HUA YI SECONDARY SCHOOL
PRELIMINARY EXAM 2024

4-G3

NAME

CLASS

INDEX NUMBER

PHYSICS **6091/01**

PAPER 1

22 August 2024

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.
Write your Name, Class, and Index Number on the Answer Sheet in the spaces provided.

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 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.

Paper 1	40

This document consists of **14** printed pages.

Setter: Mr Tan PE

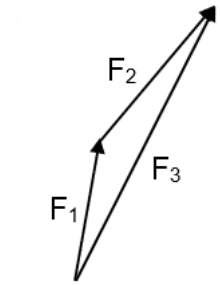
1 A strand of hair is 10^{-4} m thick.

How many times larger is this thickness as compared with the average diameter of an atom?

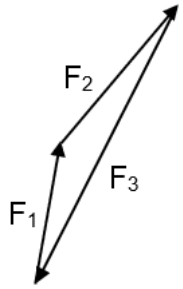
A 10^3 **B** 10^4
C 10^5 **D** 10^6

2 Which of the following shows zero resultant force when forces F_1, F_2 and F_3 are added?

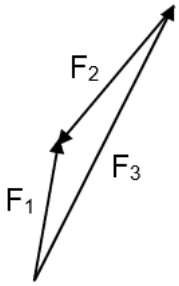
A



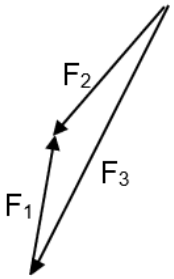
B



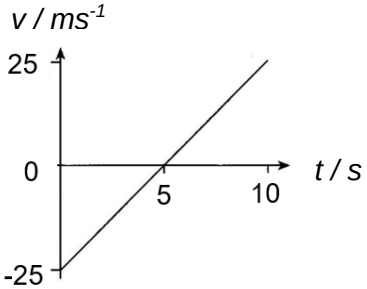
C



D



3 The motion of an object in a straight line over 10 s is shown by the velocity-time graph.



Which statement about the motion of the object is **not** correct?

A The object has positive acceleration.
B The object has zero average velocity.
C The object is constantly in motion.
D The object returns to its start point.

4 Which statement describes speed and velocity correctly?

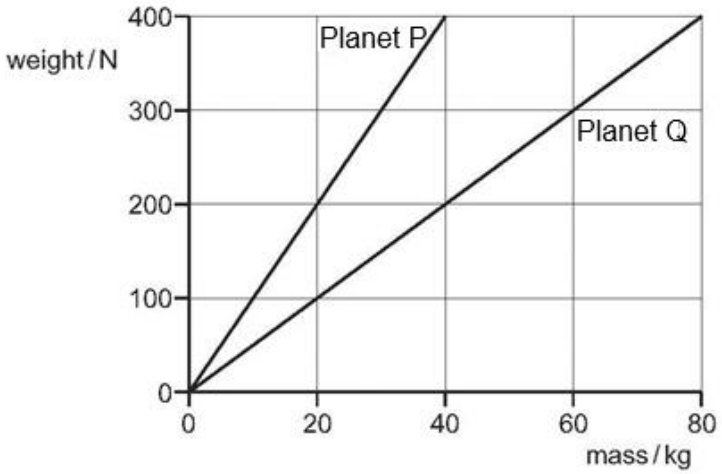
A Speed and velocity are vector and scalar quantities respectively.
B Speed and velocity are base and derived quantites respectively.
C Speed may not change when velocity changes.
D Speed always changes when velocity changes.

5 A force is applied to an object of mass 3 kg and it accelerates at 0.5 m/s^2 from rest on a smooth surface. When the same force is applied on the same object on a rough surface, the acceleration is reduced to 0.2 m/s^2.

What is the deceleration if the force is removed from the object when it is moving on the rough surface?

A 0.17 m/s^2 **B** 0.27 m/s^2
C 0.30 m/s^2 **D** 0.50 m/s^2

6 The diagram shows how weight varies with mass on planets P and Q.

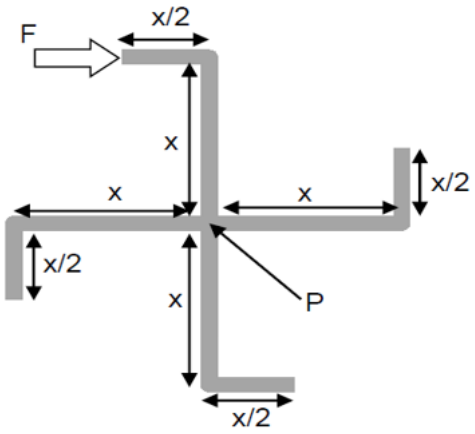


An object weighs 400 N on planet P. The object is then taken to planet Q.

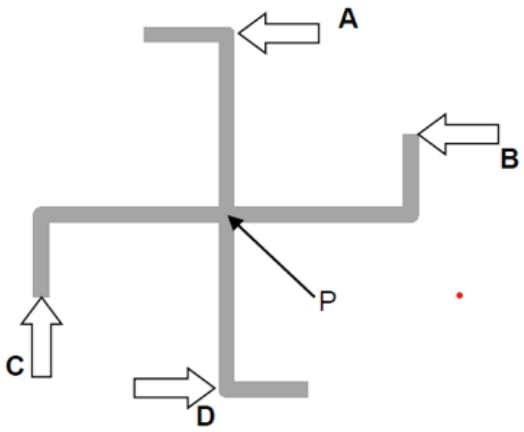
Which of the following is correct?

A The density of the object is higher on planet Q.
B The gravitational field strength on planet P is lower than that on planet Q.
C The mass of the object on planet Q is 80 kg.
D The weight of the object on planet Q is 200 N.

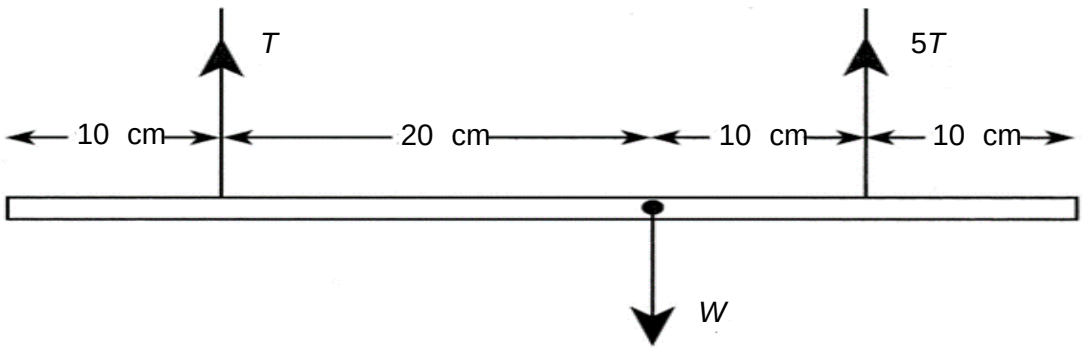
7 An object was spinning about its pivot point, P, due to a force F as shown.



Which direction should a force, 2F, be applied to stop the spinning?



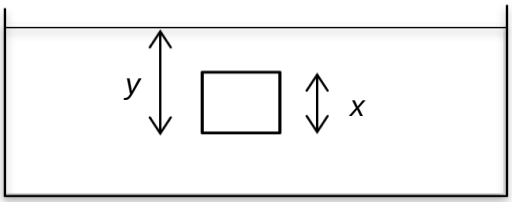
8 A non-uniform rod of unknown weight *W* is suspended by two strings as shown in the diagram. The tension in one of the strings is 5 N.



What is the tension *T* in the other string?

A 2.5 N
B 5.0 N
C 7.5 N
D 12.5 N

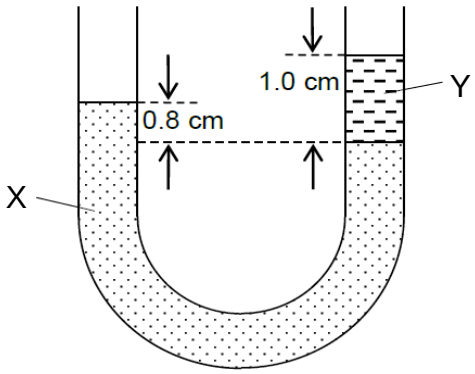
9 The diagram shows a solid cube of side x m located at y m below water surface of an open tank that is filled with water. The density of water is ρ and the atmospheric pressure is P. g is Earth's gravitational field strength.



What is the pressure experienced at the bottom of the box?

A $P + \rho gy$ **B** $P + \rho g(y - x)$
C ρgx **D** $\rho g(y - x)$

10 A U-shaped tube is filled with liquids X and Y.



What is the density of liquid X, ρ_x as compared to liquid Y, ρ_y?

A 0.2 ρ_y **B** 0.8 ρ_y
C 1.25 ρ_y **D** 1.8 ρ_y

11 Which of the following illustrates energy transfer mechanically by a force acting over a distance?

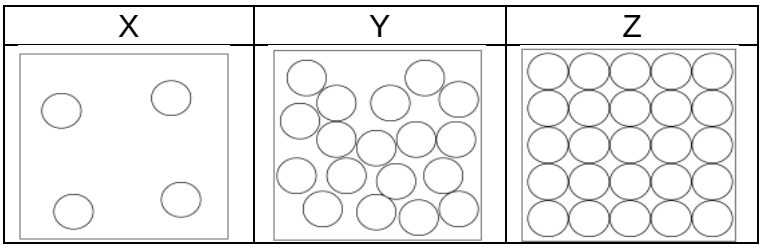
A A bungy jumper stretching a bungy as he jumps from the top of a tower.
B A person hearing music in a concert.
C A person resting and feeling the warm of the surroundings.
D An ice hockey player sliding on ice at constant velocity.

12 Illuminated smoke particles, suspended in air, are seen to move randomly.

Which of the following best describes cause of the movement of the smoke particles?

A The smoke particles are bombarded continuously by the air molecules.
B The smoke particles move due to bombardment by other smoke particles.
C The smoke particles move due to convection currents.
D The smoke particles move due to the energy gained from the illuminated light.

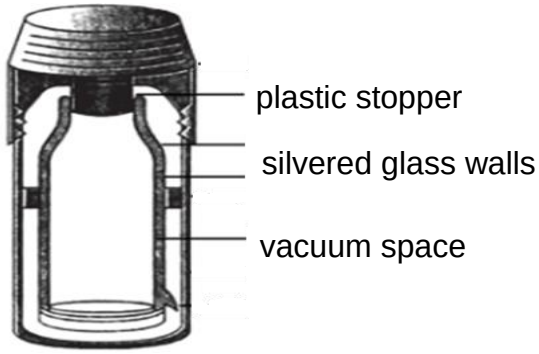
13 Diagrams X, Y and Z show three different states of a pure substance.



Which statement correctly describes X, Y and/or Z?

A X has the lowest temperature.
B Y has lower average kinetic energy than Z.
C Y is formed when heat is supplied to X.
D Z is formed when heat is removed from Y.

14 The diagram shows the sectional view of a thermal flask.



Which statement correctly describes how thermal energy transferred is reduced through a thermal flask?

	parts	conduction	convection	radiation
A	plastic stopper	yes	yes	no
B	silvered glass walls	no	no	yes
C	silvered glass walls	yes	no	yes
D	vacuum space	yes	yes	yes

15 Which statement is true about the internal energy changes during boiling and evaporation?

	boiling	evaporation
A	no change	no change
B	no change	decrease
C	increase	no change
D	increase	decrease

16 A 200 g of solid at 100°C is placed into a container that contains 200 g of liquid at 20°C. The specific heat capacity of the liquid is 4 times larger than the specific heat capacity of the solid.

Assuming that the container has negligible specific heat capacity and no heat is lost to the surrounding, what is the final temperature of the solid?

A 36 °C
B 40 °C
C 80 °C
D 84 °C

17 In which of the situations is having a low specific heat capacity an advantage?

A fiber handle of a frying pan
B glass wall of an oral thermometer
C metal bottom of a frying pan
D water in a hot water storage tank

18 A musical instrument produces two notes. The first note has a wavelength of 10 m, a period of 30 s and an amplitude of 5 cm. The second note has a higher pitch and is softer.

Which is the wavelength and amplitude of the second note?

	wavelength / m	amplitude / cm
A	5	3
B	5	10
C	20	3
D	20	10

19 A ship that is stationary on the surface of the sea sends pulses of sound vertically downwards towards the seabed. Each pulse that reflects from the seabed is received 1.0 s after it is sent out. A whale swims under the boat and a pulse is received 0.60 s after it is sent out. The speed of sound in sea water is 1500 m/s.

What is the distance of the whale above the seabed?

A 300 m
B 450 m
C 600 m
D 750 m

20 A wall made of a particular material is used to shield electromagnetic waves that have wavelengths longer than the wavelength of ultraviolet rays.

Which electromagnetic wave will be able to pass through the material?

A microwave
B radio wave
C visible light
D X-ray

21 Which row gives an example of a longitudinal wave and of a transverse wave?

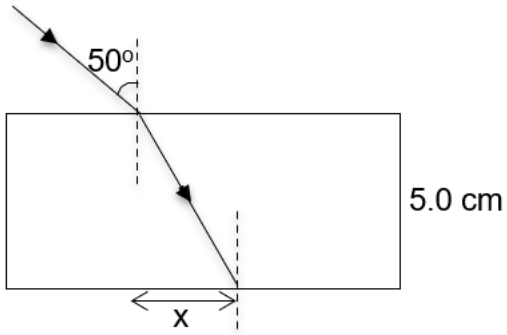
	longitudinal wave	transverse wave
A	light	ultrasound
B	microwaves	radio waves
C	radio waves	microwaves
D	ultrasound	light

22 Y and Z are electromagnetic waves. Both waves travel at the same speed in vacuum Y has shorter period than Z.

What could Y and Z be?

	Y	Z
A	radio wave	microwave
B	ultraviolet ray	infrared ray
C	visible light	X-ray
D	microwave	visible light

23 The diagram shows the refraction of a ray as it passes through a glass block of refract index 1.53. The width of the block is 5.0 cm.

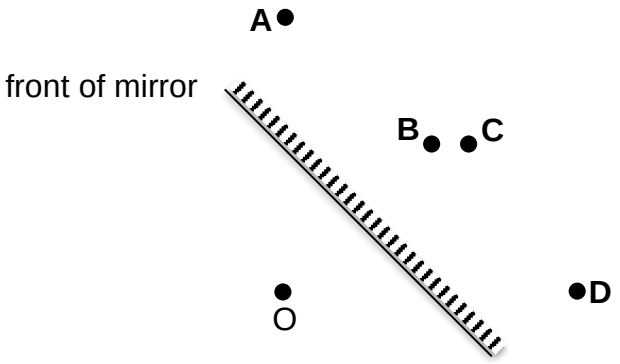


What is the angle of refraction of the incident ray, and the perpendicular displacement *x*?

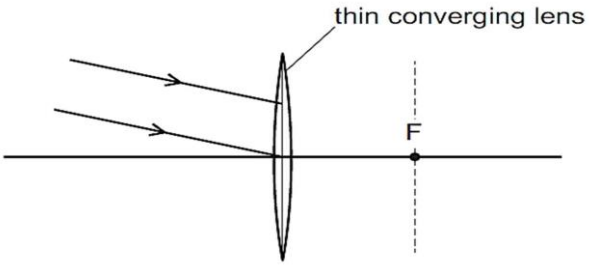
	angle refraction / °	perpendicular displacement, x / cm
A	20	1.7
B	20	1.8
C	30	2.5
D	30	2.9

24 The figure shows an object O that is placed in front of a plane mirror.

At which point **A**, **B**, **C** or **D** is the position of the image of O located?

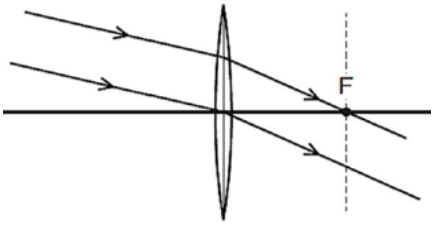


25 A parallel beam of light is incident on a thin converging lens. F is one focal point of the lens.

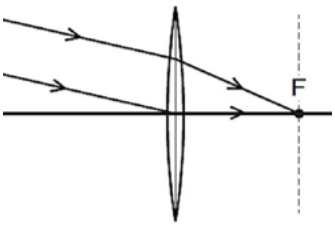


Which ray diagram shows the light after it has passed through the lens?

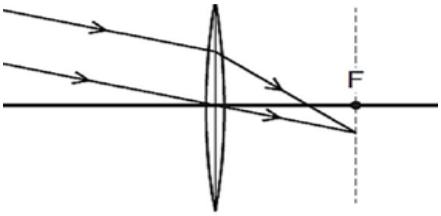
A



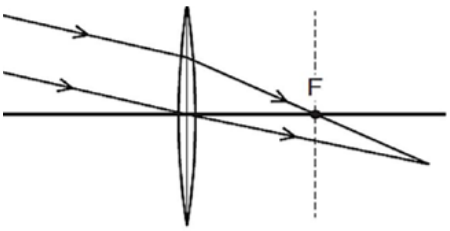
B



C



D



26 When a boy took off his layers of coats during winter, he observed sparks forming in between his clothes.

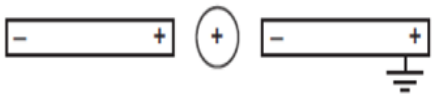
What is a possible explanation for this?

A The charges are transferred from the boy to the coat as he took them off.
B The humidity is lower in winter.
C There are more charges in the air during winter.
D There is a greater temperature difference between the boy and the surrounding.

27 A positively-charged metal sphere is placed midway between two previously uncharged metal rods, one of which is connected to earth.

Which diagram shows the charges on the rods?

A



B

C

D

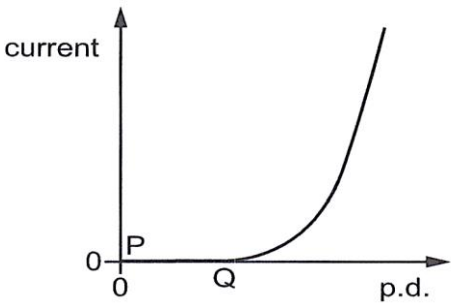
28 Lightning is an electrical discharge caused by imbalances between storm clouds and the ground, or within the clouds themselves. In one lightning occurrence between two storm clouds, the following data are collected:

potential difference / MV	current / kA	duration of occurrence / μs	electrical resistance / Ω	charge released / C
1.32	12	30	P	Q

What are the values of P and of Q?

	P	Q
A	0.11	0.36
B	0.11	360
C	110	0.36
D	110	360

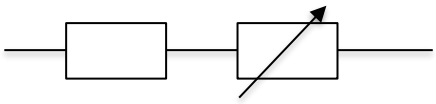
29 The diagram shows how the current in a semiconductor diode varies as the potential difference (p.d.) across it increases from zero.



What is the resistance of the diode between P and Q, and how does it change as the p.d. increases from Q?

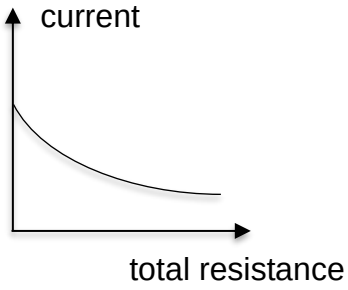
	resistance between P and Q	resistance after Q
A	very large	decreases
B	very large	increases
C	zero	decreases
D	zero	increases

30 The diagram shows part of a d.c. circuit where a fixed resistor is connected to a variable resistor that has a range of resistance from zero to a maximum value.

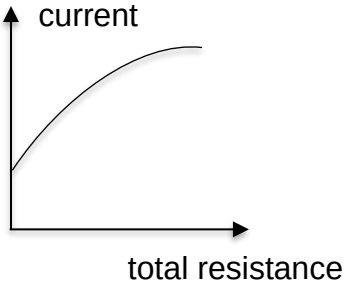


Which graph shows how the main current in the circuit varies with total resistance when the variable resistance is adjusted from zero to a maximum value?

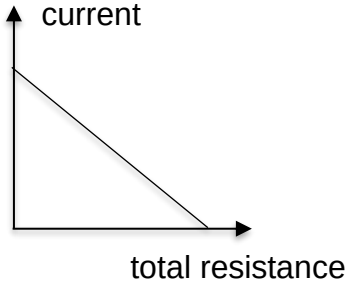
A



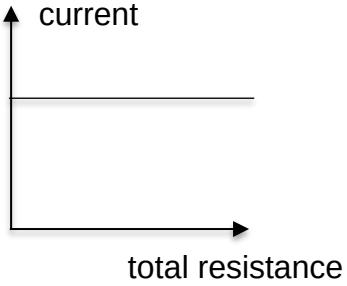
B



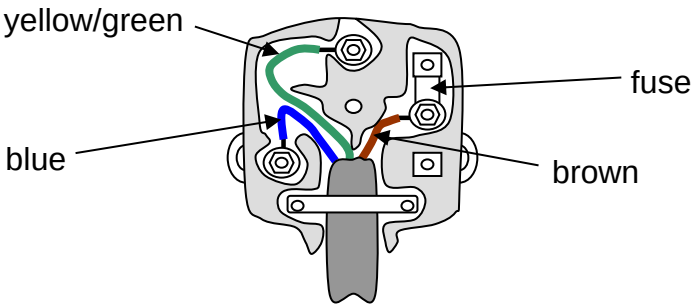
C



D



31 The diagram shows a 3-pin plug in a household.



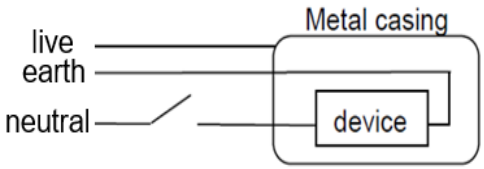
The brown wire carries a current of 4.0 A when the appliance is switched on.

What would be the current flowing in the yellow/green and blue wires and the potential difference across the brown and blue wires?

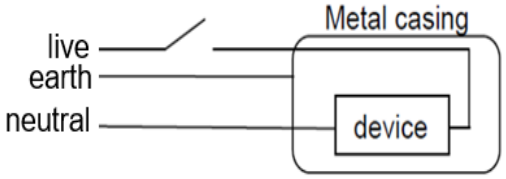
	current flowing in		potential difference across brown and blue wires / V
	yellow and green wire / A	blue wire / A	
A	0.0	0.0	0
B	0.0	4.0	240
C	4.0	0	0
D	4.0	4.0	240

32 Which one of the following electrical appliances is correctly wired?

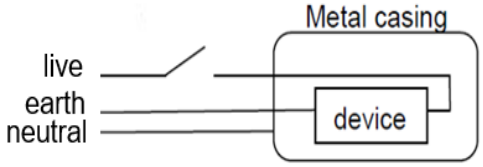
A



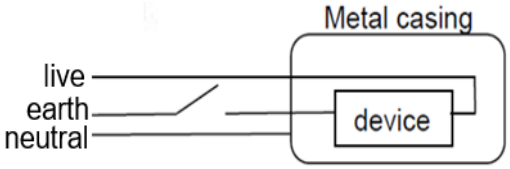
B



C



D

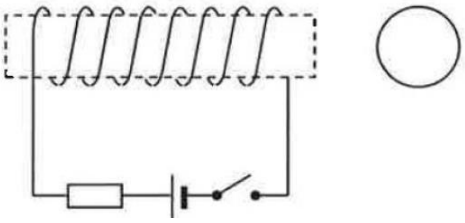


33 A household uses an electric heater with a power rating of 2 000 W for 5 hours a day in a month with 30 days.

If the monthly electricity cost is $45, what is the cost per kWh of electricity?

A $0.15
B $0.20
C $0.25
D $0.30

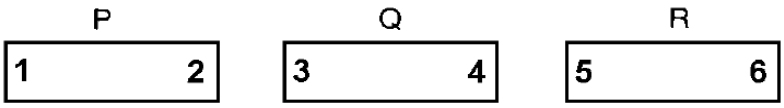
34 The solenoid is connected to a d.c. power supply. A magnetic compass is placed at the right side of the solenoid. The switch is turned on.



Which of the following statements is incorrect?

A Magnetic field is present around the solenoid and the connecting wires.
B The needle of the compass will point to the left.
C When a bar magnet is placed inside the solenoid, it will be demagnetised.
D When an iron bar is placed inside the solenoid, it becomes an electromagnet.

35 Three metal bars P, Q and R are identical in size and shape. They are suspected of being magnets. Tests are carried out and it is found that there is attraction between poles 1 and 6, between 2 and 4, and between 2 and 6. However, there is repulsion between poles 2 and 3.



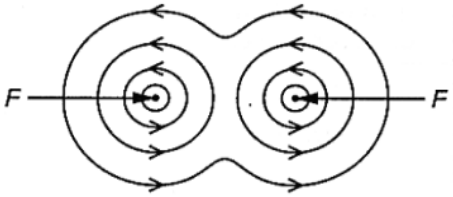
Which of these statements is correct?

A P and Q are magnets.
B P and R are magnets.
C Poles 2 and 5 would repel one another.
D All three metal bars are magnets.

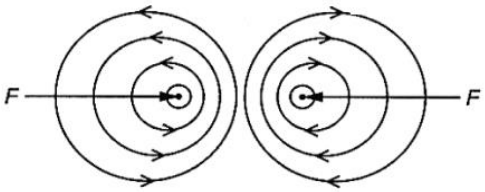
36 Two parallel, vertical wires each carries an out of page electric current.

Which diagram shows the magnetic field pattern around the wires and the direction of the force F on each wire?

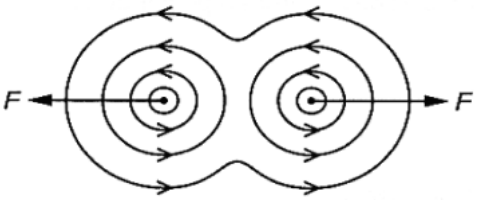
A



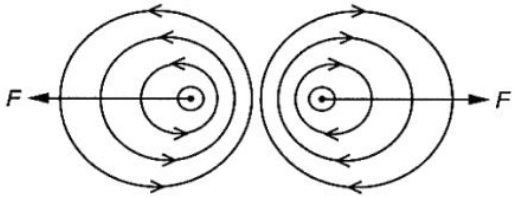
B



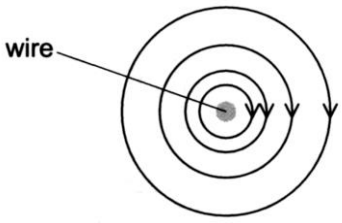
C



D

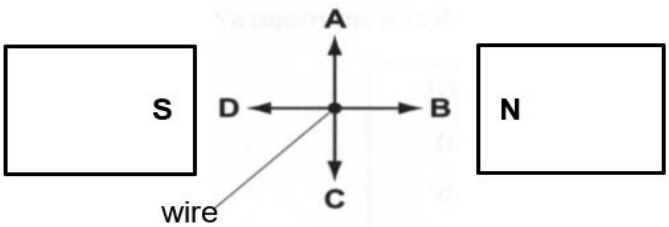


37 The diagram shows the magnetic field around a wire, when viewed from above.

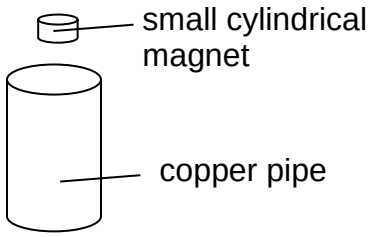


The poles of the magnet are placed on either side of the wire.

What is the direction of the force on the wire caused by the magnet?



38 When a small cylindrical magnet is released from rest near the top of a copper pipe, the magnet falls very slowly through the pipe.



Which of the following will help to slow down the motion of the magnet further?

A use a glass pipe instead
B use a pipe made from a material of lesser friction
C use a pipe made from a material of higher resistivity
D use a stronger magnet of the same mass

39 Which statement describes this isotope of uranium $^{238}_{92}U$ correctly?

	neutron	proton	electron
A	92	146	0
B	119	146	146
C	146	92	0
D	148	92	92

40 Which statement describes nuclear fusion?

A The nucleus of an atom splits into two parts.
B The nucleus with high energy knocking off electrons from atoms to form ions.
C The unstable nucleus loses energy by emission of particles or radiation.
D Two light atomic nuclei combine to form one heavier nucleus.

End Of Paper