What should be the approximate gravitational force on the same object if it were taken to another mountain with twice the elevation?

A 10 N **B** 20 N **C** 30 N **D** 40 N

22 A battery of e.m.f E and internal resistance r delivers a current I through a variable resistance R.



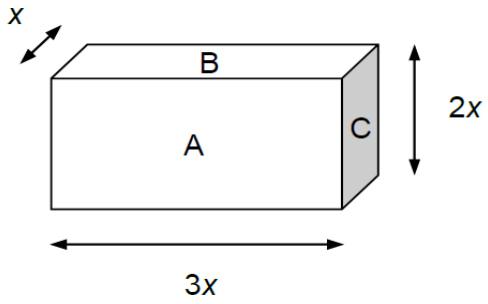
The resistance R is varied and the corresponding currents flowing through an ideal ammeter are recorded.

R / Ω	I / A
1.0	3.0
2.0	2.0

What are the internal resistance r and e.m.f E of the battery?

	E / V	r / Ω
A	3.0	1.0
B	3.0	2.0
C	6.0	1.0
D	6.0	2.0

23 A rectangular block has dimensions x, $2x$ and $3x$ as shown in the figure below.



Electrical contact can be made to the opposite sides of the block. Between which two sides of the block should the electrical contact be made, so that the resistance of the block is a maximum?

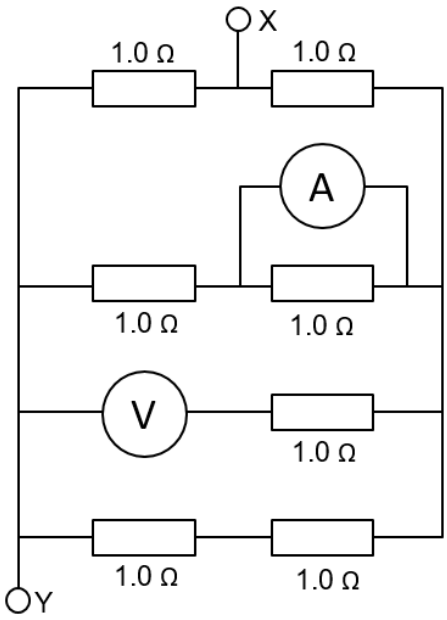
A Side A and its opposite side
B Side B and its opposite side
C Side C and its opposite side
D Any two sides, as the resistance is the same for all pairs of sides

24 A generator produces 100 kW of power at a p.d. of 10 kV. The power is transmitted through cables of total resistance 5 Ω.

What is the power loss in the cables?

A 50 W **B** 250 W **C** 500 W **D** 1000 W

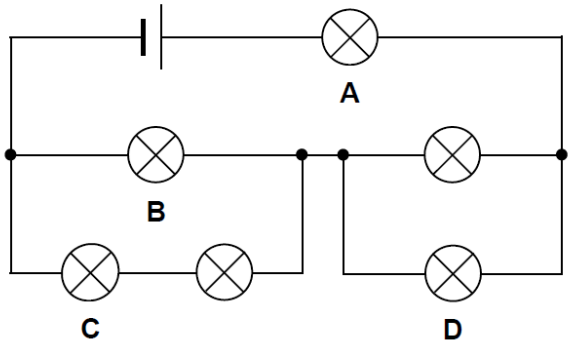
25 For the circuit shown below, what is the effective resistance between point X and Y, assuming that all the components are ideal?



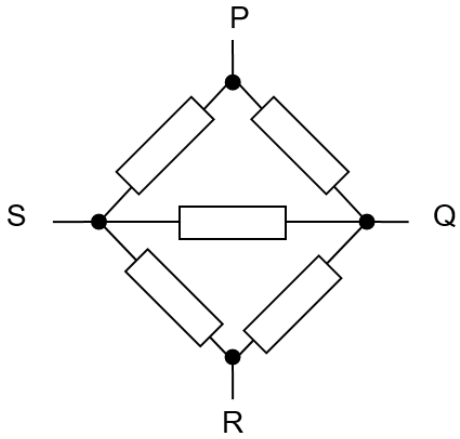
A 0.75 Ω
B 0.63 Ω
C 0.60 Ω
D 0.50 Ω

26 Six identical light bulbs are connected as shown in the figure below.

Which light bulb is the dimmest?



27 Five resistors of equal resistance are connected as shown.



Which pair of points provides the greatest effective resistance?

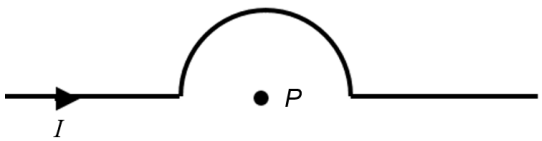
A PQ

B PR

C PS

D QS

28 A wire consists of two straight sections with a semi-circular section between them.



If current, I, flows in the wire as shown, what is the direction of the magnetic field at the centre of the semicircle, *P*, due to the current?

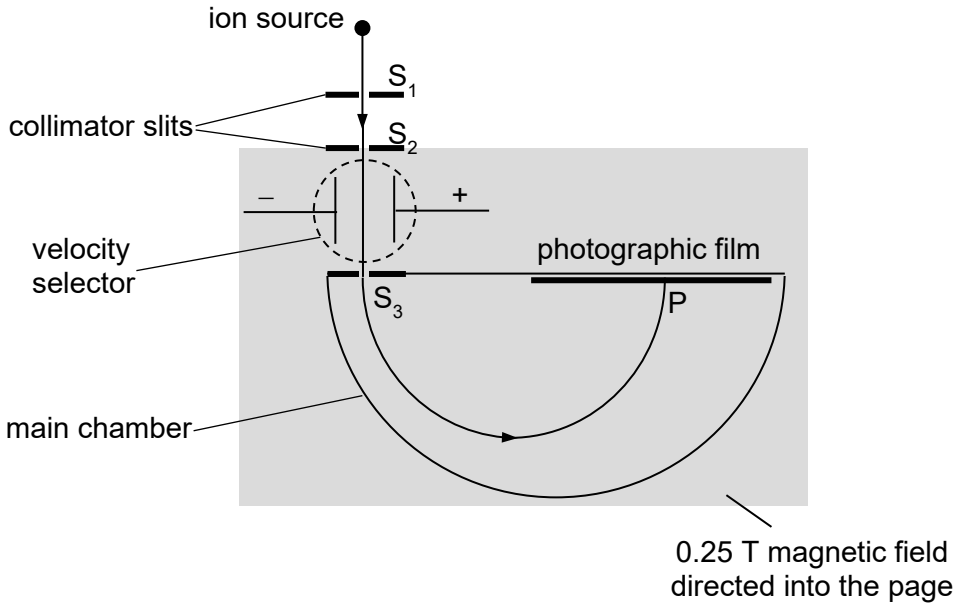
A to the right

B to the left

C out of the plane of the figure

D into the plane of the figure

29 The diagram shows a mass spectrometer in which singly-charged positive ions of mass 116*u* pass through slits S_1, S_2 and S_3 before entering the main chamber. Between S_2 and S_3, the ions pass through a velocity selector in which an electric field of intensity 20 kV m^{-1} and a magnetic field of flux density 0.25 T are applied normal to each other. The selected ions are deflected by a uniform magnetic field, also of flux density 0.25 T, within the main chamber and arrive at the point P.



What is the distance between P and slit S_3?

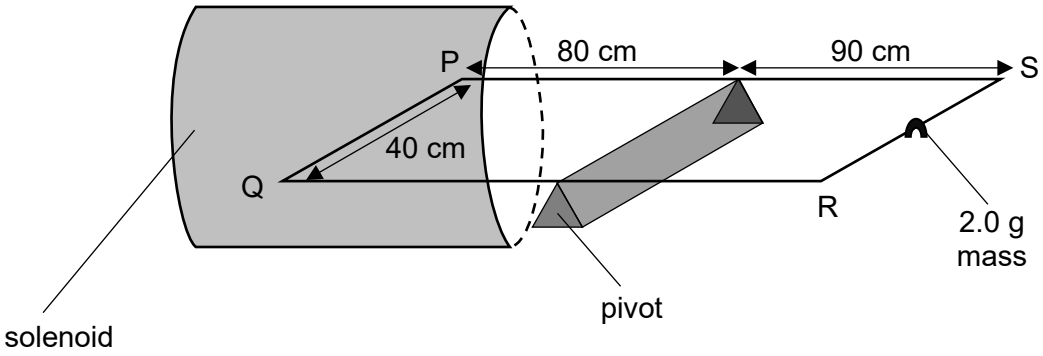
A 0.193 m

B 0.385 m

C 0.770 m

D 0.878 m

30 A current balance set up is shown below. The side PQ of a current balance is inside the middle of the solenoid that produces a magnetic field strength of 0.022 T. Both the solenoid and PQ are connected in series to the same power source. The length of PQ is 40 cm. PQ and RS are 80 cm and 90 cm respectively from the pivot. A load of mass 2.0 g is placed along RS.



The current balance is in equilibrium. How much current is there along PQ?

A 0.62 A

B 0.79 A

C 2.5 A

D 6.1 A

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