

Name:	Class:	Class Register Number:
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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)

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PRELIMINARY EXAMINATION 2024 SECONDARY 4

PHYSICS

6091/01

Paper 1 Multiple Choice

10 September 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and register number clearly in the spaces provided at the top of this page.

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.

This document consists of **17** printed pages and **1** blank page.

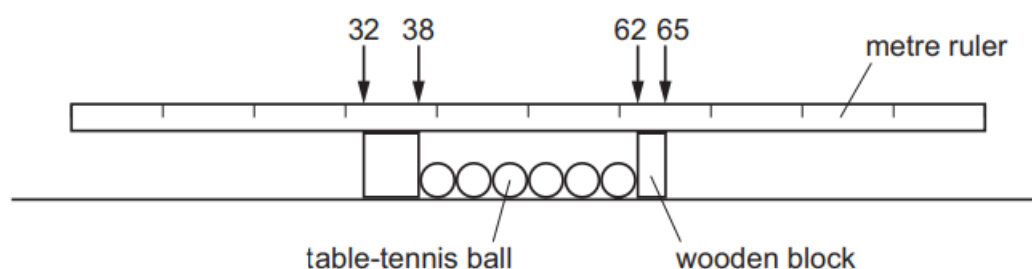
[Turn over

- 1** In order to determine the period of a pendulum, a student times one complete swing of the pendulum using an analogue stop-watch with a second hand.

Which change of method produces the greatest improvement in accuracy?

- A** asking a friend with a shorter reaction time to take the measurement
- B** measuring the time for 25 swings of the pendulum and dividing it by 25
- C** measuring the time for a half swing of the pendulum and doubling it
- D** using a digital timer

- 2 A student uses a metre ruler to measure the length of six identical table-tennis balls placed between two wooden blocks.



What is the diameter of one ball?

- A** 4.0 cm **B** 5.0 cm **C** 6.0 cm **D** 8.0 cm

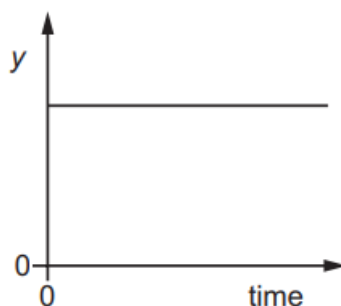
- 3** The diagram shows a series of images of a moving object taken at regular intervals. The object is moving from left to right.



Which statement describes the motion of the object?

- A** The object accelerates continuously.
- B** The object decelerates continuously.
- C** The object travels at constant speed and then accelerates.
- D** The object travels at constant speed and then decelerates.

- 4 A train is on a straight track. The graph shows how a quantity y varies with time.

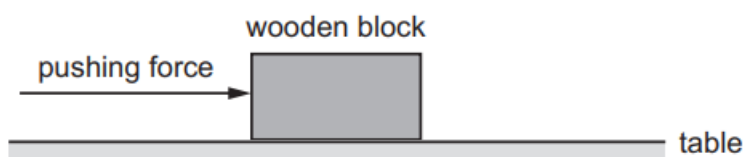


Which statements can be true?

- 1 The train is stationary and y represents the distance from the last station.
- 2 The train is moving and y represents the distance from the last station.
- 3 The train is stationary and y represents the speed of the train.
- 4 The train is moving and y represents the speed of the train.

- A** 1 and 2 **B** 2 and 3 **C** 3 and 4 **D** 4 and 1

- 5 A wooden block is pushed across a table at constant speed.

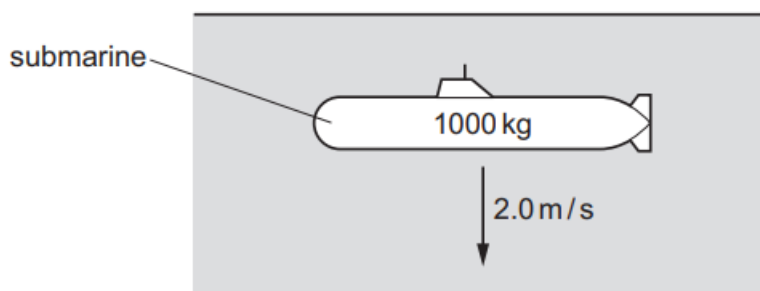


Which statement about the frictional force is correct?

- A** The frictional force increases as the block moves at constant speed.
B The frictional force is equal to the pushing force.
C The frictional force is greater than the pushing force.
D The frictional force is less than the pushing force.

[Turn over

- 6 A small submarine of mass 1000 kg sinks in water with a constant speed of 2.0 m / s.



What is the resultant force exerted on the submarine as it sinks?

- A 0 N
 B 500 N downwards
 C 2000 N downwards
 D 10000 N downwards
- 7 A plastic ball has a mass of 4.0 g and a volume of 20 cm³.

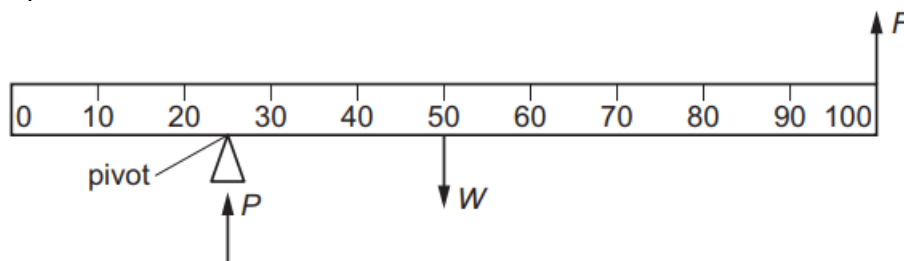
There is a crack in the ball's surface.

The ball is placed in a bath of water. Water leaks into the ball without changing the volume of the ball and eventually the ball sinks.

The density of water = 1.0 g / cm³.

Which mass of water has entered the ball when the top of the ball is first level with the water surface?

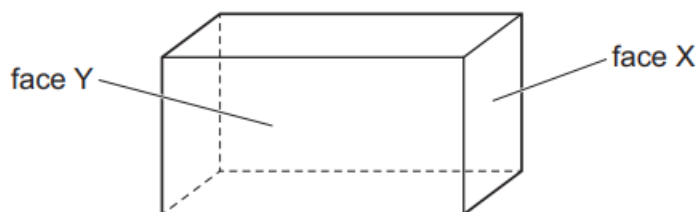
- A 5.0 g B 16 g C 20 g D 24 g
- 8 A uniform metre rule of weight W is pivoted at the 25 cm mark and held horizontal by a force F applied upwards at the 100 cm mark. The rule is supported by a vertical force P acting at the pivot.



What is the magnitude of P ?

- A $\frac{1}{3} W$ B $\frac{1}{2} W$ C $\frac{2}{3} W$ D $\frac{4}{3} W$

- 9 The centre of gravity of a solid rectangular block is at its centre. A small heavy weight is available.

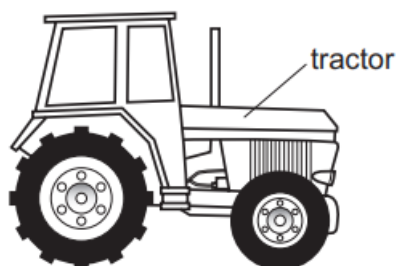


In which arrangement is the centre of gravity the lowest?

- A with face X on a table
 - B with face Y on a table
 - C with face X on a table and the heavy weight attached centrally on top of the block
 - D with face Y on a table and the heavy weight attached centrally on top of the block
- 10 When a diver swims down from the surface of the water to a depth of 10 m, the pressure experienced increases from $100\,000\text{ N / m}^2$ to $200\,000\text{ N / m}^2$.

Which statement explains this increase in pressure?

- A The density of the water increases with depth.
 - B The gravitational field strength increases with depth
 - C The weight of water above the diver increases with depth.
 - D Water is increasingly compressed with depth.
- 11 Tractors have large tyres. These help to prevent the wheels from sinking into soft ground.

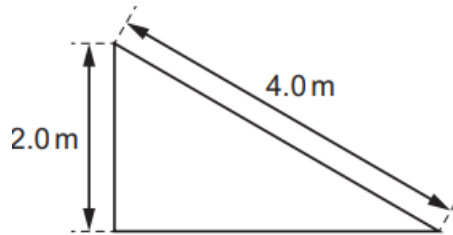


Which statement explains this?

- A Larger tyres exert a greater force on the ground.
- B Larger tyres exert a greater pressure on the ground.
- C Larger tyres exert a smaller force on the ground.
- D Larger tyres exert a smaller pressure on the ground.

[Turn over

- 12** A box is initially at rest at the top of a rough slope. The box slides down the slope. The weight of the box is 20 N. The slope is 4.0 m long and 2.0 m high.

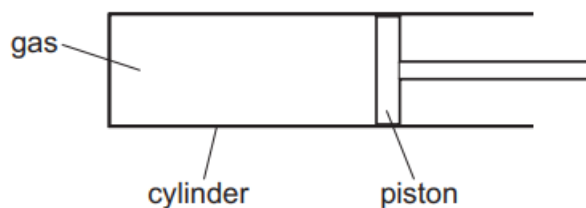


The box does 10 J of work against friction as it slides down the slope.

What is the speed of the box as it reaches the bottom of the slope?

- A** 5.4 m / s **B** 6.3 m / s **C** 7.1 m / s **D** 9.5 m / s
- 13** In a small power station, biofuel is used to generate electricity. Which energy store is reduced by this process?
- A** chemical
B kinetic
C internal
D nuclear
- 14** Brownian motion is the random motion of particles. In which states of matter is Brownian motion observed?
- A** solids, liquids and gases
B solids and liquids only
C solids and gases only
D liquids and gases only

- 15** A gas is contained in a cylinder by a movable piston.

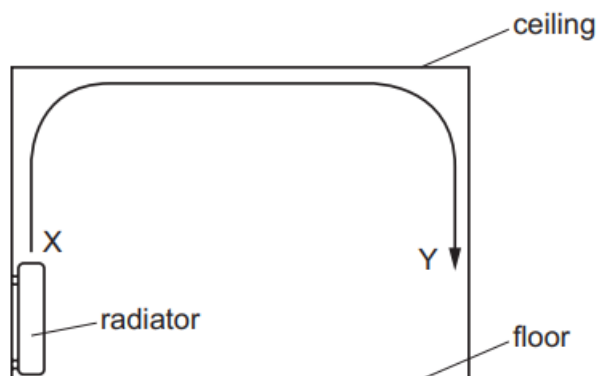


The gas is heated so that it expands at constant pressure.

How is the force of each collision of a gas particle with the piston affected and how does the frequency of collisions between the gas particles and the piston change?

	force	frequency
A	increase	decrease
B	increase	increase
C	stays the same	decrease
D	stays the same	increase

- 16** The diagram shows the view of a room heated by a radiator. The arrowed line from X to Y is the path of the convection current in the air.



Which row shows the correct air density at X and air temperature at Y?

	air density at X	air temperature at Y
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

[Turn over

- 17** A cook heats some water in a pan on a hotplate. The temperature of the water rises by $10\text{ }^{\circ}\text{C}$ in time t .

He then puts the same volume of oil in an identical pan on the same hotplate. The specific heat capacity of water is 2.5 times that of oil and water is 1.1 times denser than oil.

What is the time for the temperature of the oil to rise by $10\text{ }^{\circ}\text{C}$?

- A** $0.36\text{ }t$ **B** $0.44\text{ }t$ **C** $2.3\text{ }t$ **D** $2.8\text{ }t$

- 18** A student on a camping expedition cools a sealed bottle of water which is at the same temperature as the surrounding air.

Which method cools the water at the greatest rate?

- A** Wrap the bottle in aluminium foil and place it in a shady place.
B Wrap the bottle in dry, white cloth and put it in a shady place.
C Wrap the bottle in foam and put it in a breeze.
D Wrap the bottle in wet paper and put it in a breeze

- 19** A student writes down some facts about two transverse waves.

Wave 1 has a frequency f and a velocity v .

Wave 2 has four times the frequency of wave 1 and is travelling at a velocity of $2v$.

What is the wavelength of wave 2 in terms of f and v ?

- A** $2f / v$ **B** $8fv$ **C** $2v / f$ **D** $v / 2f$

- 20** The diagram shows the electromagnetic spectrum.

γ -rays	E	ultraviolet	F	infrared	microwaves	G
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Which types of waves are E, F and G?

	E	F	G
A	radio	visible light	x-rays
B	radio	x-rays	ultrasound
C	x-rays	radio	ultrasound
D	x-rays	visible light	radio

- 21** Light travels from glass into air.

What is the relationship between the refractive index n of the glass, the angle of incidence i and the angle of refraction r ?

- A** $n = i / r$ **B** $n = r / i$ **C** $n = \sin i / \sin r$ **D** $n = \sin r / \sin i$

- 22** Which statement about light is correct?

- A** Total internal reflection only occurs when light travels from air into glass.
B The larger the refractive index of glass, the larger is the critical angle.
C When total internal reflection occurs, the angle of incidence is less than the critical angle.
D When total internal reflection occurs, the angle of incidence is equal to the angle of reflection.

- 23** A sound is produced and an echo is heard after the sound reflects off a wall.

How do the properties of the echo compare to the original sound wave?

	amplitude	frequency	speed
A	lower	lower	lower
B	lower	same	same
C	same	lower	lower
D	same	same	same

- 24** The element mercury exists as a solid, a liquid or a gas.

Which row gives a possible set of values of the speeds of sound in m / s through mercury?

	speed of sound in frozen mercury	speed of sound in liquid mercury	speed of sound in mercury vapour
A	255	1550	2550
B	255	2550	1550
C	1550	255	2550
D	2550	1550	255

[Turn over

- 25** A teacher wishes to show the production of electrostatic charges.

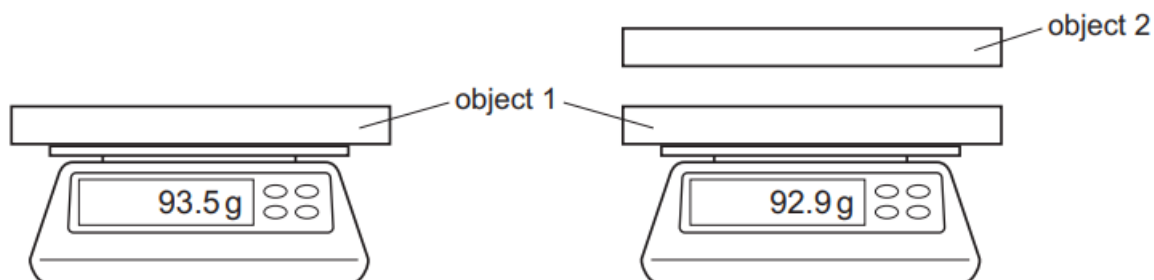
She holds a rod and rubs it with a cotton cloth. A copper rod, a glass rod, a plastic rod and a steel rod are available.

Which two rods would both be suitable to use?

- A** a copper rod and a glass rod
- B** a glass rod and a plastic rod
- C** a plastic rod and a steel rod
- D** a steel rod and a copper rod

- 26** Object 1 is given a negative charge and placed on a balance.

Object 2, which is also charged, is brought close to object 1 and the reading on the balance changes as shown.



Which action would further decrease the reading on the balance?

- A** Add the same number of electrons to both objects
 - B** Remove the same number of electrons from both objects.
 - C** Transfer electrons from object 1 to object 2.
 - D** Transfer electrons from object 2 to object 1.
- 27** The current in an electric motor is 2.0 A. It transfers 20 J of energy in 5.0 s.
- What is the potential difference (p.d.) across the motor?

- A** 0.50 V
- B** 2.0 V
- C** 8.0 V
- D** 50 V

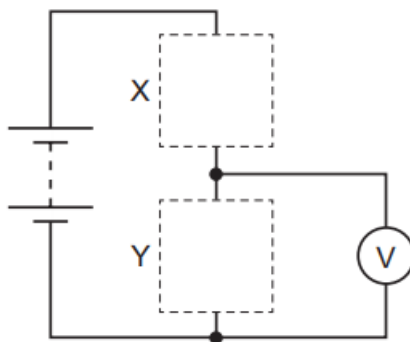
- 28** A wire has a resistance of $8.0\ \Omega$.

A second wire of the same material has twice the length and twice the cross-sectional area.

What is the resistance of the second wire?

- A** $4.0\ \Omega$ **B** $8.0\ \Omega$ **C** $16\ \Omega$ **D** $32\ \Omega$

- 29** The circuit shown can be completed by inserting components at X and at Y. The completed circuit is a potential divider in which the potential difference across component Y increases when the brightness increases.

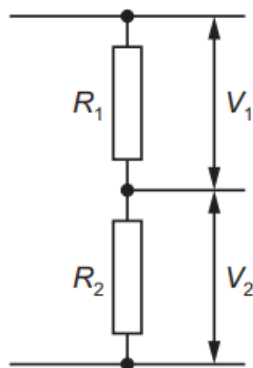


Which row shows the components X and Y?

	X	Y
A	light-dependent resistor	resistor
B	resistor	light-dependent resistor
C	resistor	thermistor
D	thermistor	resistor

[Turn over

- 30 Two resistors, with resistances R_1 and R_2 , are used as a potential divider.



What is the relationship between R_1 , R_2 and potential differences V_1 and V_2 ?

- A** $R_1 \times R_2 = V_1 \times V_2$
B $R_1 \times V_1 = R_2 \times V_2$
C $R_1 / R_2 = V_1 \times V_2$
D $R_1 / R_2 = V_1 / V_2$
- 31 The current in an electrical heater is 5.0 A.
- The heater is connected to the mains by a flexible cable that can carry a current of up to 15 A. The mains circuit can carry a current of up to 30 A.
- Different fuses are available to protect the heater's cable. Which fuse is the most suitable?
- A** 5.0 A **B** 10 A **C** 20 A **D** 40 A
- 32 Three students make comments about appliances with double insulation.
- student P: Appliances with double insulation do not need an earth wire.
 student Q: Circuits of appliances with double insulation do not contain fuses.
 student R: Double insulation protects the user of the appliance from an electric shock.
- Which students are correct?
- A** P, Q and R **B** P and Q **C** P and R **D** Q and R

33 A hard magnetic material can be used to make a permanent magnet.

A soft magnetic material can be used to make a temporary magnet.

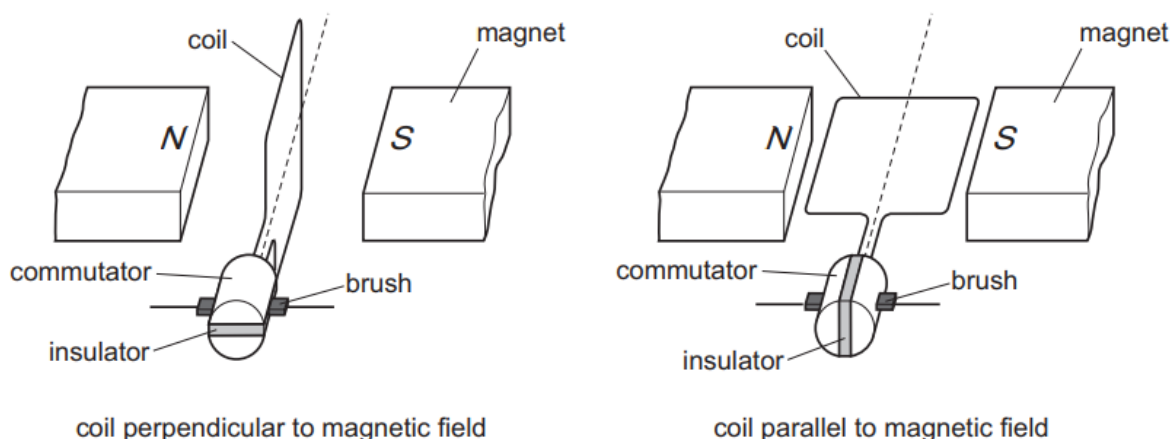
Which row correctly shows iron and steel as hard or soft magnetic materials?

	hard	soft
A	iron	iron
B	iron	steel
C	steel	iron
D	steel	steel

34 A commutator is connected to the coil of a d.c. motor.

The commutator rotates and connects the coil to the power supply.

Once every half-turn, the current in the coil reverses.

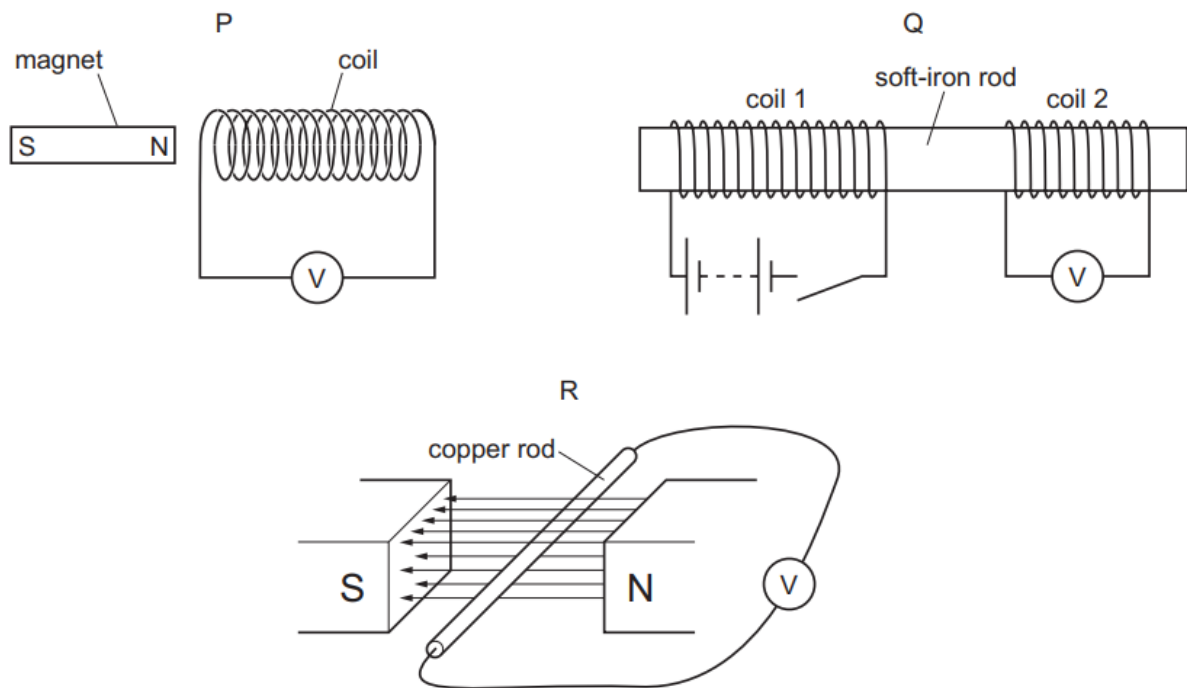


What is the name of the commutator and what is the orientation of the plane of the coil as the current reverses?

	name	orientation
A	slip ring	parallel to the magnetic field
B	slip ring	perpendicular to the magnetic field
C	split ring	parallel to the magnetic field
D	split ring	perpendicular to the magnetic field

[Turn over

- 35 A teacher sets up the equipment for three demonstrations, P, Q and R.



In demonstration P, the magnet is moved to the right.

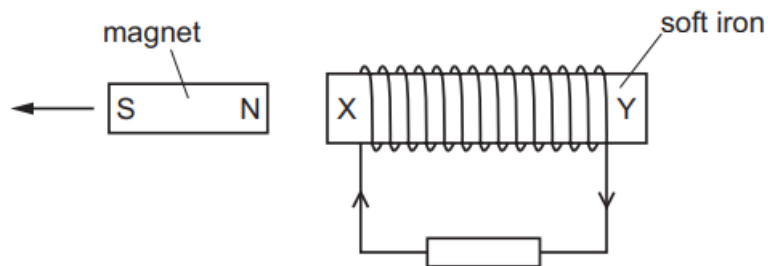
In demonstration Q, the switch is closed.

In demonstration R, the copper rod is moved vertically upwards.

Which demonstration(s) can be used to demonstrate electromagnetic induction?

- A** P only **B** R only **C** P and Q **D** P, Q and R

- 36 A piece of soft iron XY has a coil of wire wound round it.



The N pole of a bar magnet is pulled away from end X which causes an induced current in the coil.

The magnet is now turned round so that the N pole is on the left. It is taken to the other end of the soft iron and the N pole is pushed towards end Y.

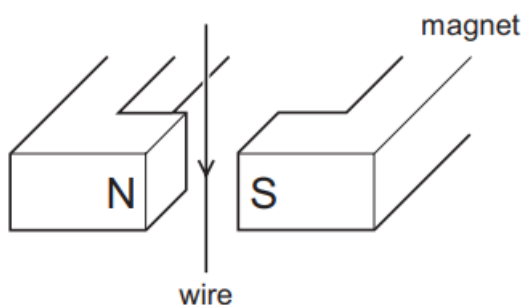
A new current is induced in the coil.

Which statement is correct?

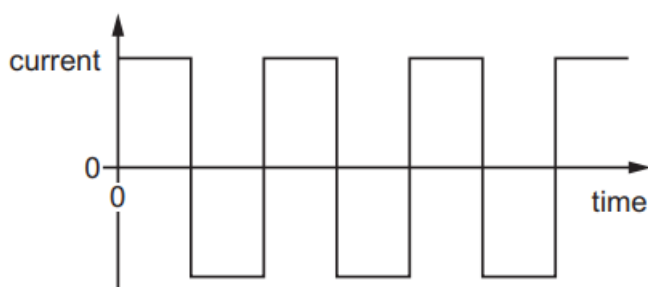
- A** The new induced current is in the opposite direction and causes the soft iron to attract the N pole.
- B** The new induced current is in the opposite direction and causes the soft iron to repel the N pole.
- C** The new induced current is in the same direction and causes the soft iron to attract the N pole.
- D** The new induced current is in the same direction and causes the soft iron to repel the N pole.

[Turn over

- 37 The diagram shows a wire in the magnetic field between two poles of a magnet.



The current in the wire repeatedly changes between a constant value in one direction and a constant value in the opposite direction, as shown in the graph.



What is the effect on the wire?

- A The force on the wire alternates between one direction and the opposite direction.
 - B The force on the wire is constant in size and direction.
 - C There is no force acting on the wire at any time.
 - D There is only a force on the wire when the current reverses.
- 38 Which row correctly describes an example of radioactive decay?

	original nucleus	emission	change or no change of element
A	stable	γ	change of element
B	unstable	α	change of element
C	unstable	α	no change of element
D	unstable	β	no change of element

- 39 A radioactive isotope of sodium has a half-life of 15 h.

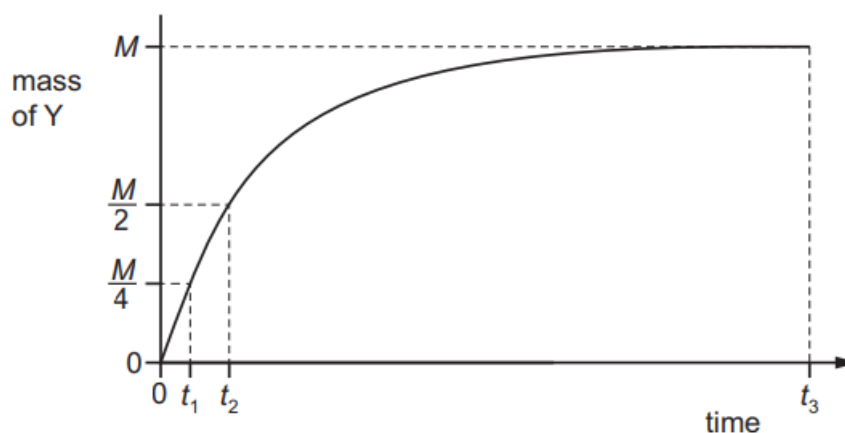
The table gives data from an experiment to show how the rate of decay of the isotope varies with time.

The background count rate has not been subtracted from these data.

time / h	0	10	20	30
$\frac{\text{count rate}}{\text{counts/s}}$	400	260	170	115

What is the background radiation count rate?

- A 12 counts / s
 B 15 counts / s
 C 20 counts / s
 D 30 counts / s
- 40 Radioisotope X decays to the stable isotope Y. The graph shows how the mass of Y present in a sample varies with time.



Which time interval gives the half-life of X?

- A $t_2 - t_1$ B t_2 C $t_3 - t_2$ D $\frac{1}{2} t_3$

[Turn over

