H

NATIONAL JUNIOR COLLEGE

SENIOR HIGH 2 PRELIMINARY EXAMINATION

Higher 1

CANDIDATE NAME			
SUBJECT CLASS		REGISTRATION NUMBER	

PHYSICS

8867/01

Paper 1 Multiple Choice

18 September 2024
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THE INSTRUCTION FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, subject class and registration number 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.

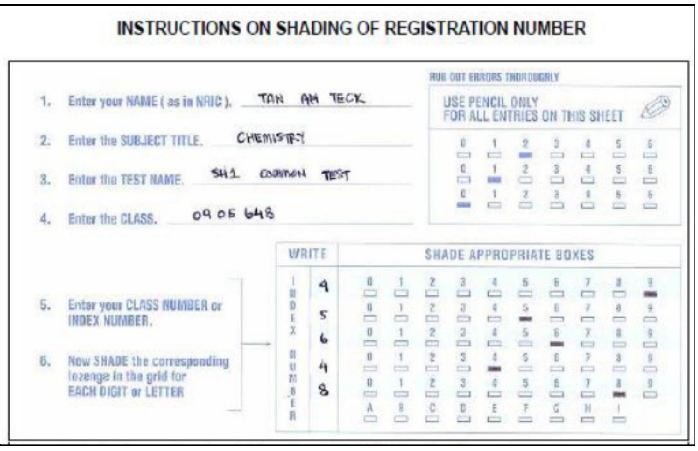
Read the instructions on the Answer Sheet very carefully.

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.

The OAS index number is in a 5-digit format.

The 5-digit format is as follows: **2nd digit** and the **last four digits** of the Reg Number.

e.g. 2**00**5011 becomes **05011**



This document contains **13** printed pages and **3** blank pages.

[Turn over

Data

speed of light in free space,	c	=	$3.00 \cdot 10^{8}$ m s^{-1}
elementary charge,	e	=	$1.60 \cdot 10^{-19}$ C
unified atomic mass constant,	u	=	$1.66 \cdot 10^{-27}$ kg
rest mass of electron,	m_e	=	$9.11 \cdot 10^{-31}$ kg
rest mass of proton,	m_p	=	$1.67 \cdot 10^{-27}$ kg
the Avogadro constant	N_A	=	$6.02 \cdot 10^{23}$ mol^{-1}
gravitational constant	G	=	$6.67 \cdot 10^{-11}$ 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 Which of the following gives the correct order of magnitude?

	pico	nano	micro
A	10^{-12}	10^{-9}	10^{-6}
B	10^{-12}	10^{-9}	10^{-3}
C	10^{-10}	10^{-9}	10^{-3}
D	10^{-10}	10^{-6}	10^{-3}

2 Four physical quantities *P*, *Q*, *R* and *S* are related by the equation $P = \frac{Q - R}{S}$.

Which statement must be correct for the equation to be homogeneous?

A *P*, *Q*, *R* and *S* are all scalar quantities.

B The product *PS* is numerically equal to (*Q* – *R*).

C *P*, *Q*, *R* and *S* all have the same units.

D The product *PS* has the same units as *Q* and *R*.

3 When comparing systematic and random errors, the following pairs of characteristics of errors in an experimental measurement may be contrasted:

X_1: error can possibly be eliminated
X_2: error cannot possibly be eliminated
Y_1: error is of constant sign and magnitude
Y_2: error is of varying sign and magnitude
Z_1: error will be reduced by averaging repeated measurements
Z_2: error will not be reduced by averaging repeated measurements

Which properties apply to systematic errors?

A X_1, Y_1, Z_2 **B** X_1, Y_2, Z_2

C X_2, Y_2, Z_1 **D** X_2, Y_1, Z_1

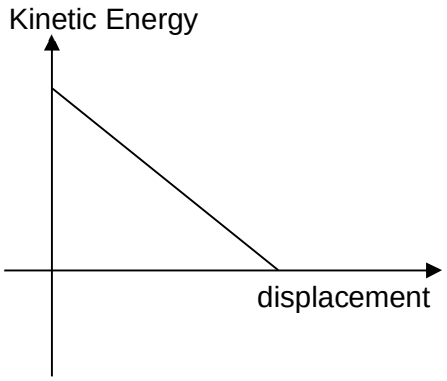
4 Four balances were used to measure the mass of a 1.000 kg weight. Measurement was repeated five times at each balance. The readings obtained and the average value for each balance are shown in the given table.

Which balance is not very precise but accurate?

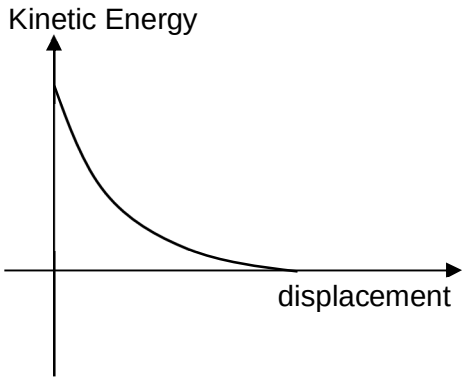
Balance	Reading / kg					Average / kg
	1	2	3	4	5	
A	1.000	1.000	1.002	1.001	1.002	1.001
B	1.011	0.999	1.001	0.989	0.995	0.999
C	1.012	1.013	1.012	1.014	1.014	1.013
D	0.993	0.987	1.002	1.000	0.983	0.993

5 A block is projected at a certain speed up a frictionless slope. Which of the following graphs correctly shows the relationship between the kinetic energy of the block and the displacement of the block along the slope after its point of projection?

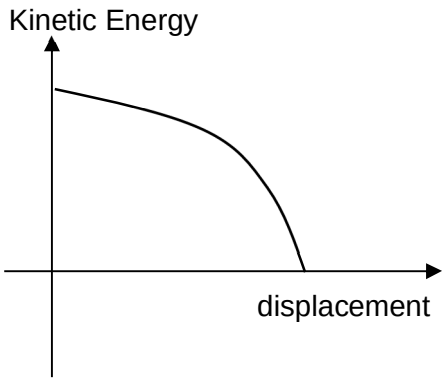
A



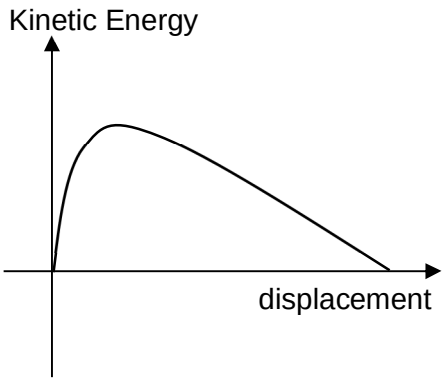
B



C



D



6 Drops of water falls from the roof of a building 9.0 m high at regular intervals of time. The first drop reaches the ground at the instant the fourth drop starts its fall. What is the distance between the second and third drops from the roof?

A 1.0 m **B** 3.0 m **C** 4.0 m **D** 5.0 m

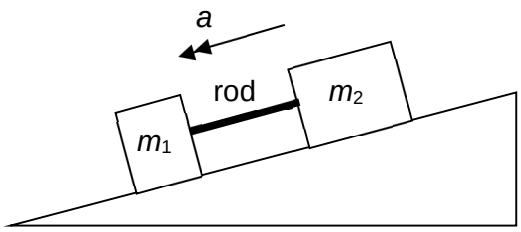
7 A golfer hits a golf ball on a flat golf course.

The golf ball travels a horizontal distance of 500 m before bouncing. It reaches a maximum height of 210 m.

What is the approximate angle to the horizontal at which the ball leaves the golf club? Air resistance may be assumed to be negligible.

A 30° **B** 40° **C** 50° **D** 60°

8 Two blocks of masses m_1 and m_2 are connected by a light rod as shown.



If the blocks are moving with acceleration a down a smooth slope, what is the tension in the rod?

A zero **B** m_1a **C** m_2a **D** $(m_1 + m_2)a$

9 Which statement shows an ***incorrect*** application of Newton's Third Law?

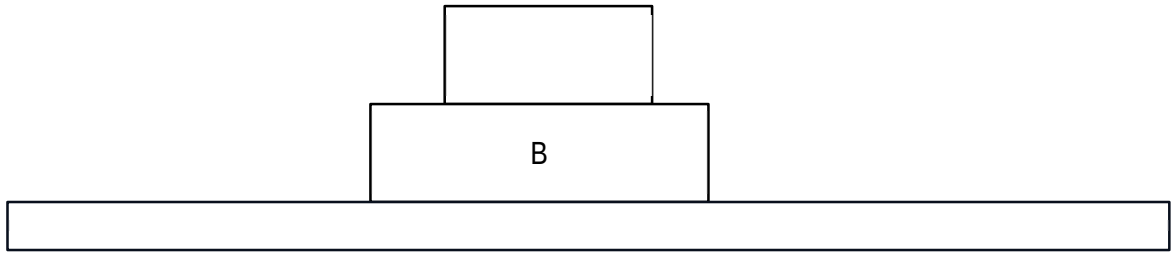
A The reason why a person is unable to move a heavy box when he pushes it is because the box pushes back on him with an equal force.

B When boy A punches boy B with a force of 100 N, boy A will experience a force of 100 N due to boy B.

C The weight of the book and the normal force which is acting on the book when placed on a table is not an action-reaction pair.

D The pull of the Earth on you and the pull you exert on the Earth is an action-reaction pair.

10 Two objects are being pulled along a smooth floor by a 70 N force as shown. Object A has a mass of 20 kg and object B has a mass of 6.0 kg. The masses do not slide against each other.



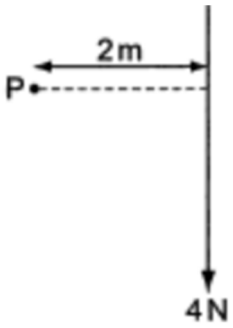
A
B
70 N

What is the magnitude and direction of the frictional force exerted on A by B?

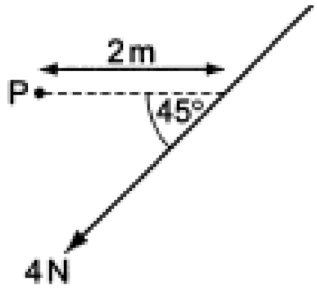
	magnitude	direction
A	16 N	to the left
B	16 N	to the right
C	54 N	to the left
D	54 N	to the right

11 In which diagram is the moment of force about point P greatest?

A

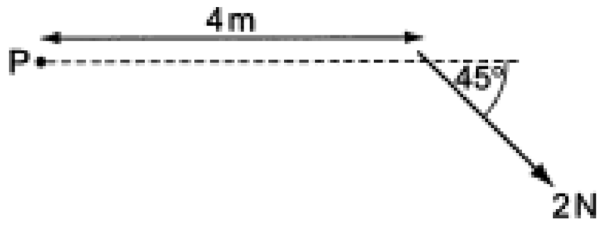


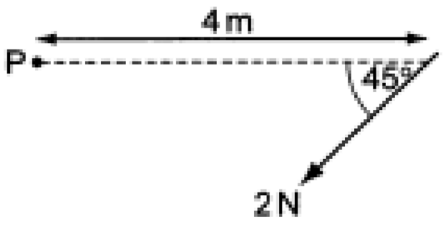
B



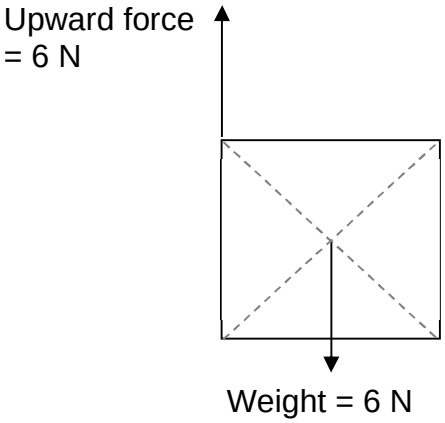
C

D



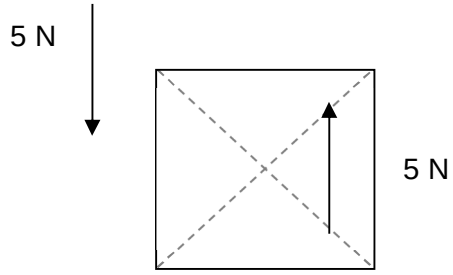


12 The figure below shows two forces acting on a uniform square plate of metal.

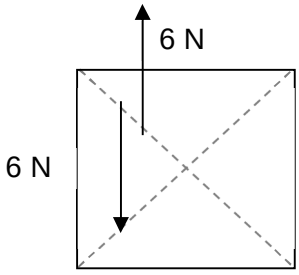


Which of the following force(s) would ensure equilibrium when added to the setup above?

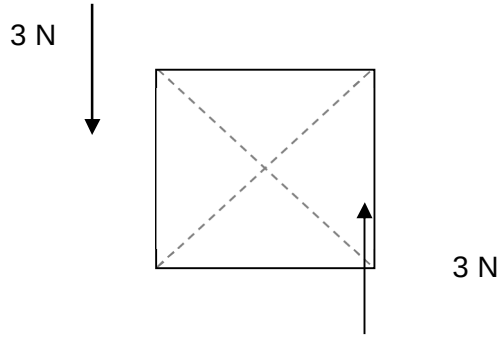
A



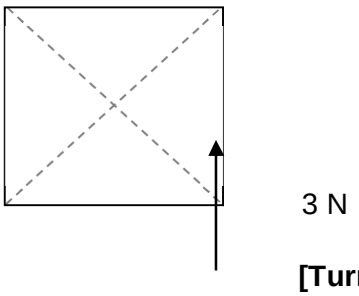
B



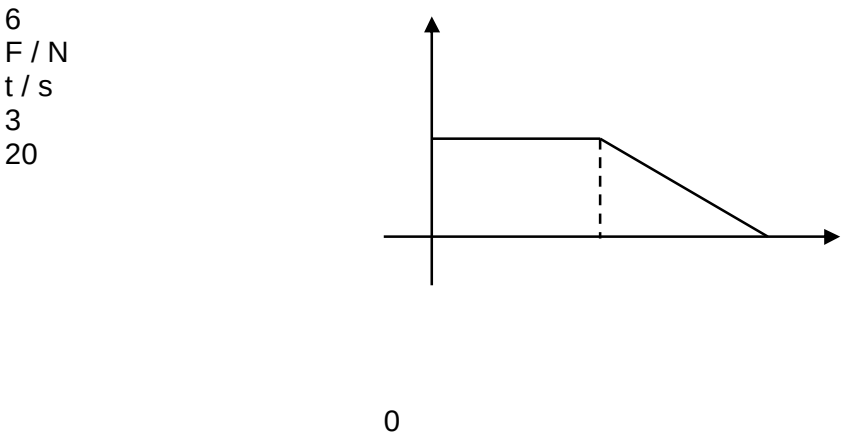
C



D



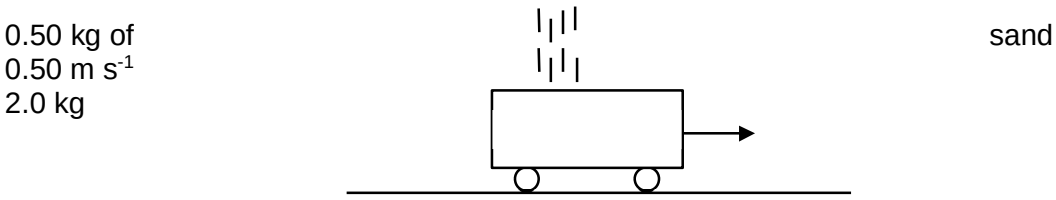
13 An object of mass 20 kg, initially at rest, is acted on by a force F that varies with time according to the figure below.



What is the velocity of the object at t = 6 s?

A 1.5 m s^{-1} **B** 3.0 m s^{-1} **C** 4.5 m s^{-1} **D** 7.0 m s^{-1}

14 The figure below shows a 2.0 kg trolley moving on a frictionless horizontal table at a speed of 0.50 m s^{-1}. 0.50 kg of sand is then released onto the trolley.



What is the magnitude of the change in the momentum of the trolley?

A zero **B** 0.20 N s **C** 0.25 N s **D** 0.40 N s

15 A ball of mass *m* makes an elastic head-on collision with a second ball initially at rest. The second ball moves off with half the original speed of the first ball.

What is the mass of the second ball?

A *m* **B** 2*m* **C** 3*m* **D** 4*m*

16 A speed-boat with two engines, each of power output 36 kW, can travel at a maximum speed of 12 m s^{-1}. The total drag D on the boat is related to the speed v of the boat by the equation shown.

$$D \propto v^2$$

What is the maximum speed of the boat when only one engine is working?

A 3.0 m s^{-1} **B** 6.0 m s^{-1} **C** 8.5 m s^{-1} **D** 9.5 m s^{-1}

17 A mass is suspended on the end of a string above the ground. It is whirled round in a horizontal circle at increasing speed until the string breaks. Air resistance is negligible.

What is the subsequent path taken by the mass?

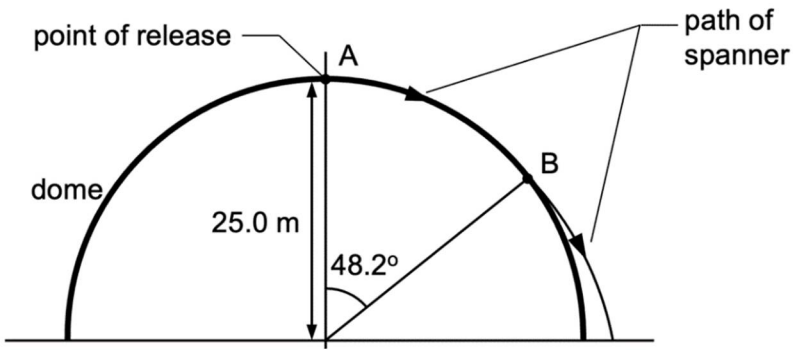
A A horizontal circular path.

B A parabolic path in the horizontal plane.

C A parabolic path in the vertical plane.

D A straight line along the radius of the circle.

18 A workman on the roof of a hemispherical sports dome of radius 25.0 m lets go of a spanner very close to the highest point A as shown.



The surface of the roof is very smooth and the spanner starts to slide from rest down the dome. The spanner just loses contact with the surface at point B.

What is the centripetal acceleration of the spanner at point B?

A 4.91 m s^{-2} **B** 6.54 m s^{-2} **C** 7.31 m s^{-2} **D** 9.81 m s^{-2}

19 An aircraft is turning in a horizontal plane at a constant speed of 650 m s^{-1}. Its turning radius is 80 km.

What is the ratio of the centripetal force to the weight of the aircraft?

A 8.3×10^{-4} **B** 0.54 **C** 1.9 **D** 52

20 A satellite has a weight of W on the surface of the Earth.

What is the weight of the satellite when it is in a circular orbit at a height of $5R$ *above* the surface of the Earth, where R is the radius of the earth?

A $\frac{W}{36}$ **B** $\frac{W}{25}$ **C** $\frac{W}{5}$ **D** 0

21 A satellite of mass m orbits a planet of mass M at a distance R from centre of the planet.

Which of the following represents the kinetic energy of the satellite?

A $\frac{GMm}{R^2}$ **B** $\frac{GMm}{R}$ **C** $\frac{GMm}{2R}$ **D** $\sqrt{\frac{GM}{R}}$

22 Which of the following statements about geostationary orbits is **false**?

A A geostationary orbit must be directly above the equator.

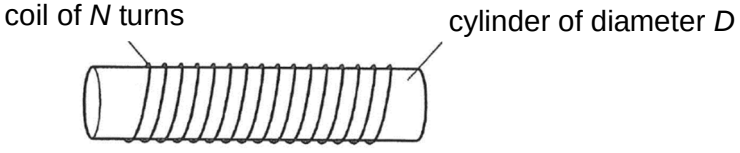
B All satellites in a geostationary orbit must have the same mass.

C The period of a geostationary orbit must be 24 hours.

D There is only one possible radius for a geostationary orbit.

23 A coil contains N turns of insulated copper wire wound on a cylinder of diameter D, as shown.

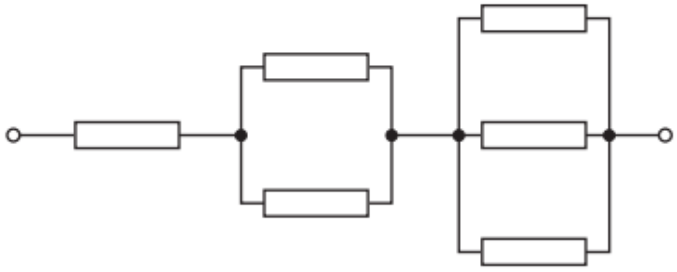
The copper wire has diameter d. The resistivity of copper is ρ.



What is the resistance of the wire?

A $\frac{4N\rho D}{d^2}$ **B** $\frac{4N\rho d}{D^2}$ **C** $\frac{8N\rho D}{d^2}$ **D** $\frac{8N\rho d}{D^2}$

24 Six resistors, each of resistance *R*, are connected as shown.

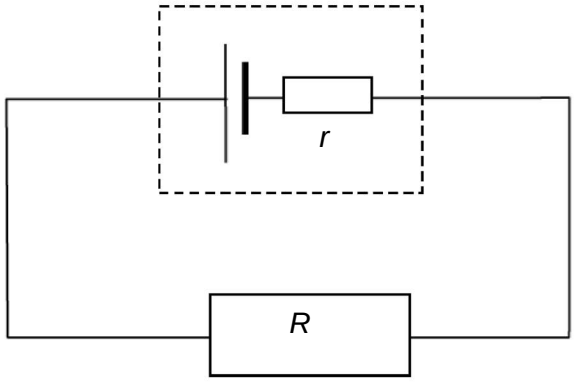


The combined resistance is 66 kΩ

What is the value of *R*?

A 11 kΩ **B** 18 kΩ **C** 22 kΩ **D** 36 kΩ

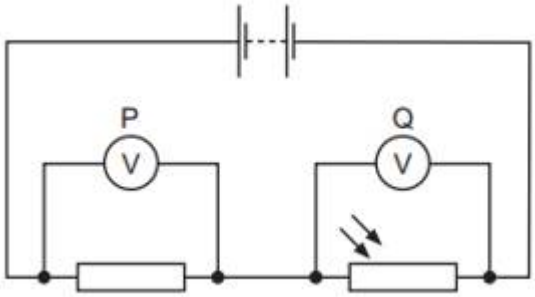
25 A battery with internal resistance *r* is connected to a resistor *R* as shown in the figure below. A constant current flows in the circuit. When a charge of 20.0 C passes through the circuit, the heat dissipated in *r* is 10.0 J and the heat dissipated in *R* is 50.0 J.



What is the e.m.f. of the battery and the potential differences across *r* and *R*?

	e.m.f. of the battery	potential difference across *r*	potential difference across *R*
A	6.00 V	1.00 V	5.00 V
B	6.00 V	5.00 V	1.00 V
C	3.00 V	2.50 V	0.50 V
D	3.00 V	0.50 V	2.50 V

26 A battery with negligible internal resistance is connected in series with a resistor and a light dependent resistor (LDR) as shown.

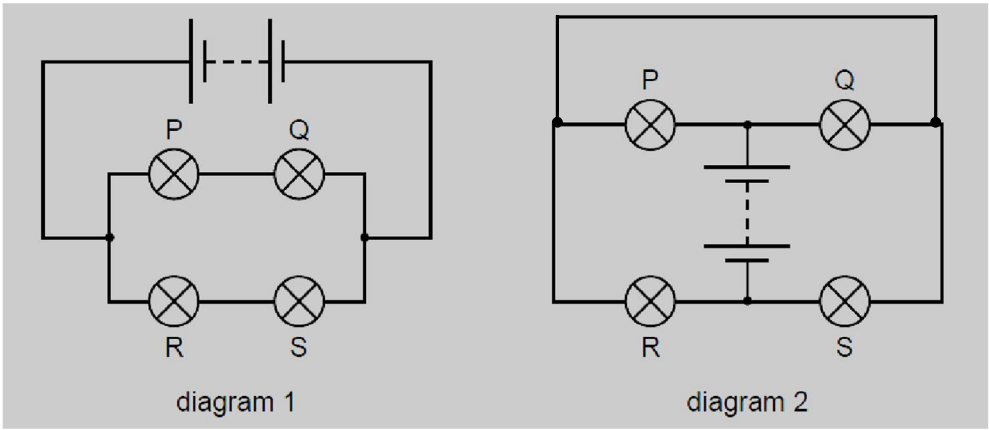


The light intensity of the LDR is decreased.

How do the readings of the voltmeter change?

	Reading on voltmeter P	Reading on voltmeter Q
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

27 When four identical lamps P, Q, R and S are connected as shown in diagram 1, they have normal brightness.



The four lamps and the battery are then connected as shown in diagram 2. Which statement is correct?

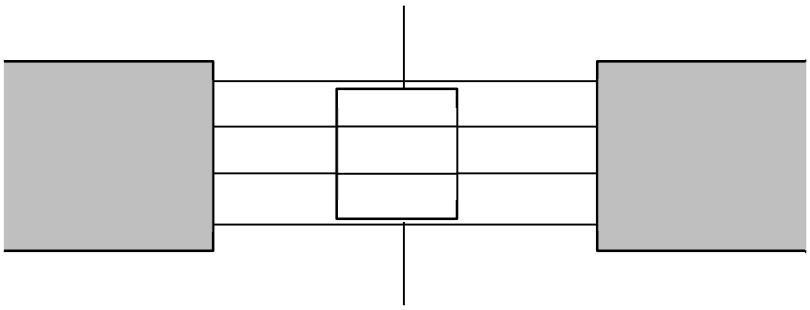
A The lamps P and Q in diagram 2 do not light up.

B All lamps in diagram 2 are brighter than normal.

C All lamps in diagram 2 have normal brightness.

D All lamps in diagram 2 do not light up.

28 In an electric motor, a rectangular coil WXYZ carrying current has 20 turns and is in a uniform magnetic field of flux density 0.80 T.



The lengths of sides XY and ZW are 0.17 m and of sides WX and YZ are 0.11 m. The maximum torque provided by the motor is 1.35 N m.

What is the current in the rectangular coil?

A 4.5 A **B** 9.0 A **C** 45 A **D** 90 A

29 A positively charged particle is projected perpendicularly into a uniform magnetic field.

The period of its motion is independent of

A the velocity of the particle.

B the charge of the particle.

C the mass of the particle.

D the magnetic flux density.

30 Thorium $_{90}^{232}Th$ decays through a series of transformations. The particles emitted in successive transformations are

α β β γ α

The resulting nuclide may be represented by

A $_{82}^{230}Pb$ **B** $_{88}^{226}Ra$ **C** $_{86}^{224}Rn$ **D** $_{88}^{224}Ra$

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