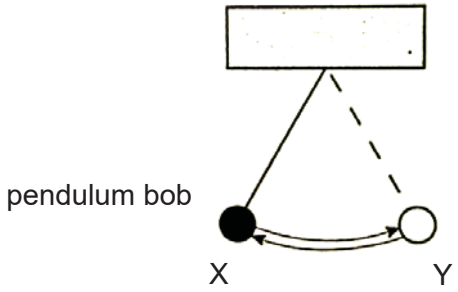
Multiple Choice Questions [40 marks]
Answer **all** questions and shade your answers on the OMR sheet provided.

1 The diagram below shows a simple pendulum. Using a stopwatch, which would be the most accurate way to measure the period of the pendulum?



A Time the motion from X to Y and back to X.
B Time the motion from X to Y and double it.
C Time the motion from X to Y and back to X for 20 cycles and divide by 20.
D Time the motion from X to Y and back to X again for 20 cycles and multiply by 20.

2 A micrometer screw gauge is used to measure the thickness of a plastic block.
A student takes an initial zero reading as shown in diagram 1 and then a reading of the thickness of the plastic block in diagram 2.

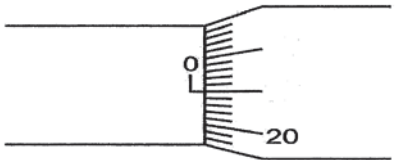


diagram 1

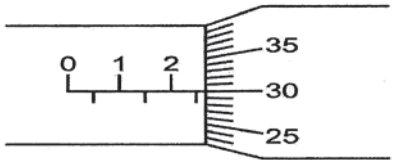
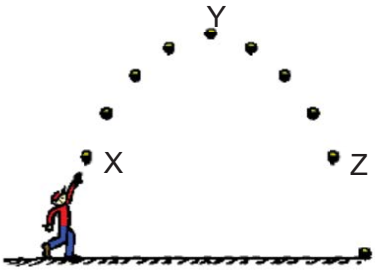


diagram 2

What is the actual thickness of the plastic block?

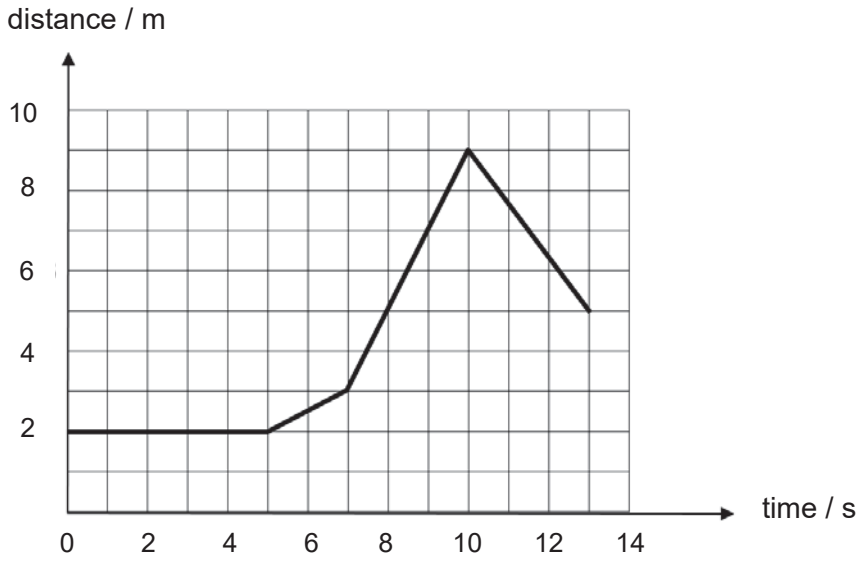
A 2.05 mm **B** 2.30 mm
C 2.55 mm **D** 3.05 mm

3 An object is thrown upwards from X and follows a path as shown. The highest point reached is Y. Assuming that no air resistance acts on the object, which of the following statements about the acceleration due to gravity is true?



A It is greater at X than Y. **B** It is greatest at Z.
C It is the same at X, Y and Z. **D** It is zero at Y.

4 The diagram shows the distance-time graph of a bicycle.



When is the speed of the bicycle 2.0 m / s?

A 0 s – 5.0 s
B 5.0 s – 7.0 s
C 8.0 s – 10.0 s
D 10.0 s – 11.5 s

5 A student studies some equations.

power = work done / time
force = mass x acceleration
velocity = displacement / time

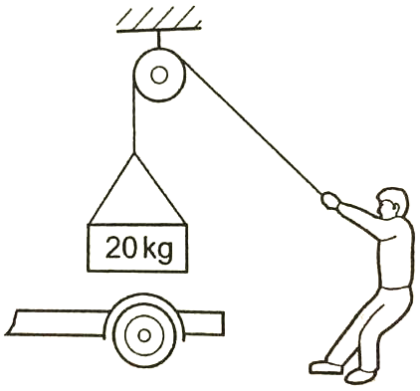
How many different scalar quantities are there in the equations?

A 2
B 3
C 4
D 5

6 What must be changing when a body is accelerating?

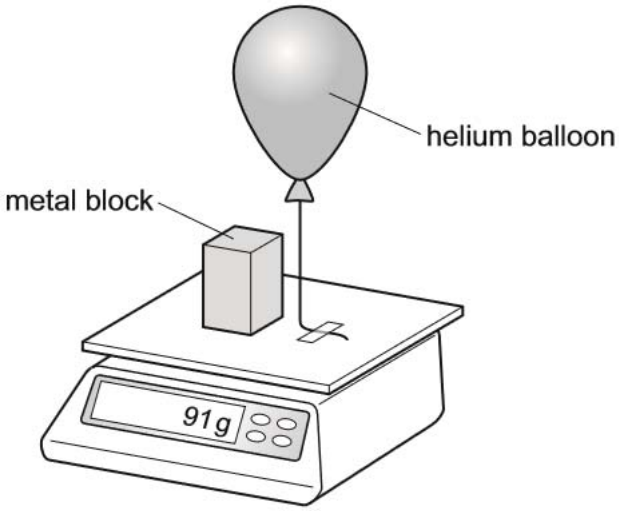
A The force acting on the body.
B The weight of the body.
C The speed of the body.
D The velocity of the body.

7 A man just supports a mass of 20 kg suspended from a rope. Given that the friction in the pulley is 10 N, what is the tension in the rope?



A 0 N
B 10 N
C 190 N
D 210 N

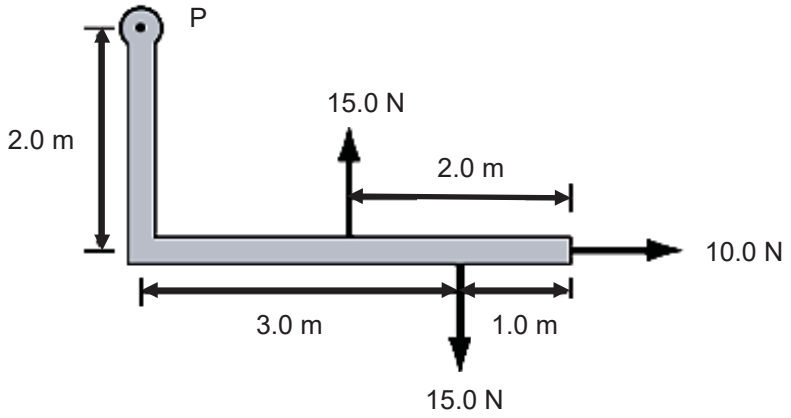
8 A helium balloon is tied to an electronic balance. A metal block of mass 100 g is placed on the balance. The reading on the balance is 91 g.



Which statement can be deduced from this experiment?

A The balloon exerts an upward force of 9.0 N on the top-pan balance.
B The balloon has a mass of -9.0 g.
C The balloon has a weight of 0.09 N.
D The resultant downward force on the electronic balance is 0.91 N.

9 An L-shaped rigid lever arm is pivoted at point P. Three forces act on the lever arm, as shown in the diagram.

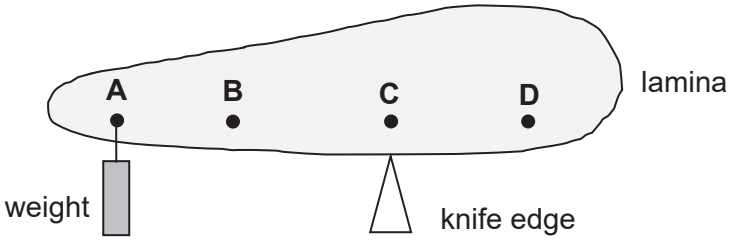


What is the magnitude of the resultant moment due to the three forces about point P?

A 0 Nm
B 5.0 Nm
C 15 Nm
D 20 Nm

10 In order to balance a non-uniform lamina on a knife edge as shown, a weight is suspended at point A.

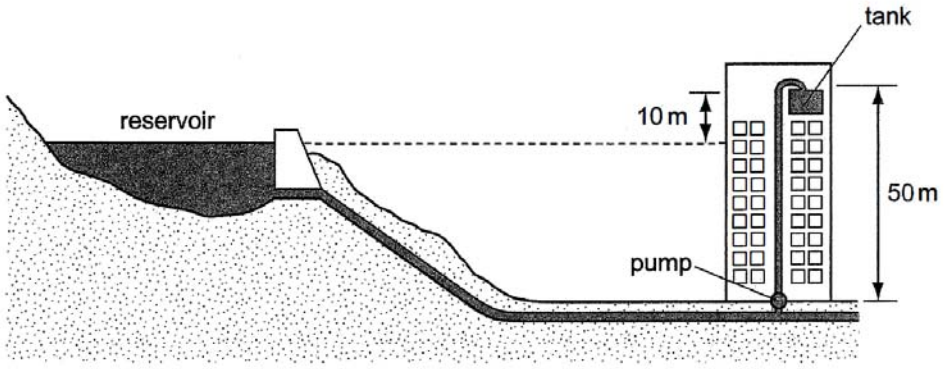
Where is the position of centre of gravity of this arrangement?



11 A crane uses a petrol engine to lift a heavy machine. What is the overall energy conversion in the system when the machine is lifted upwards at a constant speed?

A chemical potential energy to gravitational potential energy and kinetic energy
B chemical potential energy to gravitational potential energy
C electrical energy to kinetic energy
D electrical energy to gravitational potential energy

12 A building receives water from a nearby reservoir. A pump is used to lift the water into a storage tank at the top of the building.



Given that the gravitational field strength is 10 N / kg and the efficiency of the pump is 80 %, what is the energy input to the pump to lift each kilogram of water into the tank?

A 100 J
B 125 J
C 400 J
D 635 J

13 Which of the following would be the most likely to sink into soft ground?

A A loaded lorry with four wheels.
B A loaded lorry with six wheels.
C An unloaded lorry with four wheels.
D An unloaded lorry with six wheels.

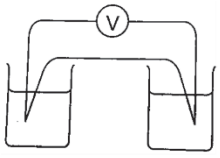
14 A barometer is carried from the sea level to the top of Mount Fuji.
Which of the following statements about the reading on the barometer is true?

A The reading falls because gravity has increased.
B The reading falls because there is less air above the barometer.
C The reading rises because temperature has increased.
D The reading rises because air pressure has increased.

15 The temperature shown by a mercury-in-glass thermometer decreases. Which of the following is constant?

A the density of the mercury
B the internal energy of the mercury
C the mass of the mercury
D the volume of the mercury

16 The table shows two measurements taken using a thermocouple.

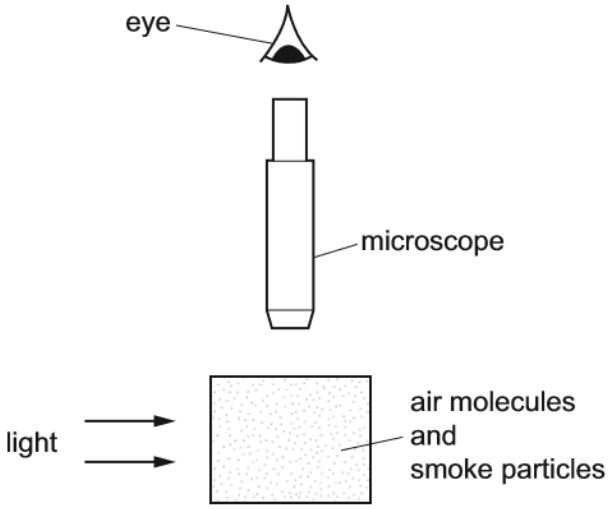


measurement	temperature of hot junction / °C	temperature of cold junction / °C	electromotive force / mV
1	100	0	25
2	θ	0	58

What is the value of θ?

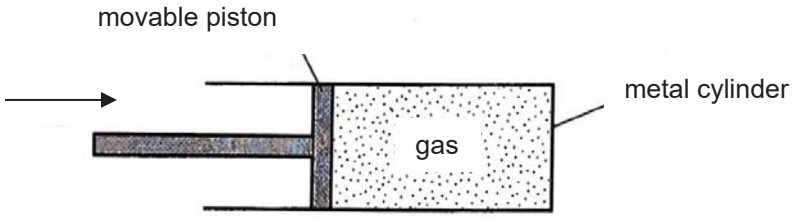
A 25 °C **B** 58 °C
C 116 °C **D** 232 °C

17 A student observes the Brownian motion of smoke particles in air through a low-power microscope. What does the student see when the temperature of the air is increased?



A Air molecules colliding with the smoke particles more forcefully.
B Air molecules are moving around at higher speeds.
C Smoke particles are vibrating about fixed positions.
D Smoke particles are moving around more randomly.

18 A fixed mass of gas is trapped in a metal cylinder by a movable piston. The piston is moved inwards slowly. The volume of the gas decreases but its internal energy is unchanged.



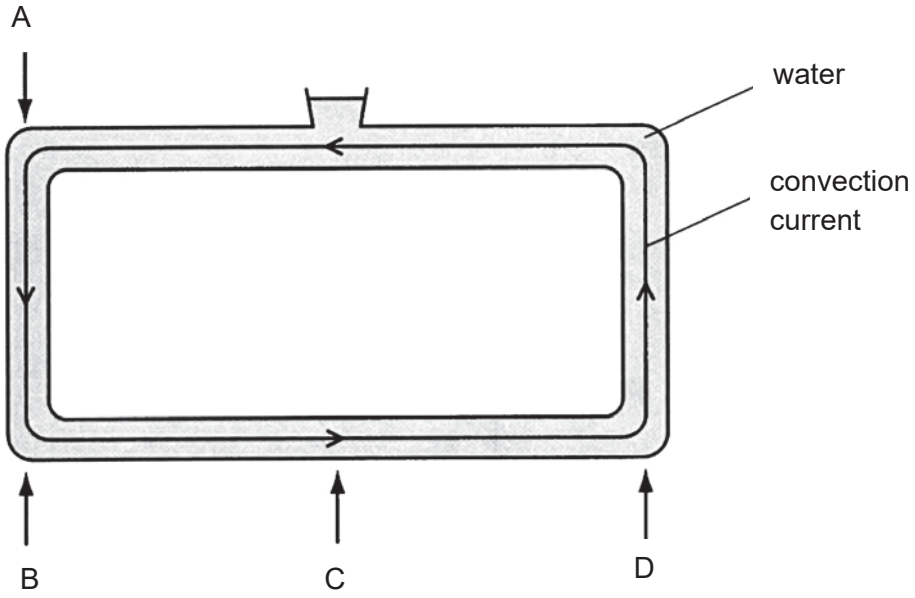
What happens to the speed of the gas molecules and their rate of collision with the piston?

	speed of gas molecules	rate of collision
A	unchanged	unchanged
B	increases	decreases
C	unchanged	increases
D	deceases	increases

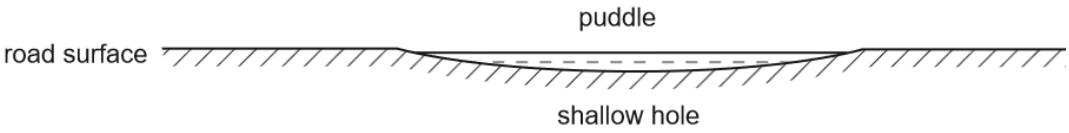
19 Which statement about aluminium explains why it is a better conductor of heat than glass?

A Atoms in aluminium are more closely packed than those in glass.
B Atoms move through aluminium and pass on kinetic energy.
C Atoms vibrate and emits infra-red radiation to the cold end of the glass at a slower rate.
D There are free electrons in aluminium.

20 The diagram shows a convection current produced when water in a standing container is heated. Where is the container heated to produce the convection current?



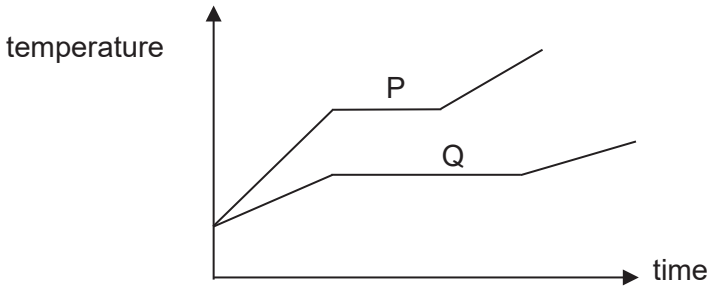
21 The diagram shows a cross-section through a rain-water puddle formed in a shallow hole in the road surface. Over a period of time, air temperature, wind speed and wind direction remain constant.



What happens to the rate of evaporation of water from the puddle?

A It decreases, because the surface area decreases.
B It increases, because the puddle gets shallower.
C It increases, because the temperature of water has decreased.
D It remains constant, because air temperature and wind speed is unchanged.

22 Two solids P and Q have the same mass. They are heated separately by the same heater under identical conditions. The changes in temperature with time for the two solids are as shown.

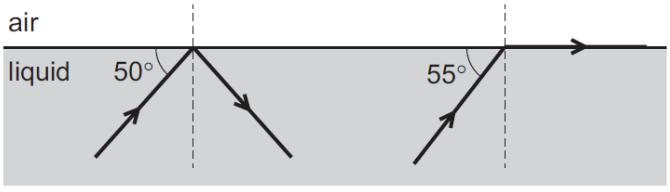


Which of these statement(s) is/are correct?

1 The specific latent heat of fusion of P is higher than that of Q.
2 P has a higher specific heat capacity than Q.
3 The freezing point of P is higher than that of Q.

A 3 only
B 1 and 2 only
C 2 and 3 only
D All of the above.

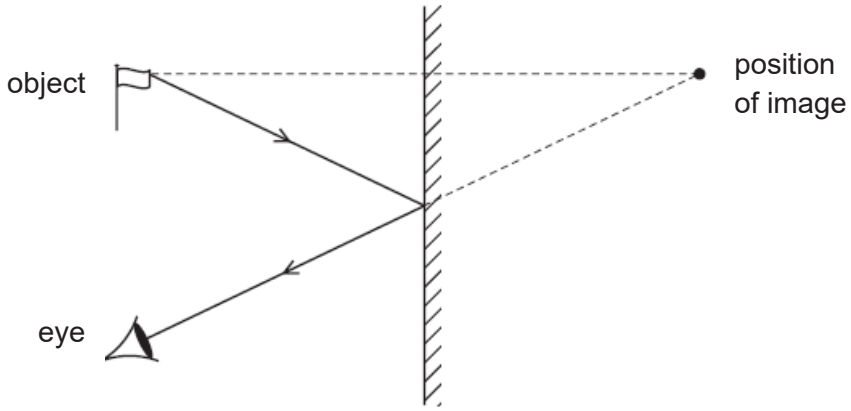
23 The diagram represents the surface of a transparent liquid. Two rays of light are travelling within the liquid. They both reach the surface. The path of each ray is shown.



What is the refractive index of this liquid?

A 1.2 **B** 1.3
C 1.6 **D** 1.7

24 The diagram shows the position of an image formed by a plane mirror.

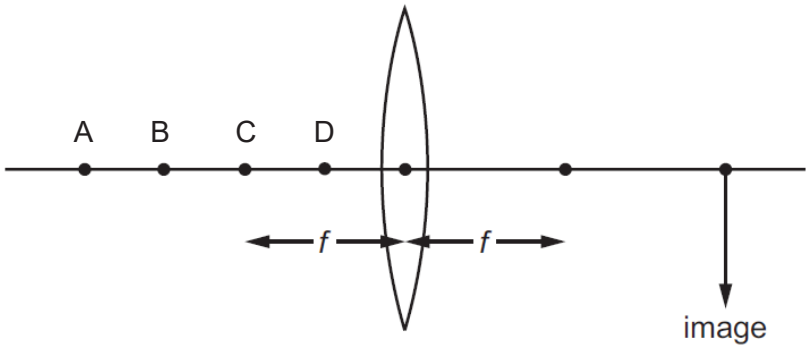


What are the characteristics of the image?

	orientation	size
A	inverted	same size
B	upright	diminished
C	laterally inverted	same size
D	upright	enlarged

25 The diagram shows a thin converging lens of focal length *f* and an image.

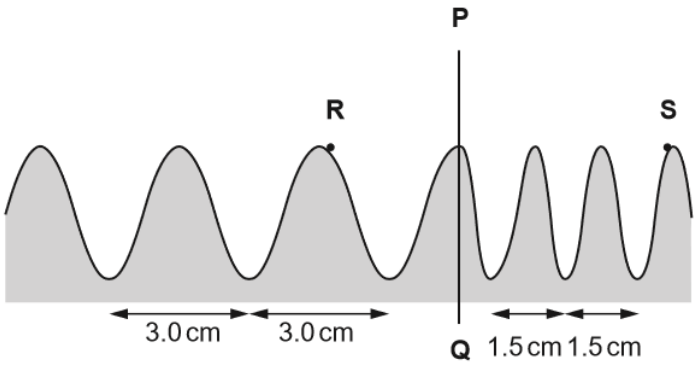
Where must the object be placed to produce an image that is real and has the same size as the object?



26 What is meant by the term *wavefront*?

A A line joining a trough and a crest on a wave.
B A line joining all the troughs on a wave.
C The distance between successive crests on a wave.
D The distance travelled by a complete wave.

27 The diagram shows a water wave in a ripple tank.



The wave has a speed of 0.15 m / s at R.

The wave crosses a boundary PQ where the distance between crests changes from 3.0 cm to 1.5 cm.

What is the velocity of the wave at point S?

A 0.075 m / s **B** 0.15 m / s
C 0.30 m / s **D** 0.45 m / s

28 The wavelength of X-ray is approximately the diameter of an atom.

What is the frequency of X-ray?

A 3.0×10^{-18} Hz **B** 3.0×10^{-6} Hz
C 3.0×10^{4} Hz **D** 3.0×10^{18} Hz

29 Which statement about electromagnetic waves is correct?

A Gamma rays are used in sunbeds for artificial sun tanning.
B Radio waves are used in satellite communications.
C Visible light can damage human proteins and DNA.
D X-rays are used to check for cracks in metals.

30 Ultrasound is used to map the ocean floor. During one survey, the depth of water is 1800 m. An ultrasound pulse is sent from the surface and when it returns to the receiver, another pulse is sent immediately. In any period of 12 s, five pulses are sent down from the surface and received.

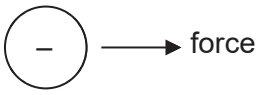
What is the speed of the ultrasound in water?

A 150 m / s **B** 360 m / s
C 1200 m / s **D** 1500 m / s

31 What is the approximate range of audible frequencies for a young and healthy person?

A 1.0 Hz – 20 Hz **B** 20 Hz – 20 kHz
C 20 kHz – 100 kHz **D** 100 kHz – 2000 kHz

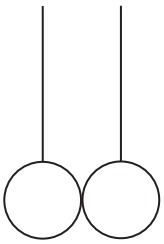
32 A stationary negative charge in an electric field experiences an electric force in the direction shown.



What is the direction of the electric field?

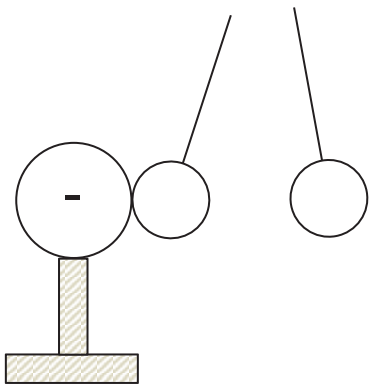
A horizontally to the right
B horizontally to the left
C into the page
D out of the page

33 Two identical uncharged light conducting balls are suspended by insulating thread and touching each other as shown.

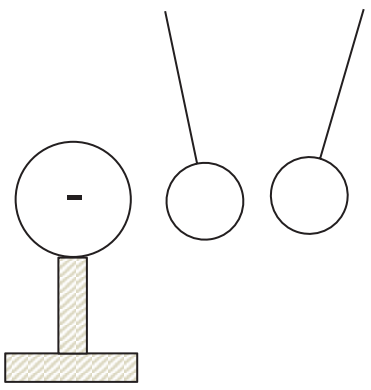


Which of the following shows the position of the balls when a strong negatively charged conducting sphere touches one of them?

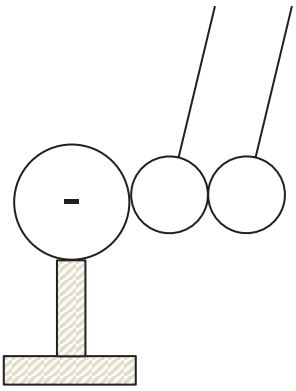
A



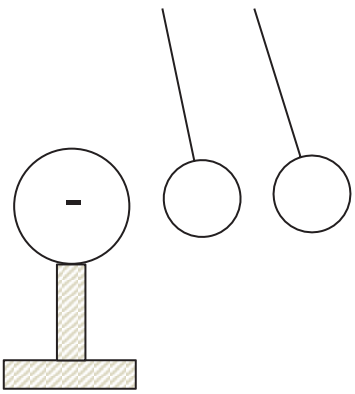
B



C



D



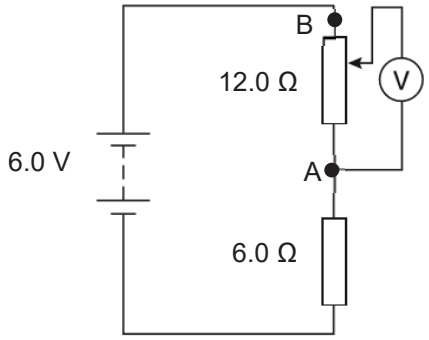
34 The terminals of a battery are joined by a length of resistance wire. Which of the following changes will increase the current through the battery?

A connecting an identical wire in series with the first one
B covering the wire with rubber insulation
C replacing the wire with a longer wire of the same material and thickness
D replacing the wire with a thicker and shorter wire of the same material

35 Which of the following is equivalent to the unit for potential difference?

A A / s
B Cs
C J / C
D W / s

36 The diagram shows a circuit with a potential divider connected in series with a fixed resistor.



What are the minimum and maximum readings that can be obtained on the voltmeter when the contact of the potential divider moved from A to B?

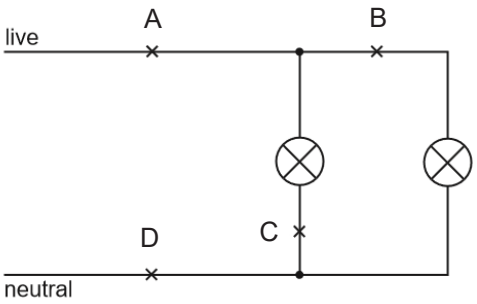
	minimum / V	maximum / V
A	0	4.0
B	0	6.0
C	2.0	4.0
D	6.0	12.0

37 In which of the following situation(s) will a fuse possibly melt?

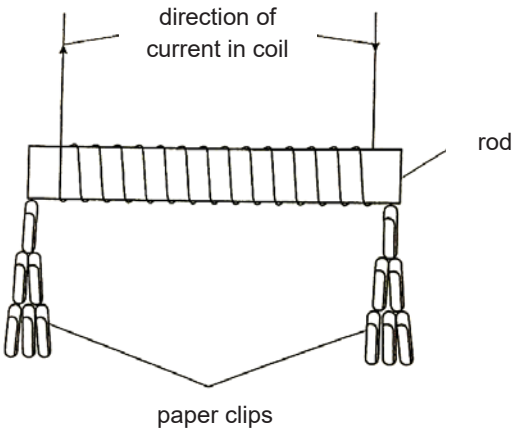
1 The live wire touches the earth wire.
2 The live wire touches the neutral wire.
3 The earth wire is touched by a person.
4 The fuse is fixed on the neutral wire instead of the live wire.

A 2 only
B 1 and 2 only
C 3 and 4 only
D 1, 2 and 3 only

38 In order to turn off only one lamp, which is the safest switch position?



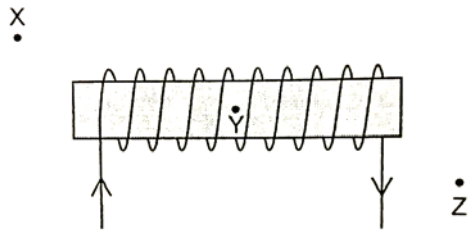
39 Four rods are placed, in turn, inside a coil of copper wire.



The table below gives the results of the experiment. Which rod would be the most suitable to use as the core of a coil in a circuit breaker?

rod	number of paper clips picked up when there is current in the coil	number of paper clips picked up when there is no current in the coil
A	1	0
B	20	5
C	40	0
D	40	20

40 There is a current in the solenoid.



How does the strength of the magnetic field at points X, Y and Z compare?

A equal at X, Y and Z
B equal at X and Z but stronger at Y
C stronger at X than Y, and stronger at Y than Z
D weakest at Y

Section A: Structured Questions [50 marks]

Answer **all** the questions in this section in the spaces provided.

1 When two forces of 5.0 N are added, they may produce a resultant force that has any value from 0 N to 10 N.

(a) Describe how it is possible to produce a zero resultant force from two forces of 5.0 N.

……

…… [1]

(b) In the space below, draw a vector diagram to show how a resultant force of about 5.0 N may be obtained from the two 5.0 N forces. Label the forces clearly and state the scale used. [3]

2 A small spacecraft, known as Skylab, is to land on the planet Mars.

The spacecraft enters Mars' atmosphere with an initial speed of V_1 and it slows down at a constant rate. When the speed reaches 1500 km / h at time t_1, a parachute attached to it opens and friction with the atmosphere increases. The spacecraft then slows down at a decreasing rate until it eventually reaches a steady speed before it hits the surface of Mars at time t_2.

(a) On Fig. 2.1, complete the speed–time graph for Skylab. Label the speed of Skylab on the axis with the information given. [3]

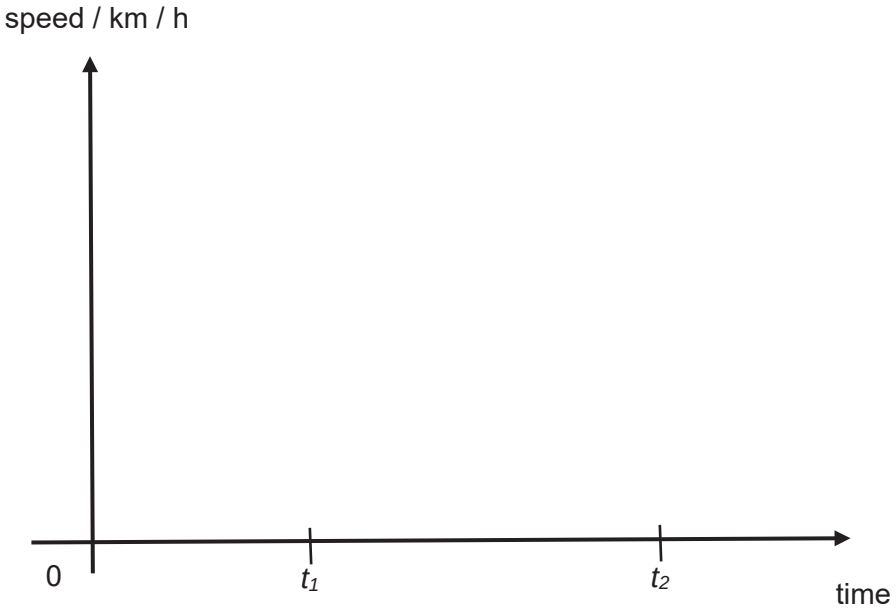


Fig. 2.1

(b) State what is meant by a *gravitational field*.

……

…… [1]

(c) The mass of Skylab is 50 kg.

At one point, the gravitational field strength of Mars is 3.0 N / kg and the total resistive force acting upwards on Skylab is 600 N.

Determine

(i) the weight of Skylab,

weight = …… [1]

(ii) the deceleration of Skylab.

deceleration = ... [2]

3 Fig. 3.1 shows a stool. A horizontal force F is exerted by Sam to keep the stool balanced. C is the centre of gravity of the stool and the weight of the stool is 25 N.

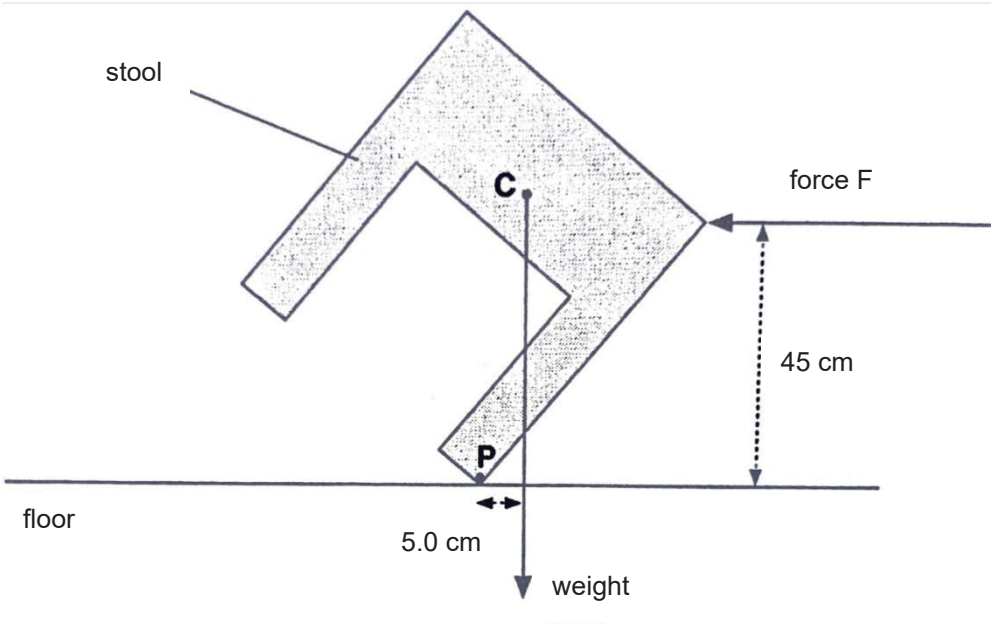


Fig. 3.1

(a) Identify an action – reaction pair in Fig. 3.1.

..... [1]

(b) On Fig. 3.1, draw an arrow to show the resultant force that the floor exerts on the stool. Label this force. [1]

(c) **(i)** State what is meant by *moment* of a force.

.....

..... [1]

(ii) Calculate the value of force F.

force F = ... [2]

4 Fig. 4.1 shows two spherical-shaped glass containers connected by a transparent tube containing mercury which has a density of 13.6 g / cm^3.

Both glass containers contain trapped gases. One is painted black and the other white.

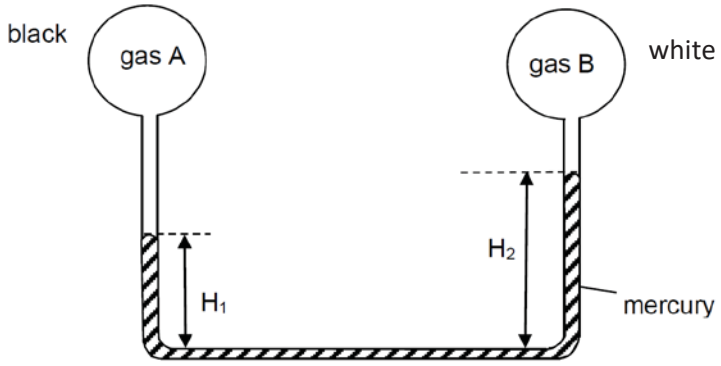


Fig. 4.1

(a) **(i)** State which of the two gases is at a higher pressure?

……..... [1]

(ii) Given that H_1 = 30.0 cm, H_2 = 48.0 cm and pressure of B is 100 000 Pa, calculate pressure of gas A.

pressure = …….. [2]

(iii) Suggest how the set-up in Fig. 4.1 can be modified for the same pressure difference between the two spheres to produce a larger difference in liquid level.

…….. [1]

(b) In Fig. 4.2, a heater is placed at equal distance from the two glass containers.

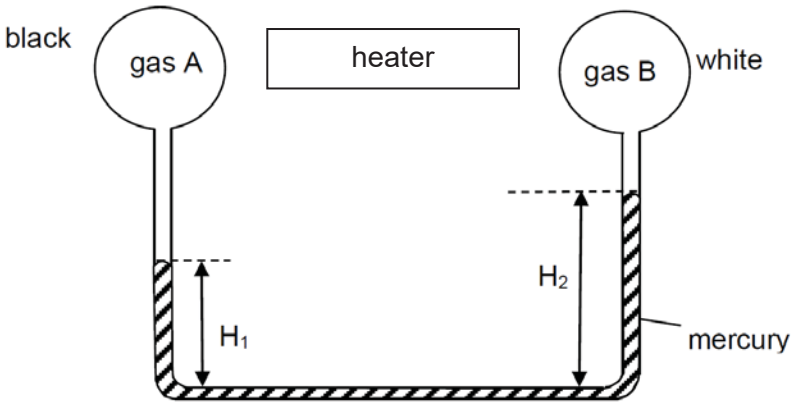


Fig. 4.2

(i) Using ideas about molecules and the definition of pressure, explain why the pressure of gas in both spheres will rise when the heater is switched on.

……..

……..

……..

……..

……..

…….. [3]

(ii) State and explain what happens to H_1 and H_2 in Fig. 4.2 after the heater has been switched on for 5.0 minutes.

……..

……..

……..

……..

……..

…….. [3]

5 Fig. 5.1 shows a virtual image **I** formed on a line that passes through the centre of a converging lens. The lens is perpendicular to the line but is not shown and the height of the image is twice the height of the object.

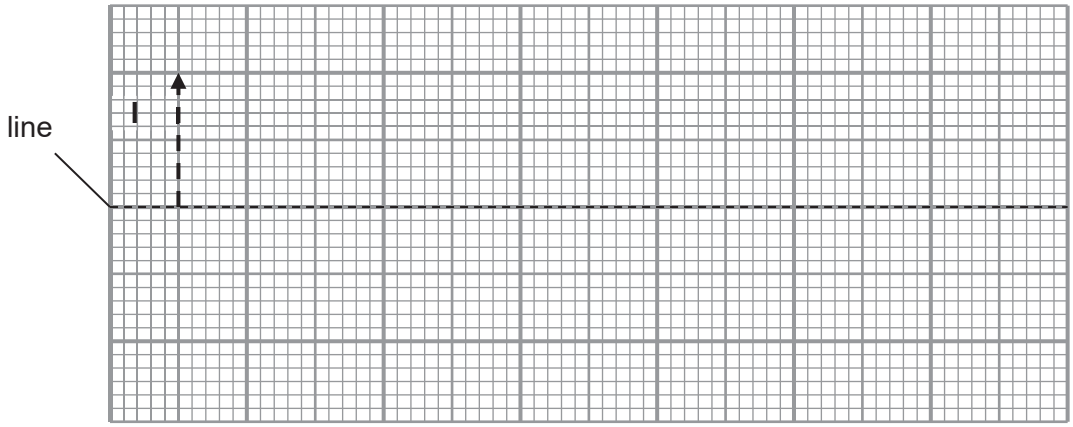


Fig. 5.1

On Fig. 5.1,

(a) **(i)** draw and label the lens in a suitable position and indicate the focal length of the lens, [2]

(ii) draw two rays of light from the top of the object to the image. [2]

(b) Explain what is meant by a *virtual* image.

……. [1]

6 Optical fibre is used widely for internet data transmission. Fig. 6.1 shows the side view of an optical fibre, made of glass.

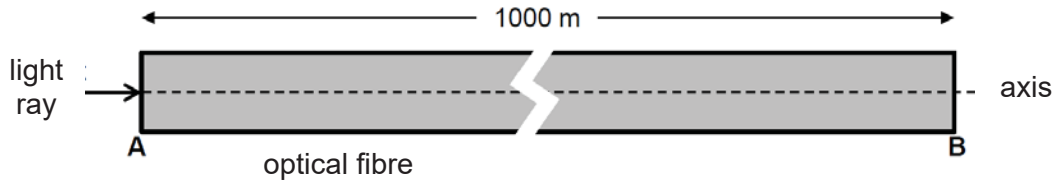


Fig. 6.1

A ray of light is incident along the axis at A, and travels for 1000 m along the fibre, emerging at B. The refractive index of glass is 1.52.

(a) Calculate the speed of light in glass.

speed = ……. [2]

(b) Calculate the critical angle of glass.

critical angle = …… [2]

(c) Another light ray enters the optical fibre from A at an angle and exits at B. With reference to **(b)**, explain how this ray of light is transmitted in the optical fibre.

……

……

…… [2]

7 Fig. 7.1 shows four spray guns dispersing pesticide on the plants. The spray droplets are given a negative charge by the spray guns.

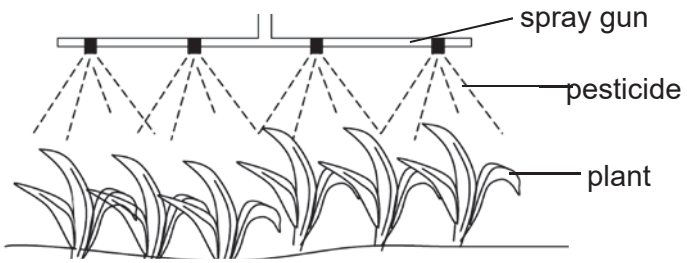


Fig. 7.1

(a) Explain how the droplets become negatively charged.

……

…… [2]

(b) Explain why the droplets spread out immediately after leaving the spray gun.

……

…… [1]

8 Fig. 8.1 shows a lighting circuit found in a household. It is made up of 4 light bulbs and a 30 A rated fuse connected to a power supply.

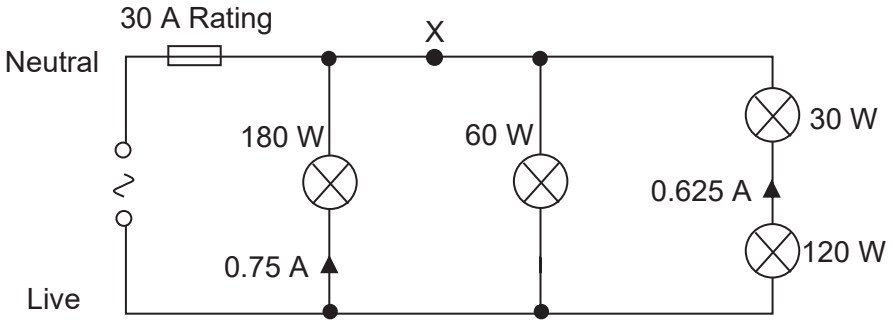


Fig. 8.1

(a) **(i)** State what is meant by an *electric current of 0.75 A.*

…….. [1]

(ii) Calculate the current flowing through point X.

current = …….. [3]

(b) **(i)** State two errors in the fuse in Fig. 8.1. Explain why each error is dangerous for the circuit.

……..

……..

……..

……..

…….. [3]

(ii) Suggest two modifications to correct the errors identified in **(b)(i)**.

……..

…….. [2]

(c) State the colour of insulation used for:

live wire : …….

neutral wire : …… [1]

Section B: [30 marks]

Answer **all** the questions in this section in the spaces provided.
Answer only one of the two alternative questions in **Question 11**.

9 Fig. 9.1 shows a circuit diagram. The circuit uses a light-dependent resistor (LDR) and a fixed resistor of resistance 5.0 kΩ.

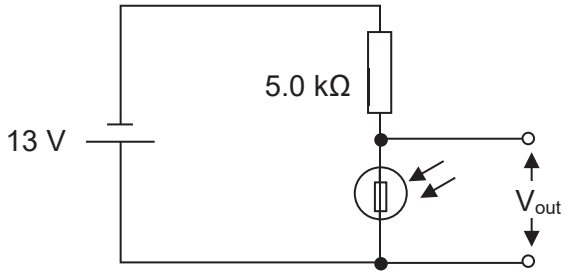


Fig. 9.1

The output voltage, V_{out} is connected to a lamp. Fig. 9.2 shows the V_{out} values and the status of the lamp at different time of a particular day.

time	V_{out} / V	status of lamp	current flowing in the lamp / mA
6:20 am	8.0	Switched on	0.050
6:30 am	7.8	Switched on	0.048
6:40 am	7.5	Switched on	0.042
6:50 am	5.0	Switched on	0.020
7:00 am	4.5	Switched off	0
7:10 am	2.0	Switched off	0
7:20 am	2.0	Switched off	0

Fig. 9.2

(a) At 6:50 am, calculate the

(i) current flowing in the fixed resistor,

current = …… [2]

(ii) resistance of the LDR.

resistance = …… [2]

(b) The lamp will be switched off whenever V_{out} is less than 5.0 V.

(i) Explain why the lamp switches off after 7:00 am.

……..

……..

……..

……..

……..

……..

……..

…….. [3]

(ii) On another day, the lamp switches off only at 7:30 am although the same circuit was used. Suggest what could have caused this.

……..

……. [1]

(iii) The fixed resistor is replaced by a 10 Ω resistor and the same 13 V battery is used. Explain the effect of this change on the battery life.

……..

……. [2]

10 Fig. 10.1 shows a d.c motor.

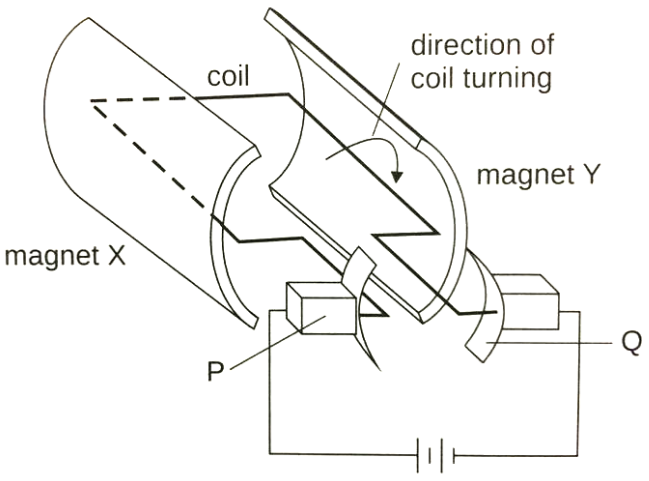


Fig. 10.1

(a) State the name and function of parts P and Q. [3]

part	name	function
P		
Q		

(b) The coil turns in the direction shown in Fig. 10.1.

(i) Draw on Fig. 10.1, the two forces acting on the coil. [1]

(ii) State the polarity of magnets X and Y.

magnet X : ……..

magnet Y : ……... [1]

(iii) Explain how you derived your answer for **(b)(ii)**.

……..

……..

…….. [2]

(c) Suggest how the turning effect on the coil in the d.c motor can be decreased.

……. [1]

(d) Describe, with the aid of a diagram, how a bar magnet can be demagnetised using an electrical method.

……

……

……

……. [2]

Either

11 Fig. 11.1 shows an electric kettle.

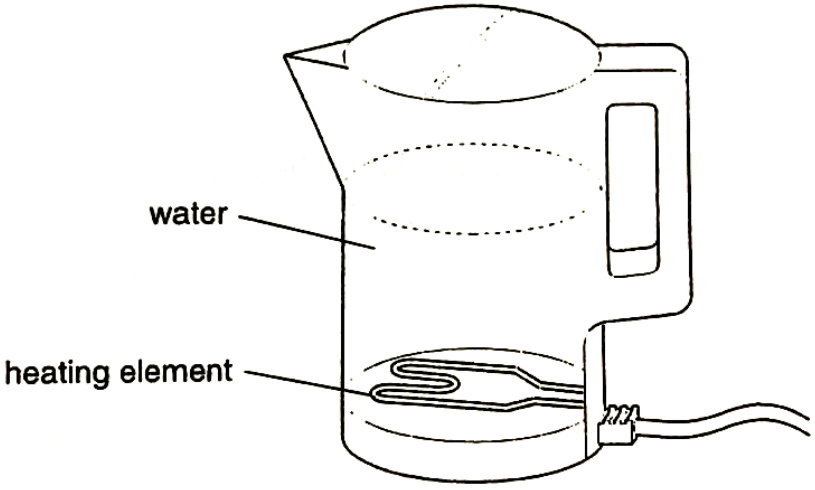


Fig. 11.1

(a) **(i)** Name the main process by which thermal energy is transferred from the heating element to the water around it.

…….. [1]

(ii) Explain how the water in the electric kettle is heated.

……..

……..

…….. [2]

(iii) For water in the kettle to be kept warm for a longer time, suggest a colour for the outer casing of the kettle. Explain your choice.

……..

…….. [1]

(b) 200 g of boiling water from the electric kettle is poured into a ceramic cup.

Ice cubes with a total mass of 100 g were dropped into the cup of hot water. The ice cubes were initially all solid at 0 °C.

The specific heat capacity of water is 4.2 J / (g°C) and specific latent heat of fusion of water is 334 J / g.

Ignore any thermal energy loss to the cup and the surroundings in the calculations.

(i) Calculate the thermal energy gained by the 100 g of ice to melt completely.

thermal energy = ……. [2]

(ii) The melted ice and hot water in the cup eventually reached thermal equilibrium. Calculate the final temperature of water in the cup.

temperature = ……. [2]

(iii) The electric kettle has an electrical power input of 2000 W. It took 5.0 minutes to heat the 200 g of water to its boiling point. Each kWh of electrical energy costs 26 cents.

Calculate the cost of using the kettle to heat the 200 g of water.

cost = ……. [2]

OR

11 Fig 11.2 shows a car, initially at rest, rolling down a hill with its engine turned off.

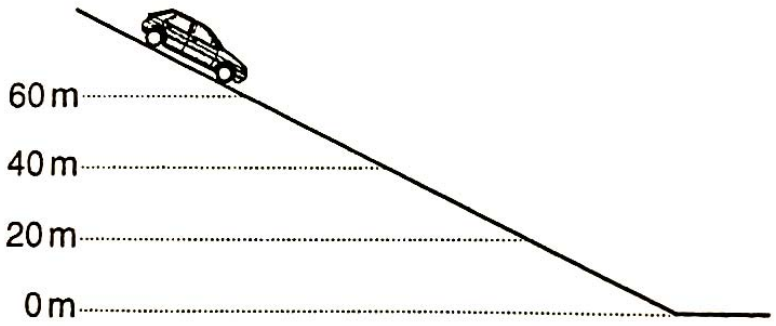


Fig. 11.2

The gravitational potential energy (GPE), kinetic energy (KE) and motion of the car is recorded in Fig. 11.3.

height of car / m	GPE / kJ	KE / kJ	speed / (m/s)
top of hill	1118	0	0
100	860	258	24.5
80	688	430	31.6
60	516	602	
40	344	774	42.4
20	172	946	46.9
0			

Fig. 11.3

(a) State the *principle of conservation of energy*.

……

…… [2]

(b) **(i)** Using the values of GPE and / or KE when the car is at 80 m in Fig. 11.3, calculate the mass of the car.

mass = …… [2]

(ii) Hence, fill in the blanks in Fig. 11.3 with the appropriate values. [2]

(iii) Use the *principle of conservation of energy* to help explain how you derived your answers for **(b)(ii)** and state the assumption used in the calculations.

……..

……..

…….. [2]

(iv) Calculate the height of the top of the hill.

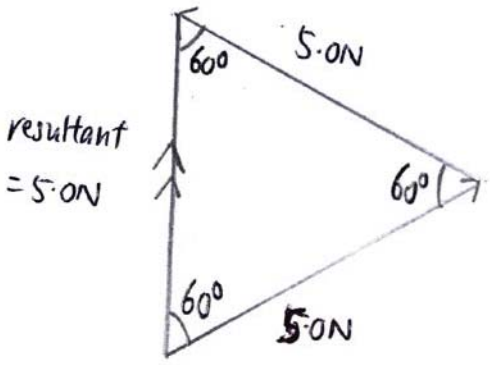
height = …… [2]

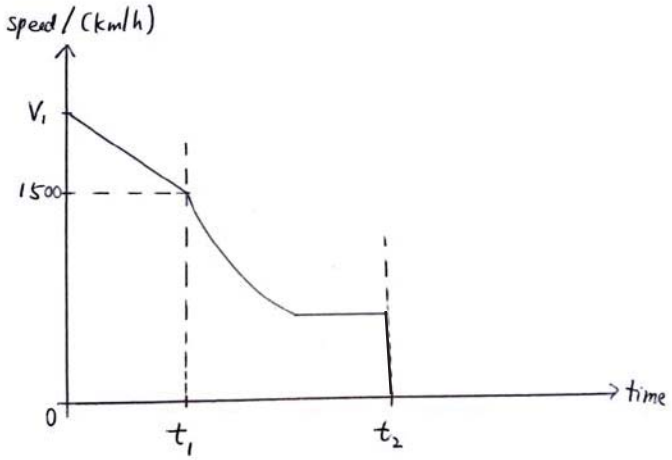
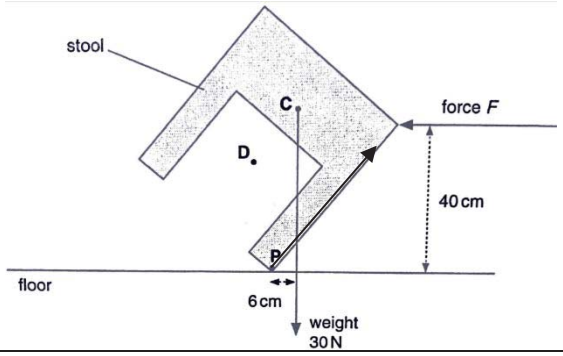
End of paper

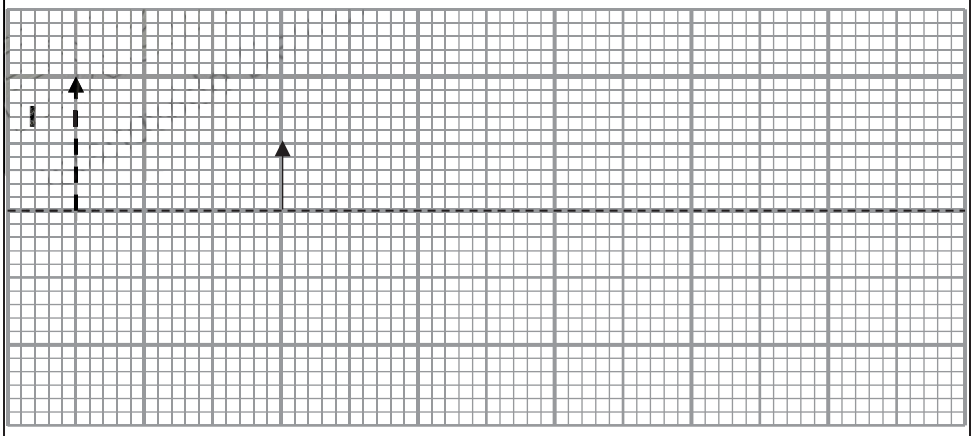
Marking Scheme
Fuhua Secondary School
Secondary 4E 6091 Physics
Preliminary Examination 2020
Paper 1

1	2	3	4	5	6	7	8	9	10
C	**C**	**C**	**C**	**C**	**D**	**C**	**D**	**B**	**C**
11	12	13	14	15	16	17	18	19	20
B	**B**	**A**	**B**	**C**	**D**	**D**	**C**	**D**	**D**
21	22	23	24	25	26	27	28	29	30
A	**A**	**D**	**C**	**A**	**B**	**A**	**D**	**D**	**D**
31	32	33	34	35	36	37	38	39	40
B	**B**	**D**	**D**	**C**	**A**	**B**	**B**	**C**	**B**

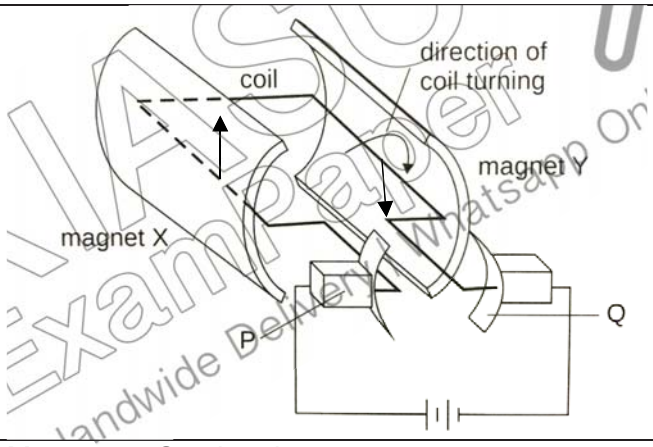
Paper 2

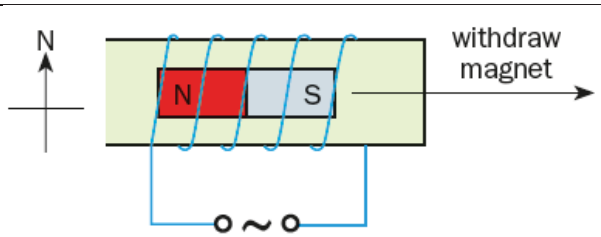
Q	Answer		
1	**(a)**	The 2 forces of 5.0 N must be acting in <u>opposite</u> direction <u>along a straight line/parallel to each other</u>.	[1]
	(b)	Scale: 1.0 cm : 1.0 N Arrows & shape Accuracy (of angles and forces)  	[1] [1] [1]

2	**(a)**	 Label vertical axis [1] [2] – must fulfil 4 different gradients $t = 0 – t_1$ (constant gradient until 1500 km / h) $t = t_1 – t_2$ (decreasing deceleration then constant) $t = t_2$ (decrease to zero)	[3]
	(b)	A gravitational field is a region in which a mass experiences a force due to gravitational attraction. Or A gravitational field is a region in which a mass experiences a gravitational force.	[1]
	(ci)	Weight of skylab = 50 x 3.0 = 150 N	[1]
	(cii)	Deceleration = (600 – 150) / 50 = 9.0 m / s^2	[1] [1]
3	**(a)**	- Gravitational force that earth acts on stool and gravitational force that stool acts on earth - contact force that stool acts on floor and contact force that floor acts on stool - force that Sam exerts on the stool and force that stool exerts on Sam - friction that floor acts on stool and friction that stool acts on floor Any one of the above	[1]
	(b)	(Direction of resultant at any angle between North and East.) 	[1]

	(ci)	Moment of a force is the product of the force and the perpendicular distance from the line of action of the force to the pivot.	[1]
	(cii)	Taking moments about P, 5.0 x 25 = F x 45 F = 2.8 N	 [1] [1]
4	**(ai)**	Gas A	[1]
	(ii)	P_A = 100000 + (0.18)(13600)(10) = 124480 Pa = 124000 Pa	[1] [1]
	(iii)	Use a liquid that has lower density Or move the set-up to where there is lower gravitational field strength	[1]
4	**(bi)**	Gas molecules move randomly, colliding with one another and with the inner walls of the container. When temperature increases, the average kinetic energy of the molecules increases. They move with greater speeds to collide more frequently with the walls of the container and more forcefully. The force per unit area exerted by the gas molecules on the walls during collision increases. Thus, the pressure exerted by the gas increases.	 [1] [1] [1]
	(bii)	H_1 will decrease while H_2 will increase. Black is a better absorber of infrared radiation. The temperature of gas A will increase at a faster rate than gas B. Hence, pressure of gas A will be greater than pressure of gas B.	[1] [1] [1]
5	**(a)**	 [1] lens [1] focal length [2] light rays with arrows	
	(b)	Virtual image cannot be formed on the screen.	[1]

6	**(a)**	$1.52 = 3.0 \times 10^8 / v$ $v = 2.0 \times 10^8$ m / s	[1] [1]
	(b)	sin c = 1/1.52 c = 41 ^{o}	[1] [1]
	(c)	The light is incident on AB with an angle of incidence that is greater than 41 ^{o}. Light undergoes total internal reflection in glass.	[1] [1]
7	**(a)**	Friction between the pesticide and the spray gun caused electrons to be transferred from the spray gun to the pesticide.	[1] [1]
	(b)	Since the droplets are of the same charge, they repel each since like charges repel.	[1]
8	**(ai)**	0.75 A is the electric current produced when 0.75 coulomb of charge passes a point in a conductor in one second.	[1]
	(aii)	Emf of power supply = 180 / 0.75 = 240 V Current passing through 60 W lamp = 60 / 240 = 0.25 A Current passing through X = 0.25 + 0.625 = 0.875 A	[1] [1] [1]
	(bi)	- The fuse is placed on the neutral wire. Even when the fuse melts due to excessive current flow in the circuit, the light bulbs will not disconnected from the high potential. - The fuse rating is too large. Even when there is an electrical fault that leads to an excessive current flow, the fuse will not blow and will result in overheating of wires and light bulbs leading to electrical fires. [1] identify 2 faults [1] per explanation	[3]
	(bii)	- Place the fuse on the live wire - Replace fuse with a lower fuse rating (2 A / 3 A)	[1] [1]
	(c)	Live: brown Neutral: blue	[1]
9	**(a)(i)**	Current in fixed resistor = 8 / 5000 = 0.0016 A	[1] [1]
	(ii)	Resistance of LDR = 5.0 / (0.0016 – 0.000020) = 3164 Ω = 3160 Ω	[1] [1]
	(bi)	At 7:00 am, the light intensity increases. This leads to a decrease in the resistance of the LDR.	[1]

		Potential difference (pd) across the fixed resistor increases, leading to a drop in the pd across the LDR. (using potential divider formula) When the pd across the LDR is less than 5.0 V, V_{out} of the lamp will be less than 5.0 V, hence it switches off.	[1] [1]
	(ii)	The sky could be cloudy/the sun rises at a later time.	[1]
	(iii)	The effective resistance of the circuit will decrease. This will lead to a larger current to flow in the circuit. Hence the battery life will shorten. Or LDR will be switched on for longer period each day or permanently on since $R_{LDR} > R_{10\Omega}$, $V_{LDR} > 5.0$ V. Battery will be drained out faster.	[1] [1]
10	**(a)**	P: Carbon brush – provide contact for current to flow from circuit to the coil Q: Split-ring commutator – to reverse the direction of current in the coil every half a revolution [1] for correct names of P and Q [1] for each correct function	[3]
	(bi)		[1]
	(ii)	Magnet X : South pole Magnet Y : North pole	[1]
	(iii)	Using Fleming's left hand rule, the thumb, forefinger and second finger are at right angles to each other. The forefinger points in the direction of the magnetic field and second finger in the direction of the current. The thumb gives the direction of the force.	[1] [1]
	(c)	Decreasing the current in the coil	[1]

	(d)	 Place the bar magnet in a solenoid with alternating current flowing in it. Slowly withdraw the magnet in the East – West direction until the magnet is far away from the solenoid.	[1] [1]
		Either	
11	**(ai)**	Conduction	[1]
	(ii)	Water near the heating element gains thermal energy, expands and becomes less dense and rises. The cooler and denser water on top will sink. This sets up a convection current in the kettle. Thus, the water in the kettle is heated by convection. Any 2 points [1]. 3 points to get [2]	[1] [1]
	(iii)	White / silver. White is a poor emitter of infrared radiation.	[1]
	(bi)	Thermal energy gained = 100 x 334 = 33400 J	[1] [1]
	(ii)	Thermal energy lost by hot water = thermal energy gained by ice to melt + thermal energy gained by melted ice 200 x 4.2 x (100 – x) = 33400 + (100)(4.2)(x) x = 40.2 °C	 [1] [1]
	(iii)	Cost = 2 x (5/60) x 26 = 4.3 cents	[1] [1]
		Or	
11	**(a)**	Energy cannot be created or destroyed. It can only be converted from one form to another or transferred from one body to another. Total energy in the isolated system is constant.	[2]
	(bi)	Mass of the car = 688000 / (10)(80) = 860 kg	[1] [1]
	(ii)		

height of car / m	GPE / kJ	KE / kJ	speed / (m/s)
top of hill	1118	0	0
100	860	258	24.5
80	688	430	31.6
60	516	602	37.4 [1]

			40	344	774	42.4		
			20	172	946	46.9		
			0	0	1118	51.0 [1]		
	(iii)	Total energy in an isolated system is constant. Therefore the total energy (GPE + KE) of the car at any point in time will be equal to 1118 kJ. Assumption: there is no energy loss to the surroundings / no work done against friction or air resistance						[1] [1]
	(iv)	Height of hill = 1118000 / (860 x 10) = 130 m						[1] [1]

End of Marking Scheme