ZHONGHUA SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2025

SECONDARY 4 EXPRESS

Candidate's Name	Class	Register Number

PHYSICS

6091 /01

Paper 1

26 August 2025
1 hour

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, index number and class on the OTAS 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 OTAS.

Read the instructions on the OTAS 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.

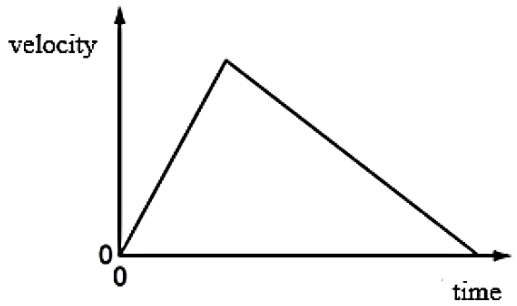
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1 Velocity is given by the change in displacement divided by the change in time.

How many vector quantities appear in this statement?

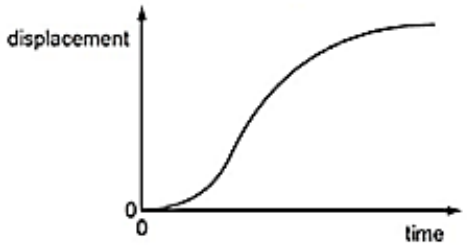
A 0 **B** 1 **C** 2 **D** 3

2 The velocity-time graph represents a short journey of an object.

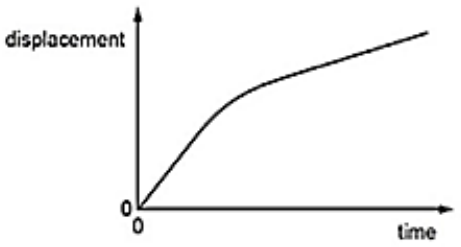


Which displacement-time graph represents the same journey?

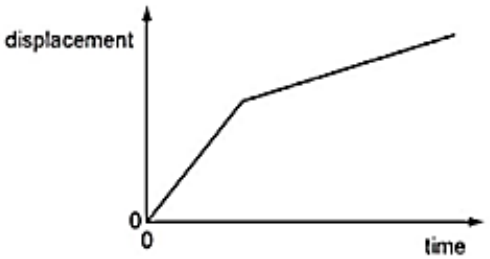
A



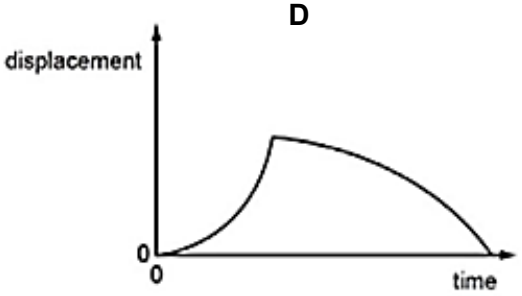
B



C



D



3 A man drives from Serangoon to Woodlands. The total distance he travels is 19 km. He started driving from Serangoon for 15 min and rested half an hour at a coffee shop. He then continued driving 20 min before he reached Woodlands.

What is the man's average driving speed?

A 0.54 km/h **B** 18 km/h **C** 19 km/h **D** 33 km/h

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4 The table below shows the readings on a car speedometer at every five seconds interval.

time / s	speed / km/h
0	0
5	10
10	22
15	36
20	54

Which of the following describes the acceleration of the car?

A constant

B decrease

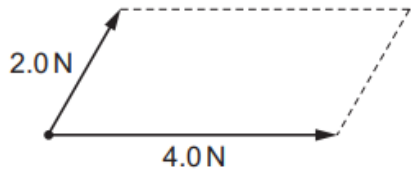
C Increase

D zero

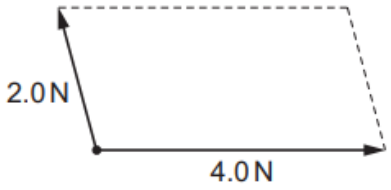
5 Forces of 4.0 N and 2.0 N act at a point.

Which scale diagram shows the forces that have a resultant of 4.0 N?

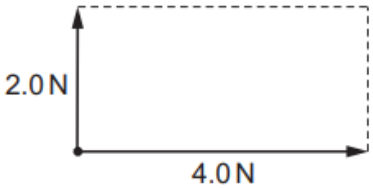
A



B



C

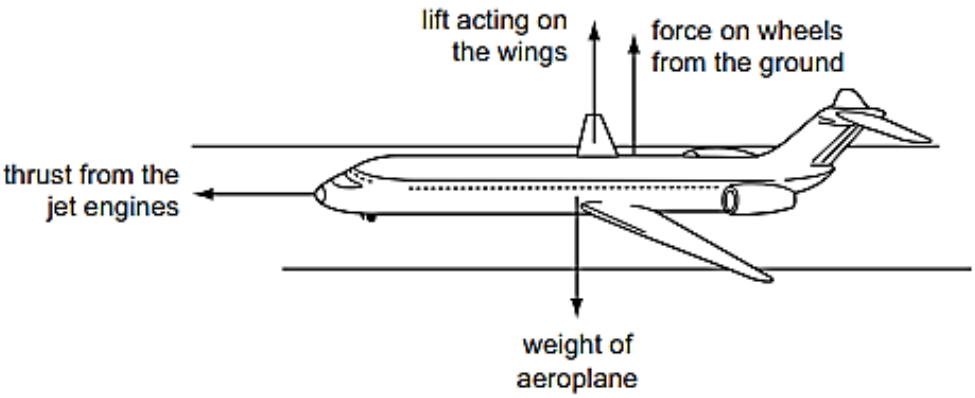


D



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6 An aeroplane is half way along a runway before it takes off. The arrows show the directions of four forces acting on the aeroplane.



The drag forces on the aeroplane are negligible. The gravitational field strength g is 10 N/ kg. The acceleration of the aeroplane is 2.0 m/s^2.

What is the largest force?

A the force on wheels from the ground

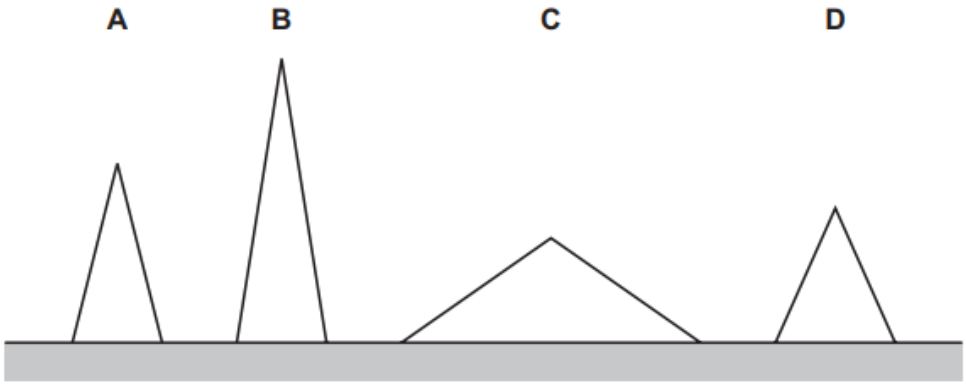
B the lift acting on the wings

C the thrust from the jet engines

D the weight of the aeroplane

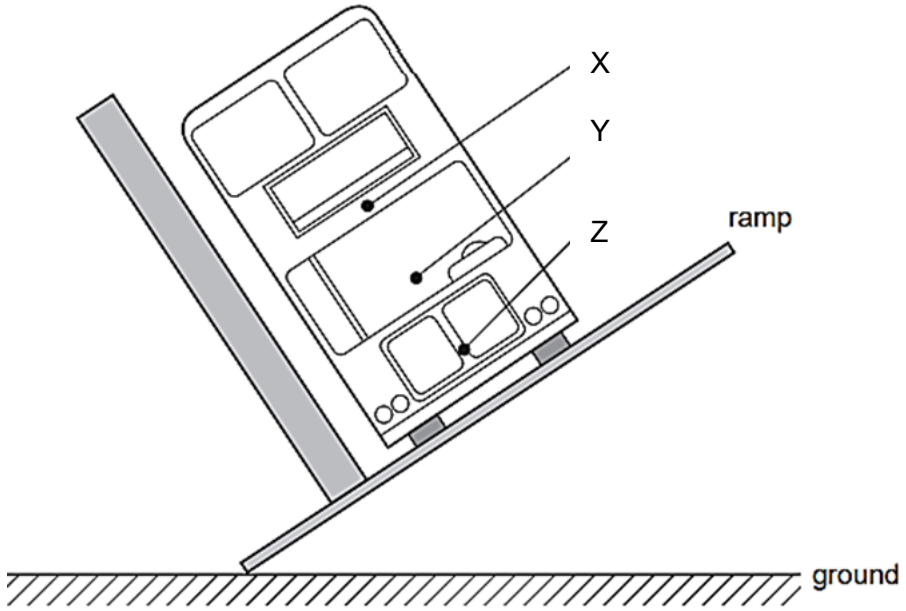
7 Four solid uniform cones have equal weight. They are placed on a bench as shown in the scale diagram.

Which cone is the most stable?



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8 The stability of a bus is tested by tilting it on a ramp. The diagram shows a bus that is just about to topple over.



Which statement is correct?

A Centre of gravity is at position X and anti-clockwise moments is contributed by the weight of the bus, about the pivot.

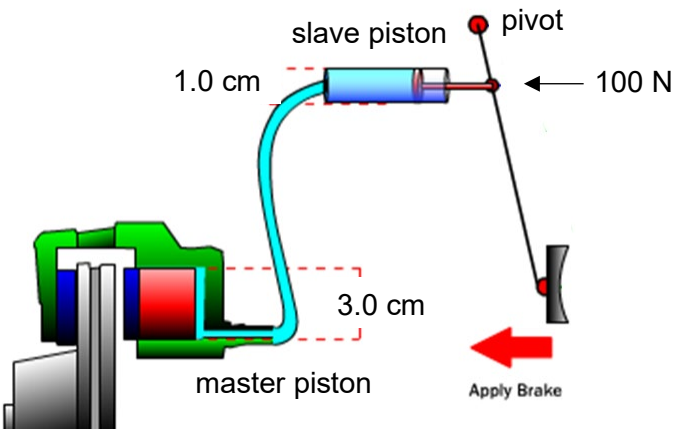
B Centre of gravity is at position Y and zero moments is contributed by the weight of the bus, about the pivot.

C Centre of gravity is at position Z and zero moments is contributed by the weight of the bus, about the pivot.

D Centre of gravity is at position Z and clockwise moments is contributed by the weight of the bus, about the pivot.

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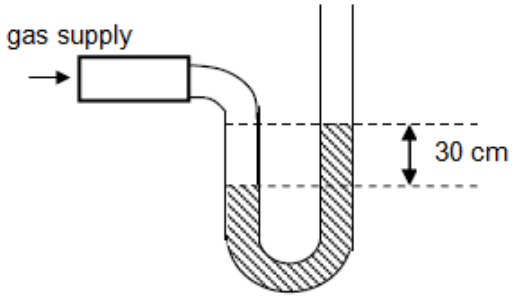
9 The diagram shows a simple car brake system. The slave piston and the master piston has a diameter of 1.0 cm and 3.0 cm respectively.



If the force exerted on the slave piston is 100 N, what is the force exerted on the master piston during braking?

A 200 N **B** 300 N **C** 600 N **D** 900 N

10 A mercury manometer that is connected to a gas supply. Atmospheric pressure is assumed to be 0.75 mHg.



What is the pressure of the gas supply?

A 29 cmHg **B** 31 cmHg **C** 45 cmHg **D** 105 cmHg

11 A man lifts five slabs from the ground on to the back of a lorry 1.5 m high. The total time taken is 50 s and each slab weighs 20N.

How much useful power does the builder produce?

A 0.60 W **B** 3.0 W **C** 30 W **D** 1500 W

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12 Hydroelectric, biofuel and fossil fuel power stations generate electrical energy.

Which option shows renewable and non-renewable energy sources?

	hydroelectric	biofuel	fossil fuel
A	non-renewable	renewable	renewable
B	non-renewable	non-renewable	renewable
C	renewable	non-renewable	non-renewable
D	renewable	renewable	non-renewable

13 Gas in a sealed glass container is cooled.

What happens to the gas molecules?

A They move closer together and their average speed decreases.

B They move closer together and their average speed increases.

C They move further apart and their average speed decreases.

D They stay the same distance apart and their average speed decreases.

14 When pollen grains suspended in water are viewed under the microscope, they are seen to be making small, erratic movements.

Which statement explains the movements?

A There are convection currents in the water.

B The grains are being hit by air molecules.

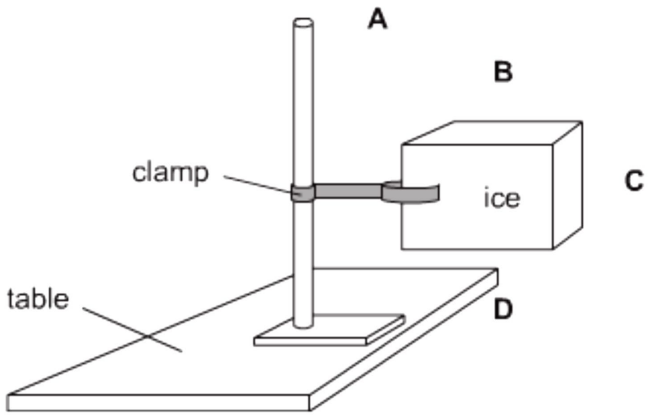
C The grains are being hit by water molecules.

D The grains are moving and colliding with one another.

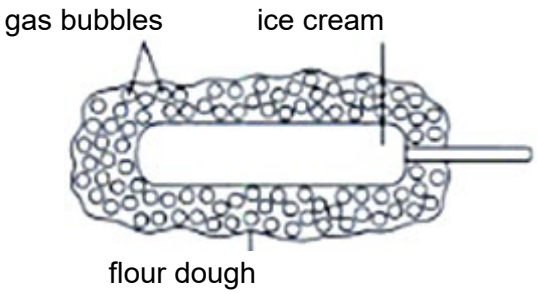
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15 The diagram shows a block of ice placed in a warm room.

At which point is the temperature the lowest?



16 The diagram shows a stick of ice cream that is fried in hot oil. Before the ice cream was fried, it was dipped in dough mixed with bicarbonate of soda.



Why does the ice cream remain frozen after it has been fried?

A The dough contains gas bubbles which allow heat energy that is trapped in the region near the ice cream to escape to the environment via convection currents.

B The dough contains gas bubbles which is a poor conductor of heat energy from hot oil to cold ice cream.

C The heat energy from the hot oil is not able to radiate effectively to the cold ice cream.

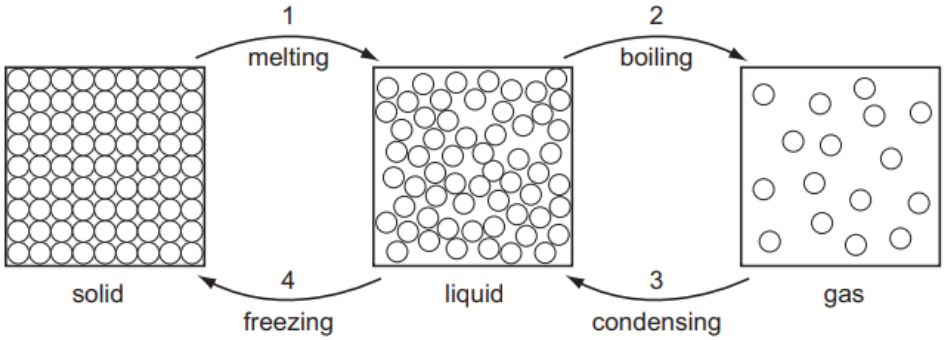
D The ice cream which is removed from the freezer has a layer of ice around it and ice is a good insulator of heat energy.

17 What is the correct unit for latent heat of vaporisation?

A J **B** J/kg **C** J/kgK **D** J/kg^{O}C

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18 Substances can change from one state to another as shown.



For substances to change from one state to another, there is a change in the internal energy between the particles in the system.

Which option correctly shows the changes involving the energy store that is made up of the total kinetic energy and the total potential energy between the particles in the system?

	stage	change in total kinetic energy	change in total potential energy
A	1	increases	increases
B	2	increases	decreases
C	3	no change	decreases
D	4	decreases	increases

19 A heater with a power rating of 1000 W is used to heat water of mass 0.10 kg. The water was initially at 30 °C and started boiling. At the end of time *t*, the mass of water left is 0.080 kg.

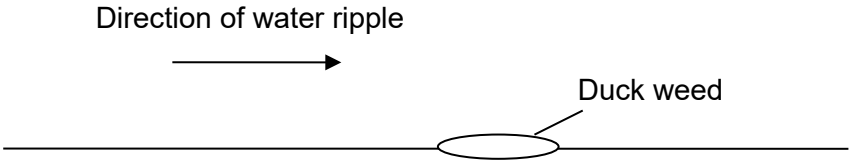
The specific heat capacity of water is 4.2 kJ/(kgK).
The specific latent heat of vaporization of water is 2.2×10^6 J/kg.

What is *t*?

A 44 s **B** 73 s **C** 180 s **D** 210 s

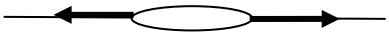
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20 Diagram shows a duck weed in the way of a water ripple.

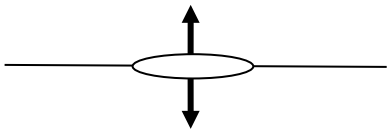


Which best describes how the duck weed will move as the water ripple passes through?

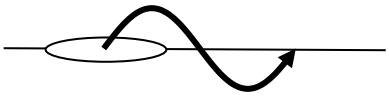
A



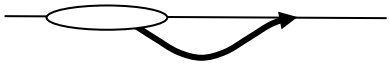
B



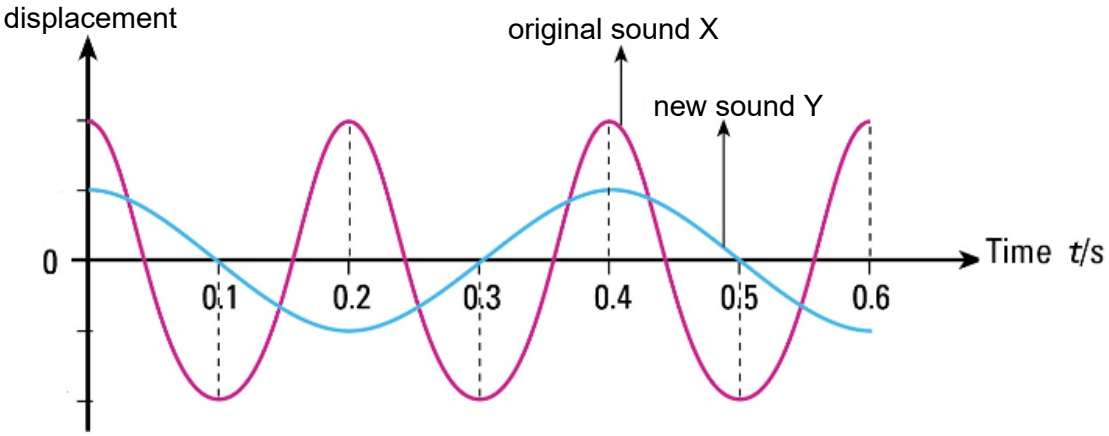
C



D



21 The displacement-time graph below represents the original, sound X and the new sound, Y, made by a violin.

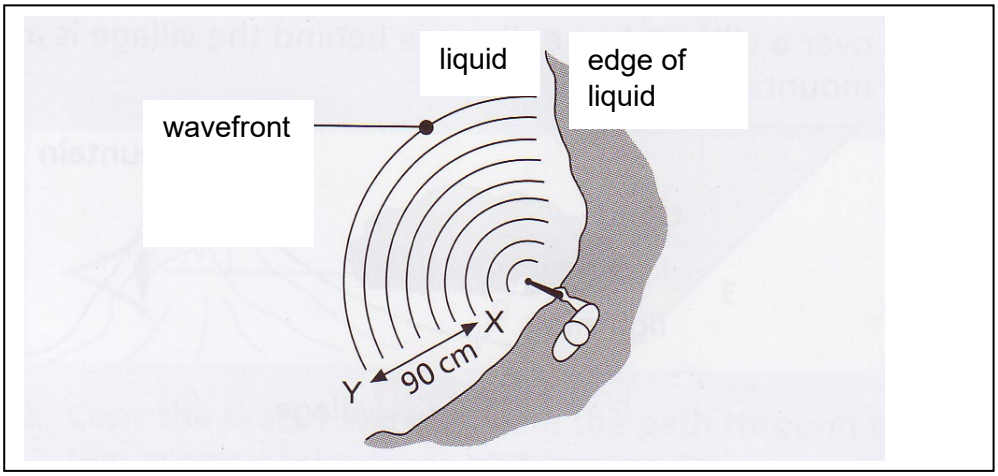


Which of the following describes the change in loudness and pitch correctly?

	loudness	pitch
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

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22 The robotic arm of a space probe is used to map the depth of the liquid body in Planet W as shown in the diagram below.



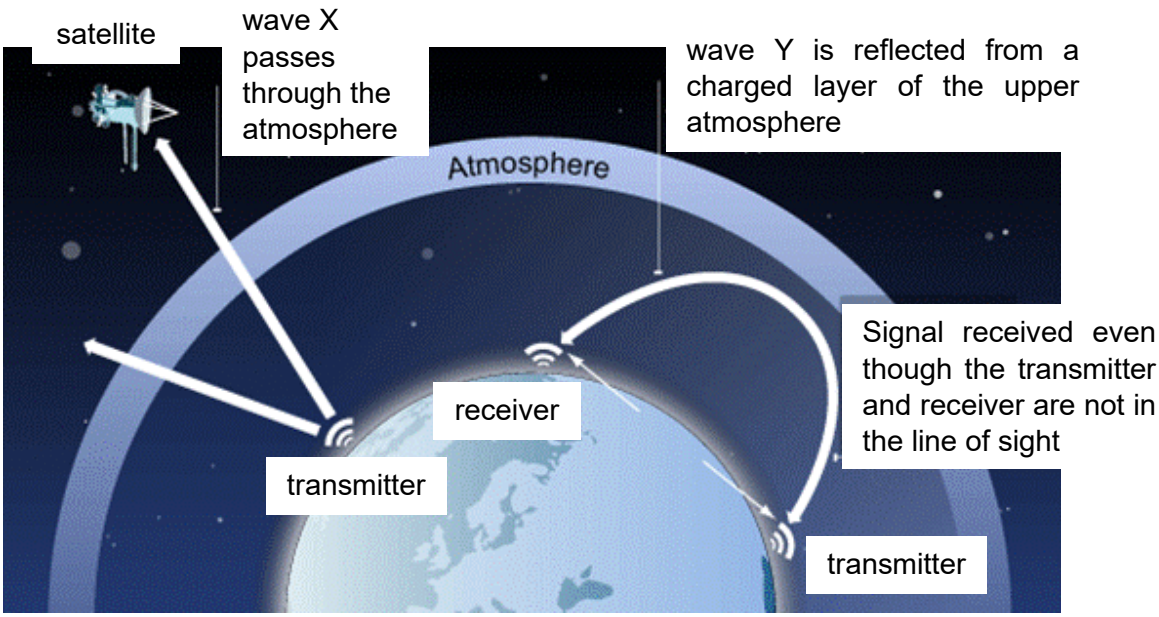
What is the wavelength of the wave and how did the frequency and speed change?

	wavelength / cm	frequency	speed
A	13	increased	increased
B	15	unchanged	unchanged
C	15	decreased	decreased
D	90	unchanged	unchanged

[Turn over

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23 The diagram shows radio waves being transmitted from transmitters and received by either a receiver or a satellite.



What is electromagnetic wave X and Y?

	X	Y
A	gamma ray	radio wave
B	radio wave	gamma ray
C	microwave	radio wave
D	radio wave	infra-red wave

24 A student holds a sheet of paper with letters on it facing a plane mirror. The letters on the paper are shown.



What does the student see in the mirror?

A



B



C

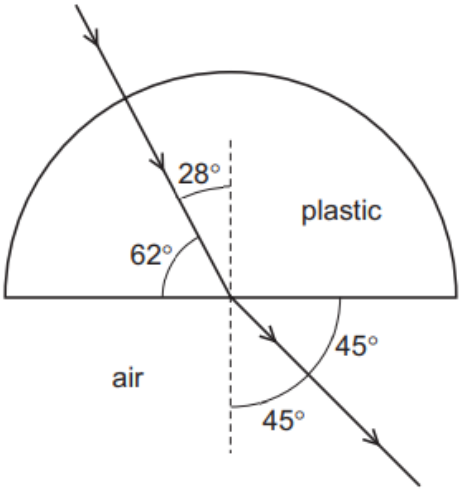


D



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25 A semi-circular block is made from a plastic. A ray of light passes through it at the angles shown.



What is the refractive index of the plastic?

A 1.3 **B** 1.4 **C** 1.5 **D** 1.6

26 Which statement correctly describes total internal reflection?

A Light travels from optically denser to less dense medium and is total reflected within the denser medium.

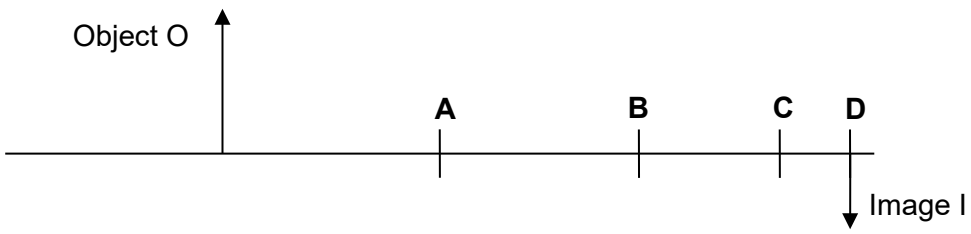
B Light travels from optically denser to less dense medium and is total reflected within the less dense medium.

C Light travels from optically less dense to denser medium and is total reflected within the denser medium.

D Light travels from optically less dense to denser medium and is total reflected within the less dense medium.

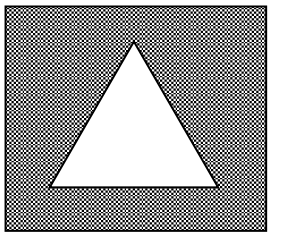
27 Diagram shows the image I formed when object O is placed in front of a thin converging lens.

Which is the principal focus of the lens?



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28 A triangular aperture of side 1.0 cm (Fig. 18A) is placed in front of a thin converging lens, as shown in Fig. 18B. When light is shone through the aperture, an image is formed on the screen placed 30.0 cm away.



length of each side of aperture = 1.0 cm

Fig. 18A

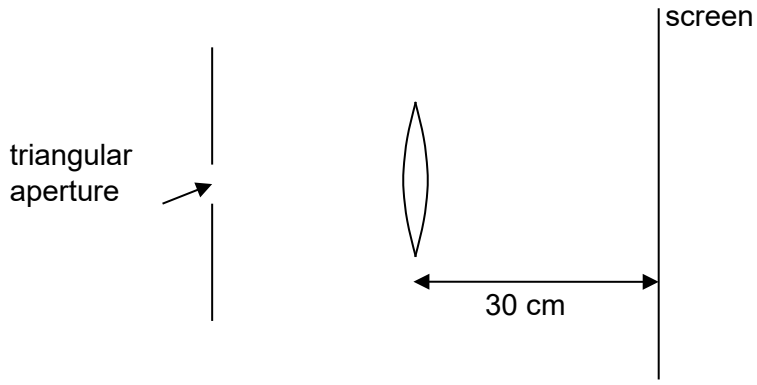
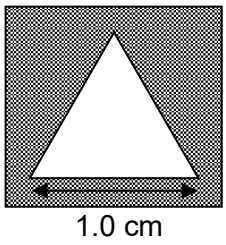


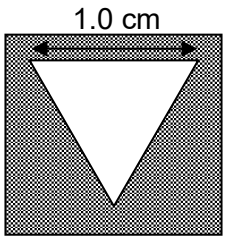
Fig. 18B

If the focal length of the lens is 15.0 cm, which is the image formed on the screen?

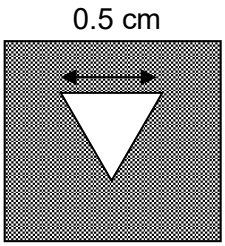
A



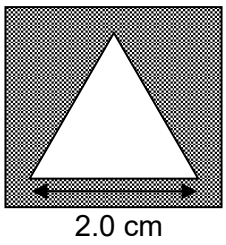
B



C

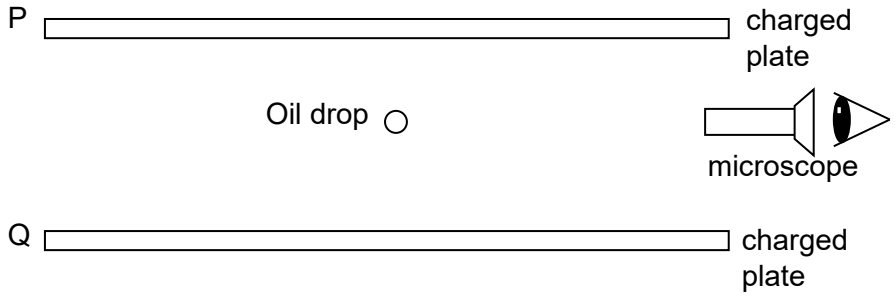


D



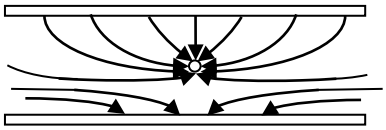
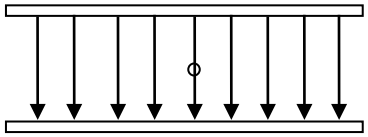
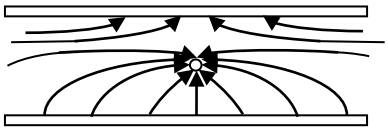
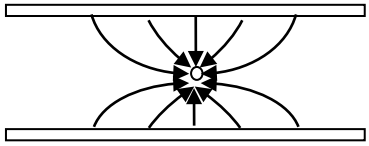
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29 Diagram shows an experiment performed by physicist Robert Millikan in 1909.



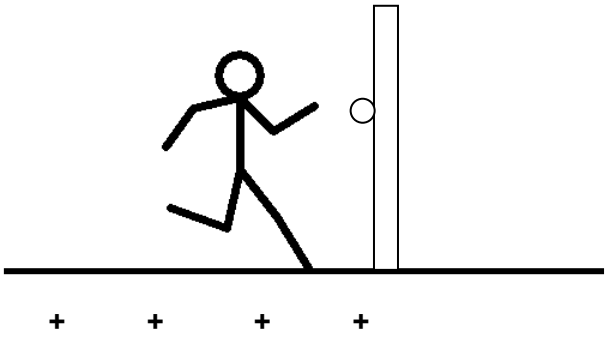
In the experiment, he placed a negatively charged oil drop between a pair of charged parallel plates. He then attempted to stop the oil drop from falling under the influence of gravity by changing the strength of the electric field between the plates.

What are the charges formed on plates P and Q, and the combined electric field pattern between the oil drop and the two plates?

	P	Q	Electric field pattern
A	Positive	Negative	
B	Positive	Negative	
C	Negative	Positive	
D	Positive	Positive	

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30 A man walks bare-foot in an air-conditioned room and rubs his feet against the carpet. The carpet is then charged positively.



He then touches a wooden door knob. Which correctly describes the charges on the knob and the man?

	charge on man	charge on knob
A	negatively charged	neutral
B	negatively charged	positively charged
C	positively charged	neutral
D	positively charged	negatively charged

31 Sets of voltage-current readings are obtained for different electrical components.

Which set of readings is for a 100 Ω resistor?

A	voltage/ V	-3	-2	-1	0	+1	+2	+3
	current/ mA	-30	-15	-5	0	+5	+15	+30
B	voltage/ V	-3	-2	-1	0	+1	+2	+3
	current/ mA	-30	-20	-10	0	+10	+20	+30
C	voltage/ V	-3	-2	-1	0	+1	+2	+3
	current/ mA	-60	-40	-20	0	+20	+40	+60
D	voltage/ V	-3	-2	-1	0	+1	+2	+3
	current/ mA	-60	-45	-30	0	+30	+45	+60

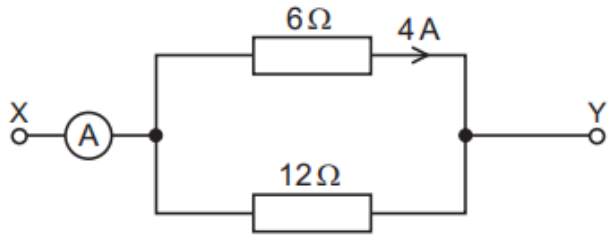
32 A pair of crocodile clips is inserted into a lemon and connected to a small light-bulb. The lemon carries 2.0 C of charge and the charge takes 8.5×10^{-3} min to travel from one end of the clip to the other.

What is the current produced by the lemon?

A 0.017 A **B** 1.0 A **C** 3.9 A **D** 240 A

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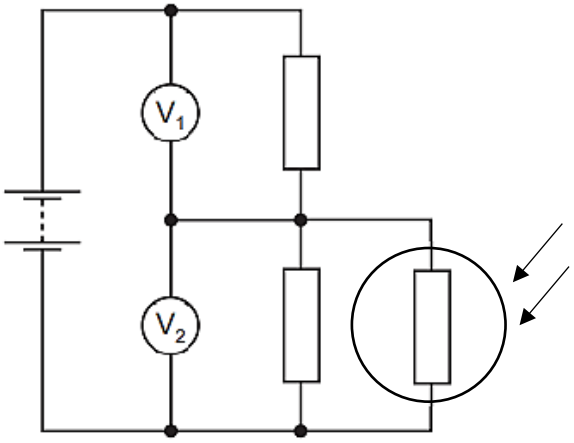
33 Two resistors of 6 Ω and 12 Ω are arranged in parallel. A potential difference is connected across the terminals X and Y. The current in the 6 Ω resistor is 4 A.



What is the current in the ammeter?

A 4 A **B** 6 A **C** 8 A **D** 12 A

34 The circuit diagram shows a light dependant resistor (L.D.R.) connected in parallel to the lower half of a potential divider.



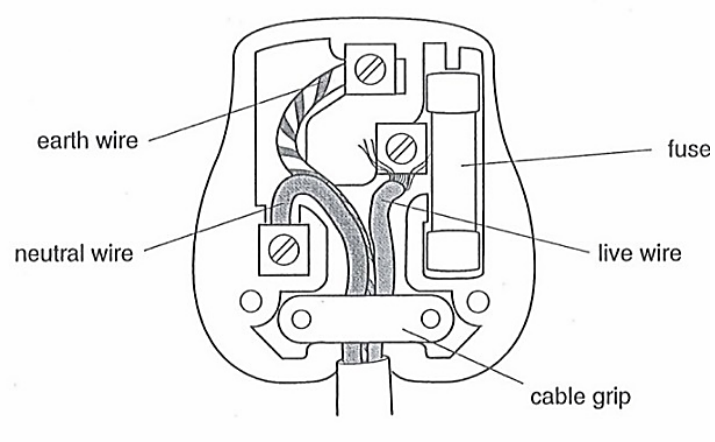
The brightness surrounding the L.D.R. decreases.

What happens to the two voltmeter readings?

	reading on V_1	reading on V_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

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35 The following shows a three-pin plug of a kettle whose live wire has not been connected properly.



The exposed copper wires of the exposed live wire touch the neutral pin.

Which of the following will occur?

A The current increases and the fuse will blow to prevent any electrical fire risk.

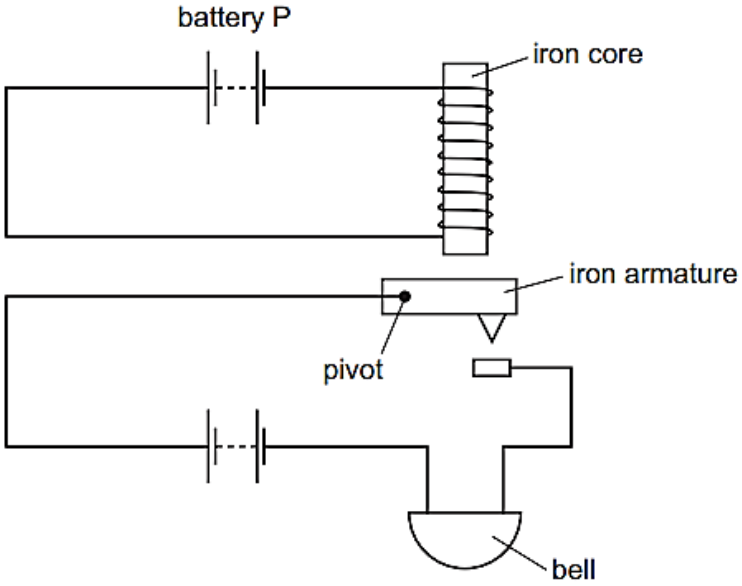
B The earth wire will divert the high current to the ground to prevent any electrical risk.

C The metal casing of the kettle will be at high potential and pose an electrocution risk.

D The neutral wire will divert the high current to the ground to prevent any electrical risk.

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36 The diagram shows an alarm system.

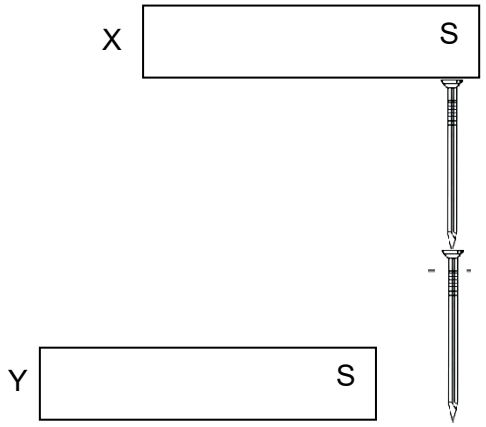


What happens when battery P is disconnected?

	iron armature	bell
A	falls	rings
B	moves up	stop ringing
C	moves up	rings
D	stays horizontal	stop ringing

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37 Two nails are attracted to a magnet X. A second magnet Y is held near the bottom of the nails.



Which statement describes the motion of the nails?

The nails will

A drop to the ground.

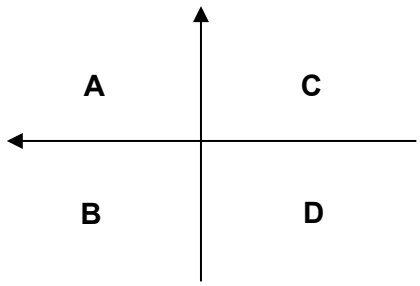
B remain stationary.

C swing to the left.

D swing to the right.

38 Equal amount of current is flowing in two insulated wires, perpendicular to each other as shown in the figure below.

Which segment, **A**, **B**, **C** or **D**, has the strongest magnetic field flowing into the paper?



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39 Fig. 39.1(a) shows a simple alternating current (a.c.) generator and Fig. 39.1(b) shows the initial voltage produced against time.

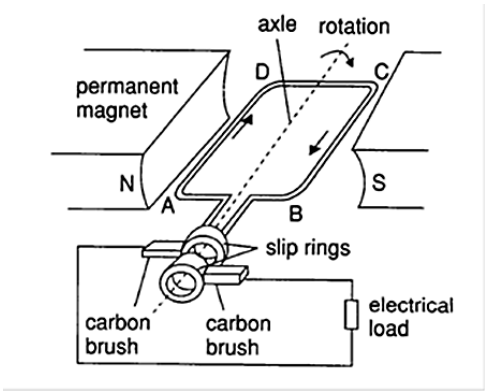


Fig. 39.1(a)

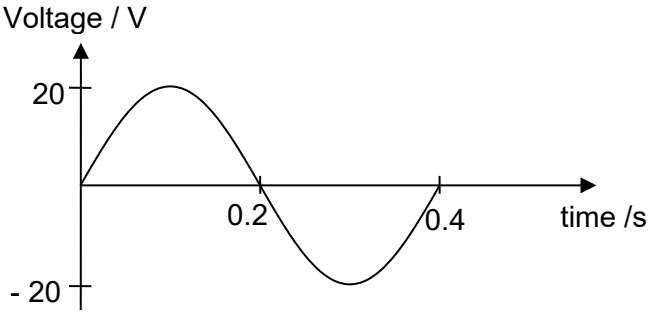


Fig. 39.1(b)

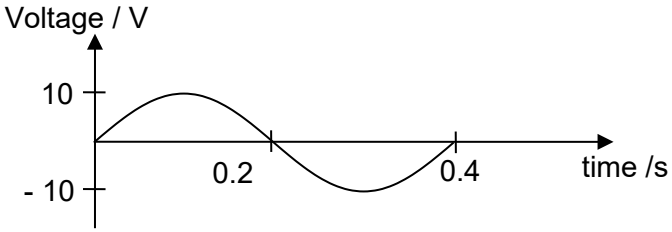


Fig. 39.2

After a certain change was made to the a.c. generator, the voltage against time waveform is as shown in Fig. 39.2.

What is likely to be the change?

A Reduce the rotating speed.

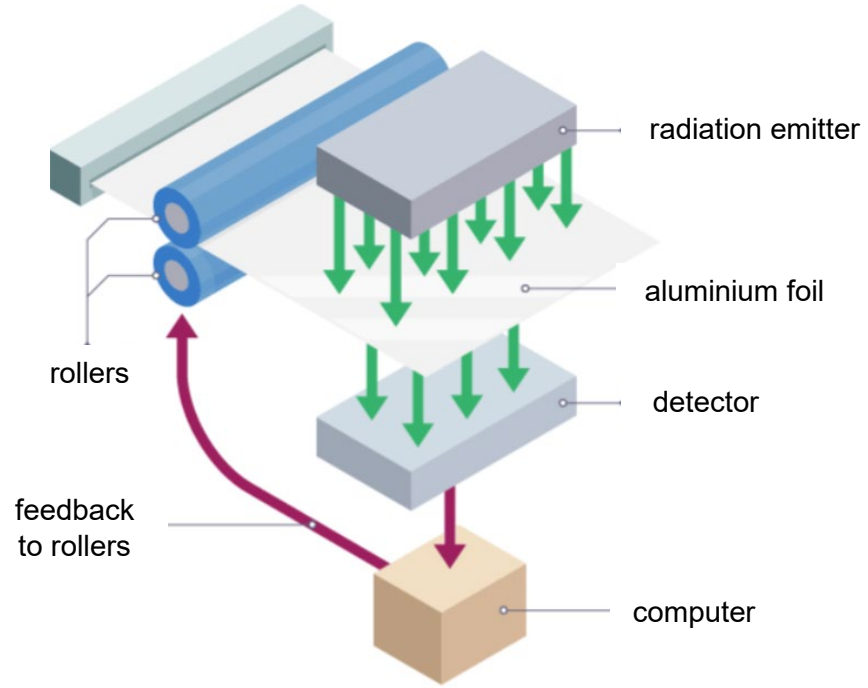
B Use a magnet that has a weaker strength.

C Increase the number of turns of the coil in the generator.

D Place a soft iron core in the centre of the coil.

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40 The diagram shows a machine that is used to produce aluminium foil of the correct thickness. Radiation is made to pass through the foil.



If the foil is too thick, it absorbs more radiation and if the foil is too thin, it absorbs less radiation. The detector will send signals to the rollers to either increase or decrease the force on the foil.

Which type of radiation is suitable to use?

A alpha-particles only

B beta-particles only

C gamma-rays only

D either alpha-particles or beta-particles

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