didate Name: **partnerinlearning**

Class:	
Index No:	

Chong Boon Secondary School

Preliminary Examination 2016
Secondary 4 Express
Physics **5059/01**

Paper 1

19 Sep 2016 (Monday) **1 hour**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

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.

For Examiner's Use
40

This document consists of 12 printed pages including the cover page.

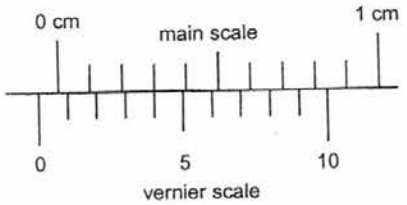
1 In an experiment, Merychris is required to perform a calculation based on the formula:

Length = **X** + **Y** + **Z**

Given that the recorded values of **X** = 1.11 cm, **Y** = 1.1 cm and **Z** = 1.111 cm, what is the answer recorded?

A 3 cm **B** 3.3 cm **C** 3.32 cm **D** 3.321 cm

2 The diagram below shows the reading of a vernier caliper when its jaws are closed.



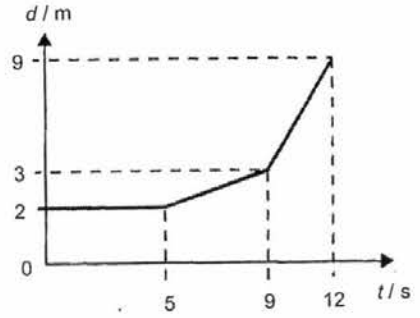
What is the zero error shown?

A -0.06 cm **B** -0.04 cm **C** 0.04 cm **D** 0.06 cm

3 A car travels at a constant speed of 2 m s^{-1} for 5 s and then accelerates constantly to 8 m s^{-1} in the next 3 s.
What is the distance travelled during the 8 s?

A 9 m **B** 18 m **C** 25 m **D** 28 m

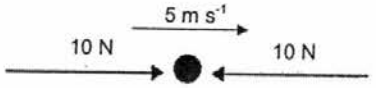
4 The distance-time graph of a car is shown below.



When was the car travelling at 2 m s^{-1}?

A 2.5 s **B** 5.0 s **C** 8.0 s **D** 10.5 s

5 A particle moving at a constant speed of 5 m s^{-1} is being acted upon by two 10 N forces at the same time as shown below.



The particle will

A continue to move at 5 m s^{-1}.
B increase its speed gradually.
C slow down and gradually stop.
D stop immediately.

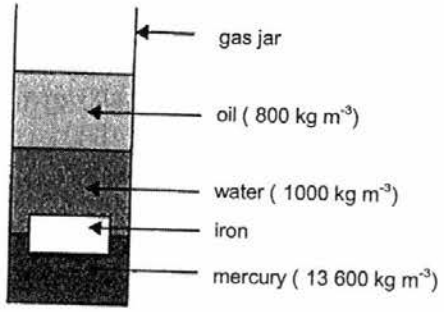
6 A man of 50 kg stands on a weighing scale in a lift. When the lift is ascending at a constant acceleration of 1.0 m s^{-2}, what is the reading on the weighing scale?

A 60 N B 450 N C 500 N D 550 N

7 Inertia is a measure of the

A ability for objects to move.
B ability for objects to stop.
C initial mass of bodies.
D resistance for objects to start moving and stop moving.

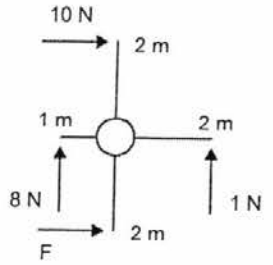
8 The following density experiment was set up.



Which of the following is a possible density for iron?

A 600 kg m^{-3} B 1000 kg m^{-3} C 8000 kg m^{-3} D 14 000 kg m^{-3}

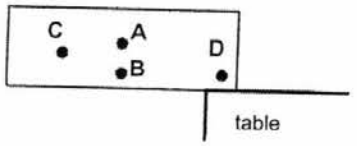
9 A windmill is pushed by 4 external forces as shown.



Calculate force **F** required to stop the windmill from turning.

A -10 N B 10 N C 13 N D 17 N

10 A box is balanced at the edge of the table as shown. Which point is possibly the centre of gravity of the box?



11 A diver is 20 m below water level. Given that the atmospheric pressure is 100 000 Pa and the density of water is 1000 kg m^{-3}, what is the pressure experienced by the diver? (Take g = 10 m s^{-2})

A 110 000 Pa B 200 000 Pa C 300 000 Pa D 400 000 Pa

12 Below are three actions that a barometer manufacturer can do.

- insert the opening of the tube deeper into the trough of liquid
- use a glass tube of larger inner diameter
- use a longer glass tube

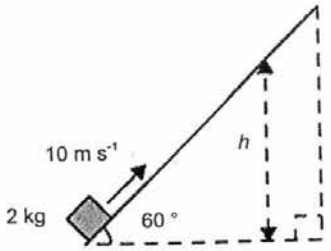
How many of the above stated actions will **not** affect the height of the liquid level in the column of a barometer?

A 0 B 1 C 2 D 3

13 A box of mass 2 kg increases its speed from 3 m s^{-1} to 7 m s^{-1}. What is its increa kinetic energy?

A 4 J B 16 J C 32 J D 40 J

A box of mass 2 kg has an initial speed of 10 m s^{-1} at the foot of the ramp.



Given that the friction along the ramp is 2 N, What is the maximum height h that it can reach? (Take g = 10 m s^{-2})

A 2.8 m **B** 4.5 m **C** 5.0 m **D** 43.3 m

15 The kinetic energy of the molecules or atoms in a substance decreases from

A gas, liquid, solid
B gas, solid, liquid
C solid, liquid, gas
D solid, gas, liquid

16 During a barbecue, why do we always cook food on top of the charcoal?

A To increase the rate of heat transfer by conduction.
B To increase the rate of heat transfer by convection.
C To increase the rate of heat transfer by evaporation.
D To increase the rate of heat transfer by radiation.

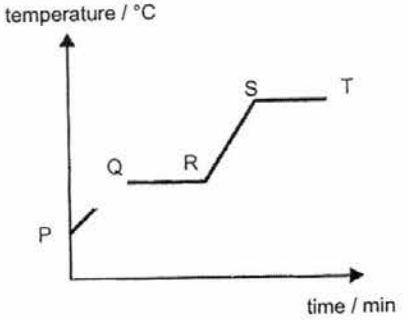
17 Why is aluminum a better conductor than wood?

A Aluminium has a higher density than wood.
B Aluminium has a higher mass than wood.
C Aluminium has a higher specific heat capacity than wood.
D Aluminium has more free electrons than wood.

18 A liquid-in-glass thermometer has a mercury level of 2.0 cm at ice point and a mercury level of 6.0 cm at steam point. What will be the mercury level when the temperature is 120 °C?

A 4.8 cm **B** 6.8 cm **C** 7.2 cm **D** 9.6 cm

19 A solid substance is placed in a boiling tube and heated steadily. The temperature-time graph of the substance is as shown below.



At which portion is the substance increasing internal potential energy?

A PQ and QR only
B PQ and RS only
C RS and ST only
D QR and ST only

20 24 000 J of energy is required to increase the temperature of 2 kg of liquid by 3 °C. What is the heat capacity of the liquid?

A 4 000 J/K **B** 6 000 J/K **C** 8 000 J/K **D** 12 000 J/K

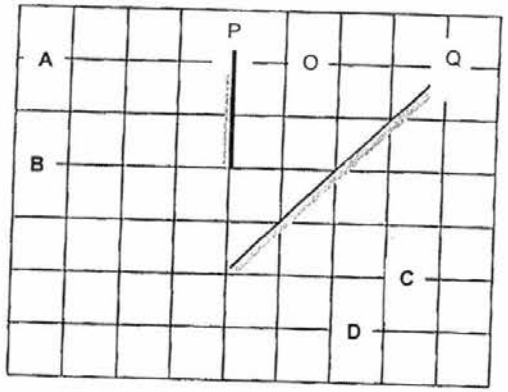
21 In a ripple tank experiment, a dipper is connected to a motor to generate water waves. If the motor rotates with higher speed, what is the effect on frequency, wavelength and speed of the waves generated?

	frequency	wavelength	speed
A	decreases	increases	decreases
B	decreases	increases	no change
C	increases	decreases	increases
D	increases	decreases	no change

22 A series of circular wavefronts are created in a ripple tank. Given that the speed of the wave is 6.0 cm/s and the wavelength is 0.80 cm, what is the frequency of the wave?

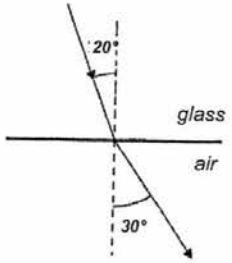
A 0.13 Hz **B** 4.8 Hz **C** 6.8 Hz **D** 7.5 Hz

23 An object **O** is placed in between two mirrors, **P** and **Q**, as shown below.



Which is a possible image of the object?

24 The diagram below shows how light is refracted when it is travelling from glass to air.



Calculate the speed of light in glass?

A 0.67×10^8 m s^{-1} **B** 1.50×10^8 m s^{-1} **C** 2.05×10^8 m s^{-1} **D** 2.52×10^8 m s^{-1}

25 Which one of the following uses radio waves?

A Detecting fake notes
B Heating food
C Killing cancerous cells
D Transmitting communication signals

26 Which of the following changes when sound is reflected?

A amplitude **B** frequency **C** speed **D** wavelength

27 A car driving at a constant speed of 20 m s^{-1}, heads straight to a mountain. The driver presses the car horn and receives an echo 2.4 s later. Calculate the distance between the car and the mountain when the driver pressed the horn.
(Take the speed of sound to be 300 m s^{-1}.)

A 336 m **B** 384 m **C** 672 m **D** 768 m

28 The diagram below shows a positive point charge in between two positively charged objects.

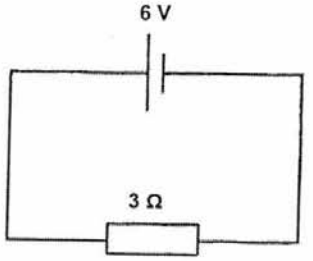
In which direction will the positive point charge move?

A down **B** left **C** right **D** up

29 What does 5 A refer to?

A 5 C of charge flowing through a point.
B 5 C of charge flowing through a point in 1 s.
C 5 V of electricity across 1 Ω of resistance.
D 5 V of electricity causing 1 C of charge to flow.

30 The circuit below is switched on for 30 seconds.



Calculate the amount of energy dissipated by the 3 Ω resistor.

A 60 J **B** 180 J **C** 360 J **D** 540 J

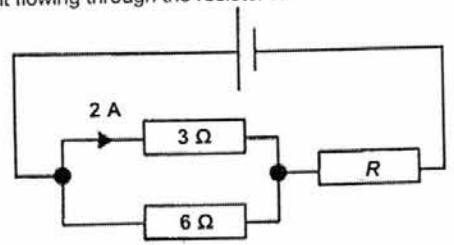
Wire A and B has the following ratios:

$\frac{length\ L_A}{length\ L_B} = \frac{2}{1}$; $\frac{diameter\ D_A}{diameter\ D_B} = \frac{2}{3}$; $\frac{resistivity\ \rho_A}{resistivity\ \rho_B} = \frac{4}{3}$.

Given that wire B is 2 Ω, what is the resistance of wire A?

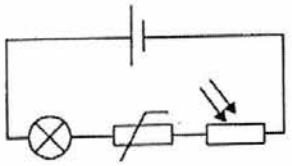
A 0.17 Ω **B** 4 Ω **C** 6 Ω **D** 12 Ω

32 What is the current flowing through the resistor R?



A 3 A **B** 4 A **C** 6 A **D** 9 A

33 The circuit below shows a light bulb connected in series with a thermistor and light dependent resistor.



Given that the resistance of the thermistor decreases with increasing temperature, and the resistance of the light dependent resistor decreases with increasing light intensity, the lamp in the circuit below will light up when it is

A cold and bright.
B cold and dark.
C hot and bright.
D hot and dark.

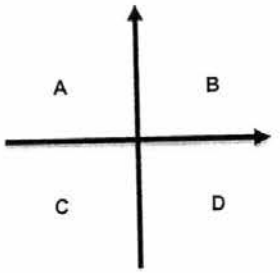
34 Many domestic hair-dryers have no earth wire. Why?

A The casing of the hair-dryer is made of plastic material.
B The current is small.
C The fan prevents the heating coil from becoming too hot.
D The plug is installed with a fuse.

35 The needle of a plotting compass is made of

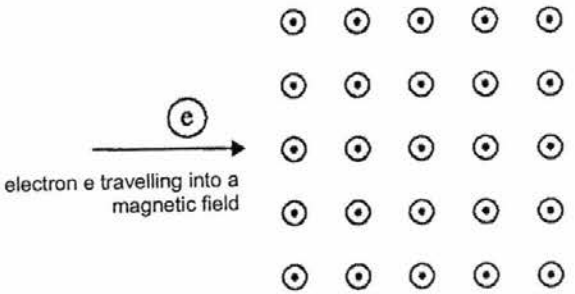
A copper **B** iron **C** steel **D** tungsten

36 Equal amount of current is flowing in two insulated wires perpendicular to each other as shown.



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

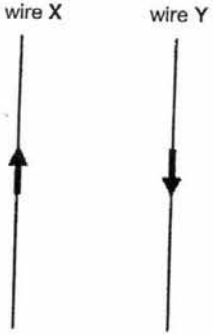
37 An electron enters a region of magnetic field as shown below.



The electron will

A experience a downward force.
B experience a force into paper.
C experience an upward force.
D not be affected and continue to travel straight through.

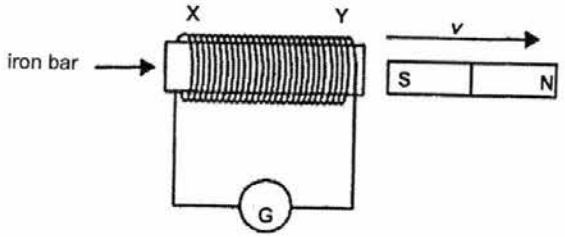
38 Two current-carrying wires are arranged in parallel as shown below.



What is the direction of the electromagnetic force on each wire?

	wire X	wire Y
A	to the left	to the left
B	to the left	to the right
C	to the right	to the left
D	to the right	to the right

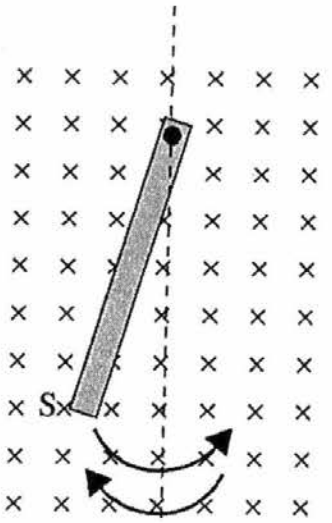
39 A permanent magnet moves away from a solenoid with a constant speed *v*.



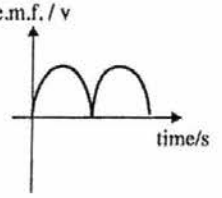
What is the magnetic pole induced at the portion Y of the solenoid and the directions of the induced current into the galvanometer?

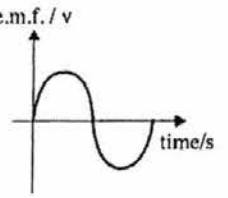
	polarity at Y	galvanometer direction
A	north	to the left
B	north	to the right
C	south	to the left
D	south	to the right

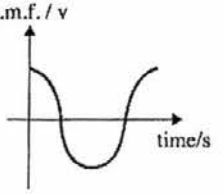
40 A copper rod is pivoted freely at one end. Starting from point *S*, it is released to swing to and fro in a region of magnetic field as shown in the diagram below.

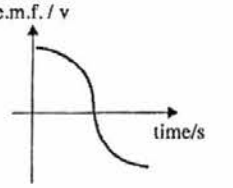


Which of the following graphs shows how the induced e.m.f varies with time?

A


B


C


D


~END OF PAPER~

didate Name: partnerinlearning

Class:	
Index No:	

Chong Boon Secondary School

Preliminary Examination 2016

Secondary 4 Express

Physics 5059/02

Paper 2

13 Sep 2016 (Tuesday) | **1 hour 45 min**

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your name, class and index number on all the work you hand in.
Write in dark blue or black ink.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **all** questions. **Question 11** has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
	80

Section A (50 marks)

Answer **all** questions in the space provided.

1 Fig. 1.1 shows a parachutist jumping off a plane and falling in free-fall until he opened his parachute.
The speed-time graph for the diver is shown in Fig 1.2.

Fig. 1.1

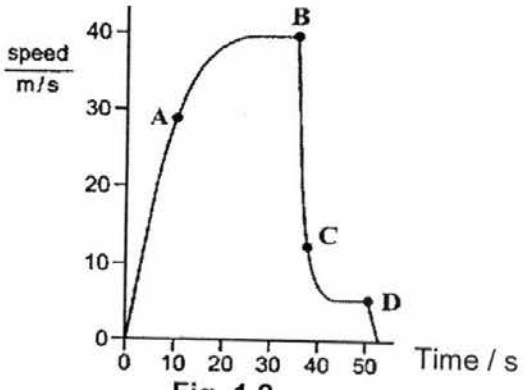


Fig. 1.2

During the free-fall, the gravitational field strength is 10 N / kg.
The mass of the diver was 80 kg.

(a) State what is meant by the gravitational field strength is 10 N / kg.

.....

..... [2]

(b) Describe how you could verify from Fig. 1.2 that the gravitational field strength is 10 N / kg.

.....

.....

..... [2]

(c) Explain, in terms of the forces acting, why the acceleration changes between point **A** and point **B**.

.....

.....

.....

..... [3]

(d) Describe how you could find the distance travelled between point **C** and point **D**.

.....

.....

Fig. 2.1 shows a helicopter **stationary** in the air.

Vertical forces are produced by the front rotor and the back rotor.

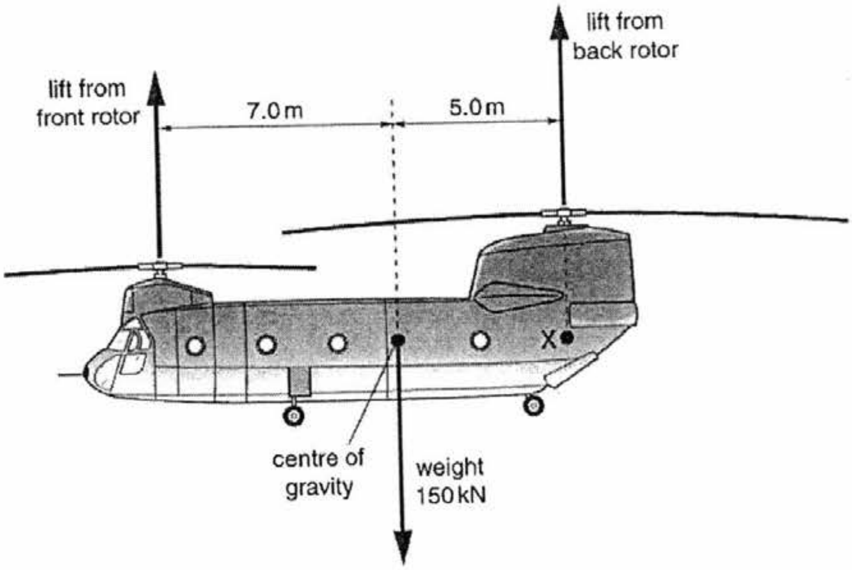


Fig. 2.1

The weight of the helicopter is 150 kN. Horizontal distances are marked on Fig. 2.1.

(a) By taking moments about the centre of gravity, determine whether the lift from the front rotor is greater or the lift from the back rotor is greater.

.... [2]

(b) Explain why it would be impossible to calculate the lift force from the back rotor by taking moments about point **X**.

....

.... [2]

(c) Suggest a possible reason why this helicopter uses two rotors instead of one rotor.

....

....

3 Fig. 3.1 shows the dimension of a gold bar.

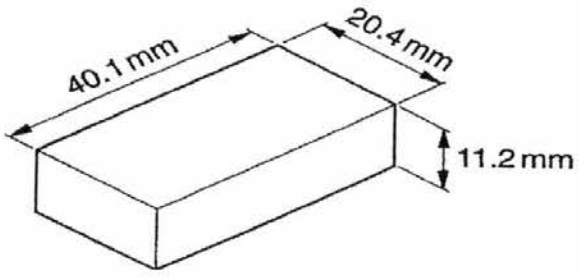


Fig. 3.1

The mass of the bar was measured as 176.8 g and the weight of the bar as 1.80 N.

(a) Calculate the gravitational field strength where the measurements were made.

gravitational field strength = ... [2]

(b) Calculate the density of the bar. Give your answer in g cm^{-3}.

density = ... g cm^{-3} [3]

The density of pure gold is 19.281 g cm^{-3}.

(c) State and explain whether the bar is made of pure gold.

.....

.....

..... [2]

An experiment is carried out to find how the pressure of a fixed mass of air at room temperature varies with volume. Fig. 4.1 shows the apparatus used. The syringe is sealed at one end and the piston is free to move up and down as different metal weights are used. The temperature of the air is kept constant throughout the experiment.

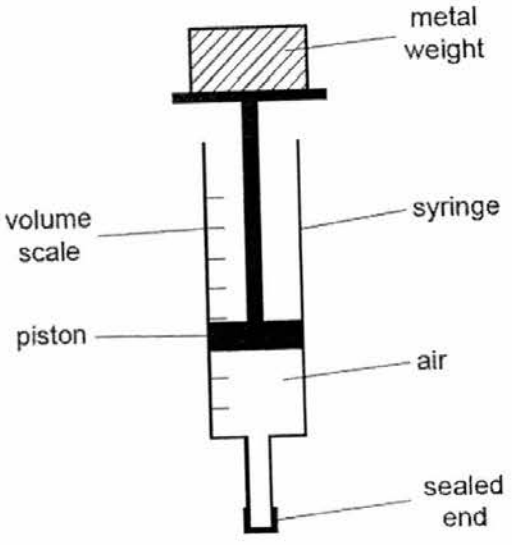


Fig. 4.1

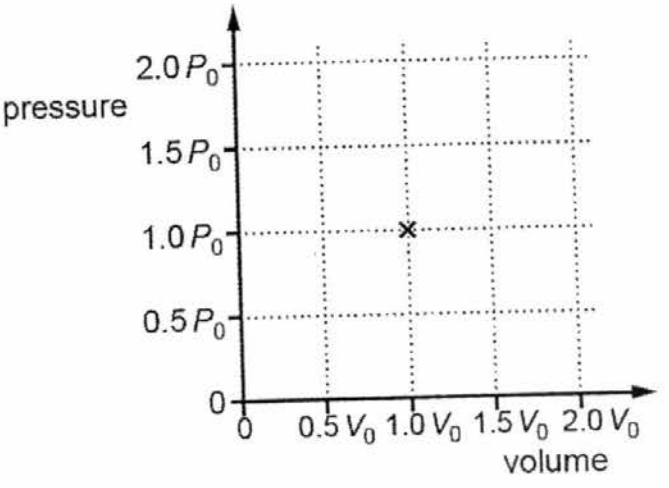


Fig. 4.2

Fig. 4.2 shows the axes for a graph of pressure against volume for the air in the syringe.

One point is plotted on the graph at pressure of P_o and volume V_o.

(a) On Fig. 4.2,

(i) plot points at volumes of 0.5 V_o and 2.0 V_o, [1]

(ii) draw a best fit curve to complete the graph. [1]

(b) Explain why the temperature must be kept constant throughout the experiment.

.....

..... [2]

More metal weights are placed on top of the syringe.

(c) Explain how the molecules of air inside the syringe are able to support more metal weights.

.....

.....

.....

.....

5 The camera lens shown in Fig. 5.1 is used to photograph the object **O**.

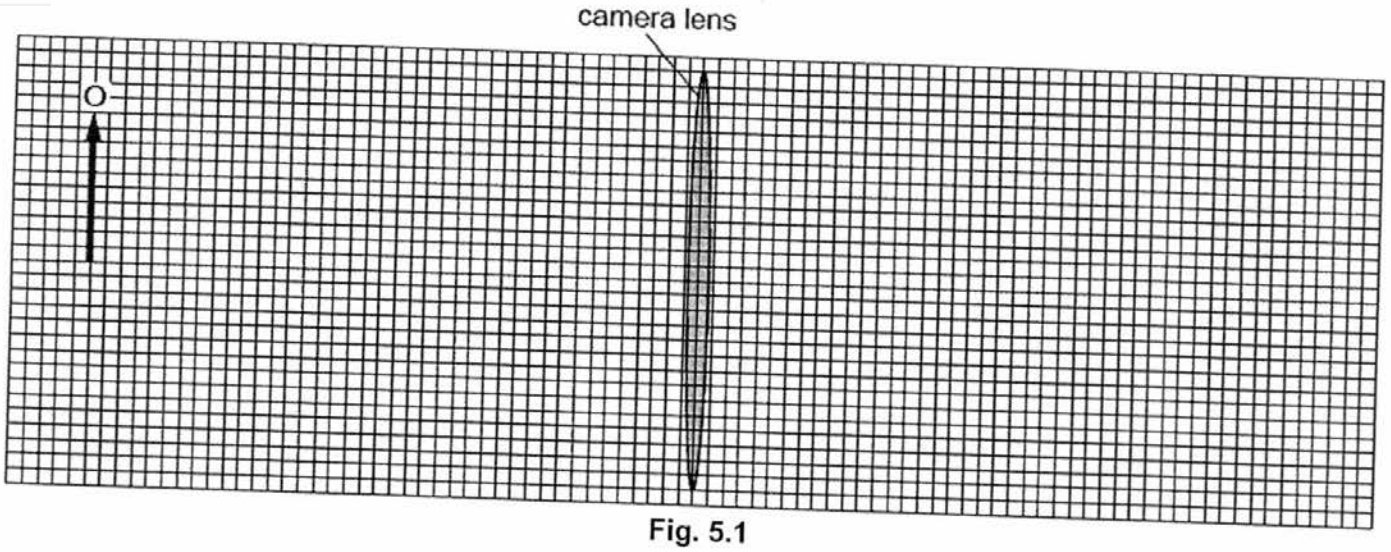


Fig. 5.1

The object **O** is 2.0 cm high and is placed 8.0 cm from the centre of the lens. The lens has a focal length of 3.0 cm.

(a) Draw rays on Fig. 5.1 to find the position of the image formed by the lens. Label the image **I**. [3]

The image formed by the lens is a real image.

(b) Explain the difference between a real image and a virtual image.

.....

..... [1]

(c) State how converging lens can be used to produce an enlarged virtual image.

..... [1]

The human eye works as the same principle as the camera lens.

(d) Fig. 5.2 shows a normal eye viewing an object close to it. Fig. 5.3 is a long-sighted eye viewing an object at the same distance.

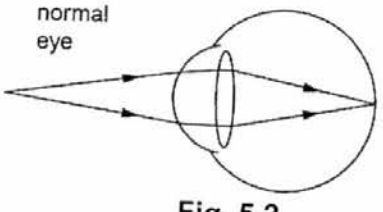


Fig. 5.2

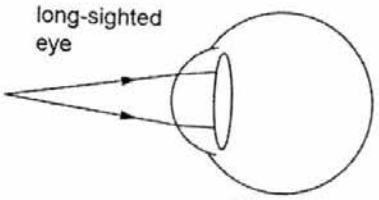


Fig. 5.3

Long-sightedness is a condition where the light can only be focused behind th
eye.

Complete Fig. 5.3 to show the rays travelling through the eye. [

Fig. 6.1 shows an electrical circuit containing a 12 V power supply and a number of resistors.

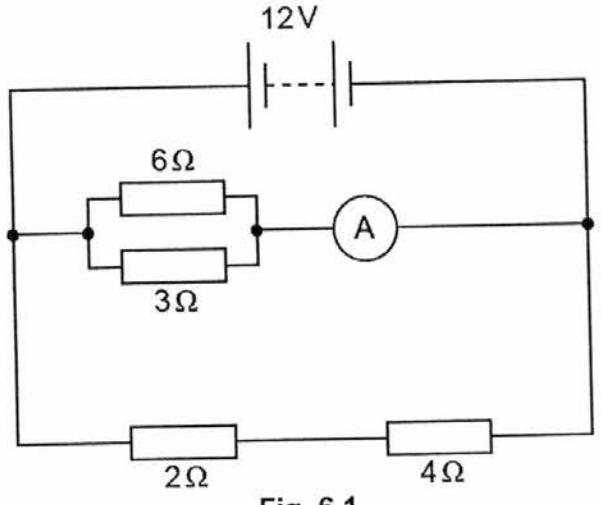


Fig. 6.1

(a) Calculate the combined resistance of

(i) the 2 Ω and 4 Ω resistors in series,

resistance = ... [1]

(ii) the 3 Ω and 6 Ω resistors in parallel.

resistance = ... [2]

(b) Calculate the reading of the ammeter in Fig. 6.1.

ammeter reading = ... [2]

(c) Determine the potential difference across the 4 Ω resistor.

potential difference = ...

7 Fig. 7.1 shows a coil of wire wrapped around a plastic tube. Inside the tube are two pieces of soft iron. You may ignore the magnetic field of the Earth in this question.

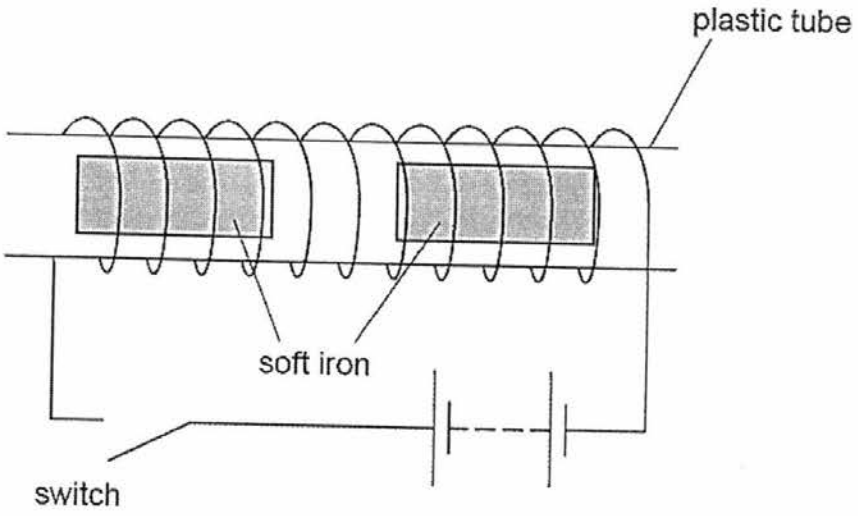


Fig. 7.1

When the switch is closed, the two pieces of soft iron in the tube become magnets and move.

(a) On Fig. 7.1, mark the poles formed on each piece of soft iron. [1]

(b) State how the pieces of iron move.

.....

..... [1]

(c) State the effect on the magnetic field of the coil when

(i) an a.c. power source is used

..... [1]

(ii) the size of the current is increased.

..... [1]

Fig. 8.1 shows the construction of a simple a.c. generator. When the coil is rotated an e.m.f. is induced in the coil.

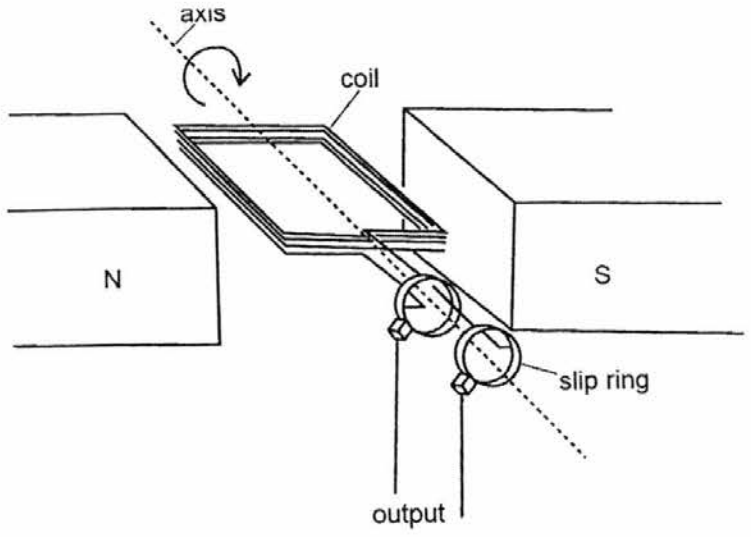


Fig. 8.1

(a) Explain why an e.m.f. is induced.

.....

..... [2]

(b) State the function of the slip rings.

.....

..... [1]

(c) The direction of the current in the coil can be found from Lenz's law.
State Lenz's law.

.....

..... [1]

(d) The induced e.m.f. can be decreased by rotating the coil slower. State one other change in the induced e.m.f. waveform apart from the decrease in its amplitude.

.....

..... [1]

Section B (30 marks)

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

9 Ultrasound may be used to measure the depth of the sea. Fig. 9.1 shows a pulse of ultrasound sent down to the sea bed and the reflected pulse returning to the ship.

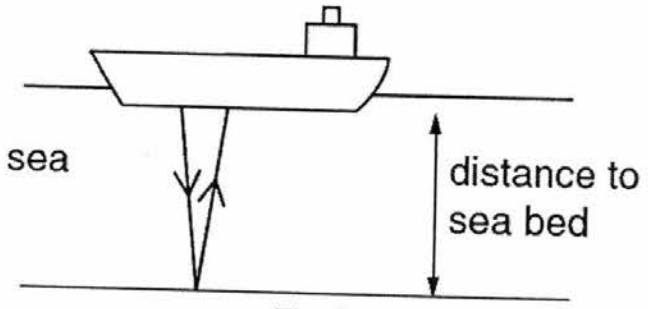


Fig. 9.1

(a) Describe what is meant by *ultrasound*.

.....

..... [2]

Fig. 9.2 is a cathode-ray oscilloscope (c.r.o.) trace of the pulses of ultrasound sent from the ship and the reflected pulses.

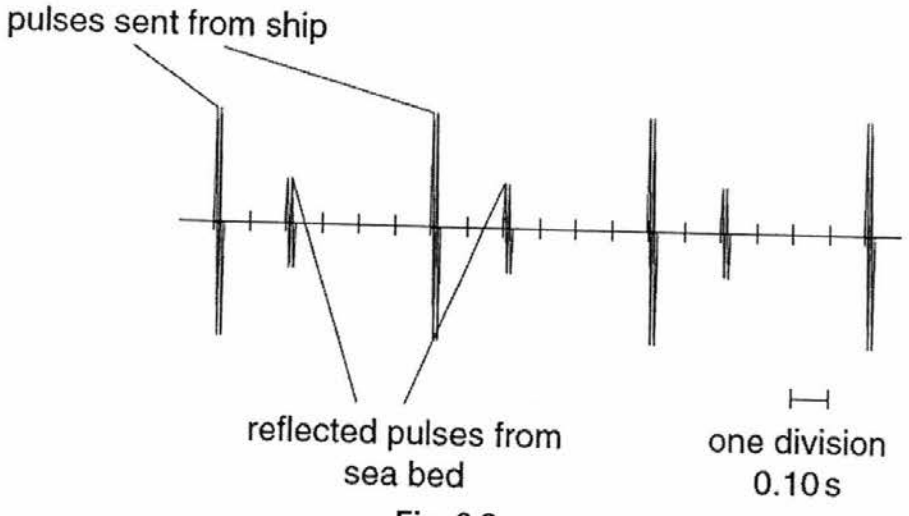


Fig. 9.2

The speed of ultrasound in water is 1500 m/s and the wavelength of the ultrasound wave is 0.030 m. The time-base setting for the *x*-axis on the c.r.o. is 0.10 s/division.

(b) Calculate the distance to the sea bed.

distance = ...

The ship moves to a place where the sea is deeper.

(c) When the sea is deeper, the ultrasound pulses must be sent out less often. Using data from Fig. 9.2, explain why this is necessary.

.....

..... [2]

(d) State how will the c.r.o. traces change when the sea is deeper.

.....

..... [2]

(e) Suggest if it is feasible for the ship to transmit sound wave (instead of ultrasound) to measure the depth of the seabed.

.....

..... [1]

10 Fig. 10.1 shows the datasheet of a typical thermistor.

For this question, you may assume that the nominal resistance, R_{nom}, is the resistance of the thermistor. For example, at 25°C, the resistance of the thermistor is 15 Ω.

Temperature measurement B57164

Leaded NTCs, lead spacing 5 mm K164

	B57164K0150K000					
R/T No.	1203					
T (°C)	$B_{25/100}$ = 2900 K, R_{25} = 15 Ω, T_R = 25 °C, $\Delta R_R/R_R$ = ± 10%					
	R_{nom} [Ω]	R_{min} [Ω]	R_{max} [Ω]	$\Delta R_R/R_R$ [±%]	ΔT [±°C]	α (%/K)
0.0	35.89	31.33	40.46	12.7	3.4	3.8
5.0	29.80	26.18	33.42	12.1	3.3	3.7
10.0	24.89	22.01	27.78	11.6	3.3	3.5
15.0	20.91	18.60	23.23	11.1	3.2	3.4
20.0	17.67	15.80	19.53	10.5	3.2	3.3
25.0	15.00	13.50	16.50	10.0	3.1	3.2
30.0	12.80	11.45	14.15	10.5	3.4	3.1
35.0	10.98	9.769	12.18	11.0	3.6	3.0
40.0	9.455	8.372	10.54	11.4	3.9	2.9
45.0	8.180	7.208	9.152	11.9	4.2	2.9
50.0	7.108	6.233	7.982	12.3	4.4	2.8
55.0	6.200	5.412	6.989	12.7	4.7	2.7
60.0	5.430	4.718	6.142	13.1	5.0	2.6
65.0	4.773	4.129	5.418	13.5	5.3	2.5
70.0	4.211	3.627	4.795	13.9	5.6	2.5
75.0	3.728	3.197	4.258	14.2	5.9	2.4
80.0	3.310	2.827	3.794	14.6	6.2	2.3

Fig. 10.1

(a) Using Fig. 10.1, describe how does the resistance of the thermistor varies with the temperature.

.....

.....

..... [2]

Esther, an engineer, design a circuit such that the thermistor is in series with a fixed resistor of 5 Ω as shown in Fig. 10.2 below.

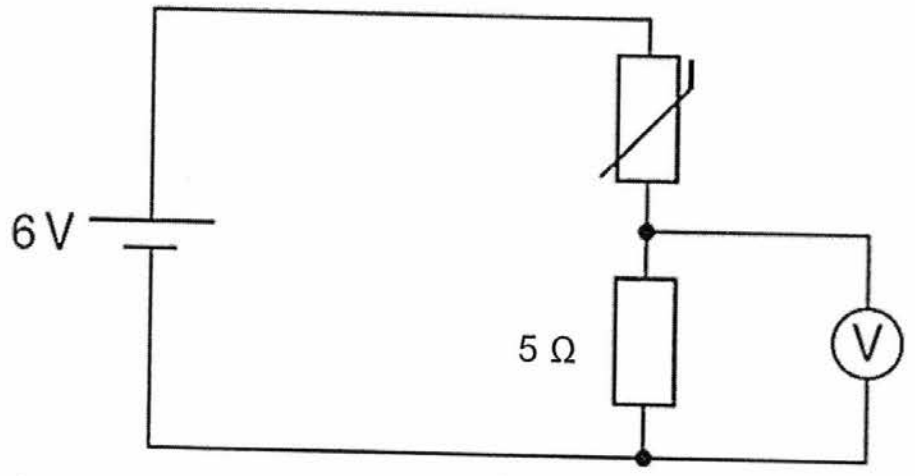


Fig. 10.2

) The circuit is designed to work within a temperature range of 15 °C to 80 °C.

(b) Calculate the voltage range that the voltmeter will be expected to measure.

voltage range = ... [3]

Esther has three voltmeters with different ranges: 0 to 3.0 V, 0 to 6.0 V and 0 to 30 V. The best range for use in this circuit is 0 to 6.0 V.

(c) Explain why

(i) using the voltmeter on the range 0 to 3.0 V is unsuitable,

.....

..... [1]

(ii) using the voltmeter on the range 0 to 30 V is unsuitable.

.....

..... [1]

Esther replaced the voltmeter with a buzzer to modify the circuit to work as a fire alarm.

The buzzer will sound off if it is supplied with a 2 V potential difference.

(d) Calculate the temperature at which the buzzer will be triggered.

temperature = ... [2]

(e) State a limitation of the circuit.

.....

.....

11 Either

Fig. 11.1 shows the main parts of an electric grill. An electric current in the heating element causes it to become red hot and to emit visible light and infra-red radiation. The infra-red radiation is used to cook food.

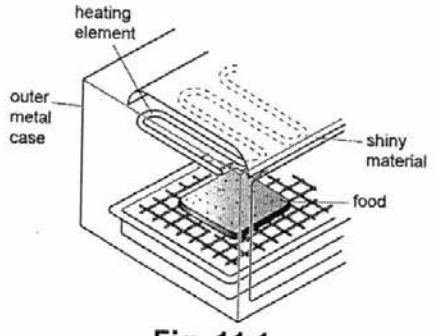


Fig. 11.1

(a) State the function of the layer of shiny material between the heating element and the outer case.

.....

..... [1]

(b) Food that is grilled will usually have black marks which are due to the metal grill lines. Explain why other parts of the food not in contact with the metal grill lines are not as easily charred.

.....

.....

..... [2]

The electric grill is now used to heat up some water. The heater is set to a power rating of 200 W.
The mass of water in the beaker is initially 100 g.

The water in the beaker is heated for a time of 120 s. During this time, the temperature of the water in the beaker rises from 80 °C to 100 °C and then the water boils. At the end of this time, the mass of water in the beaker is 95 g.

The specific heat capacity of water is 4.2 J / (g °C).
The specific latent heat of vaporisation of water is 2250 J / g.

(c) Calculate the thermal energy (heat) produced by the heater in 120 s.

thermal energy = ...

(d) Calculate the total thermal energy (heat) absorbed by the water.

thermal energy = ... [3]

(e) Explain why the answers in **(c)** and **(d)** are not the same despite the principle of conservation of energy.

.....

.....

..... [2]

11 **Or**

A farmer connects a house to the mains electricity. The house is a long way from the nearest 230 V mains electricity supply.

Fig. 11.2 shows the mains supply connected to the house.

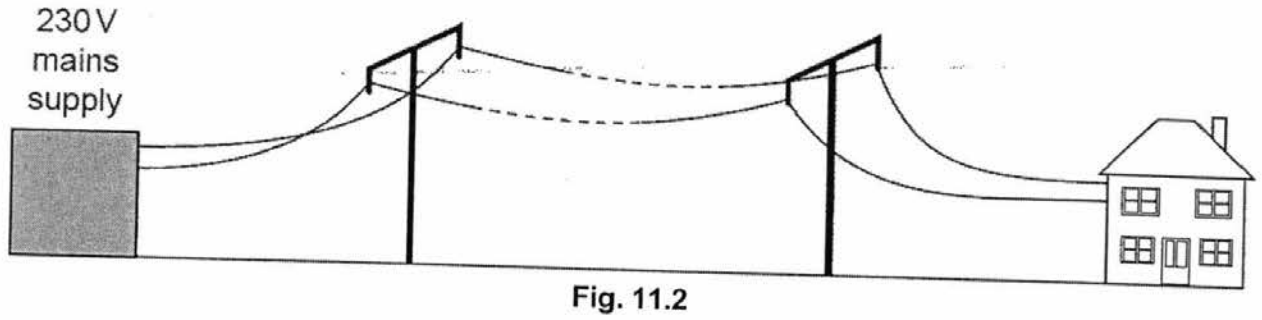


Fig. 11.2

(a) The farmer uses 230 V lamps in the house but they do not light up at full brightness. Explain why the lamps are dim.

.....

..... [2]

The farmer adds transformers, as shown in Fig. 11.3, to transmit power at high voltages.

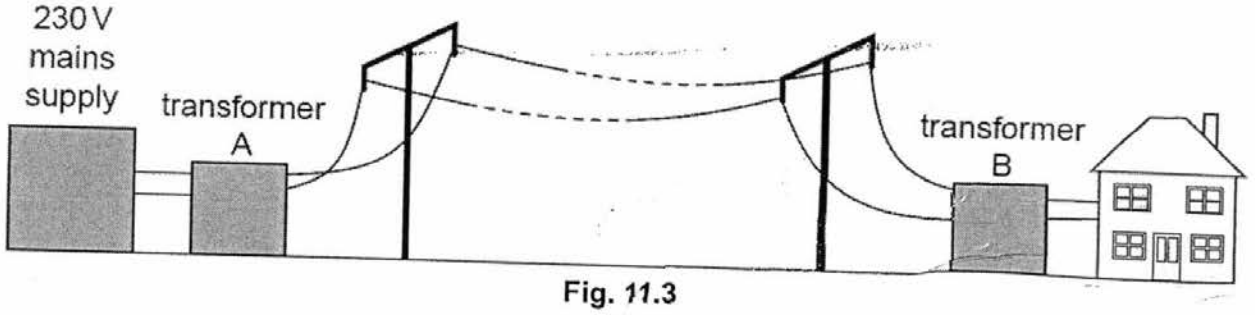


Fig. 11.3

The lamps in the distant house light up at full brightness.

(b) Explain why the lamps are now bright.

.....

..... [2]

1 Fig. 11.4 shows the set-up of Transformer **A**. You may assume that this is an ideal transformer.

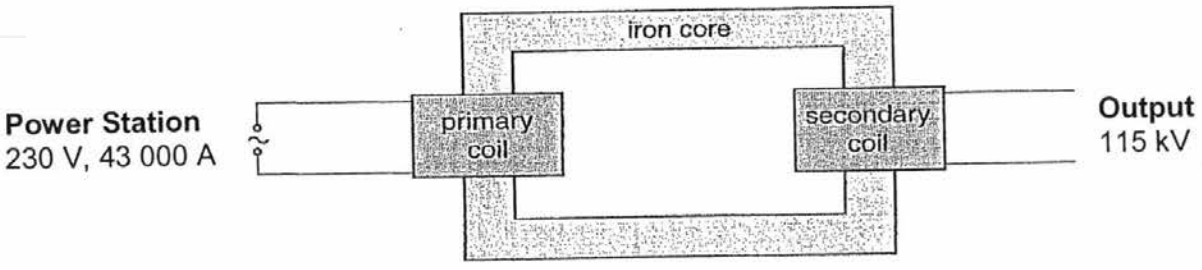


Fig. 11.4

(c) State if Transformer **A** is a step-up or step-down transformer.

..... [1]

(d) Calculate the ratio of the number of turns in the primary coil to the number of turns in the secondary coil.

ratio =.....[2]

(e) Calculate the output current from the transformer.

current = ...[2]

(f) In real life, the efficiency of the transformer ranges from 95% to 98.5%. Explain how energy is lost in the transformer.

.....

.....

..... [1]

~ END OF PAPER ~

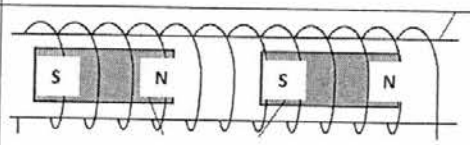
CHONG BOON SECONDARY SCHOOL Marking Scheme for 4E Phy 2016 O level Prelim

Paper 1

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

Paper 2

Qn	Answers	Mark	Remarks
1a	This means an object with a mass of 1kg would be attracted towards the centre of the Earth by a force of 10N.	B1 B1	Students merely gave definition and not answer question
1b	Draw a tangent of the curve at t=0. Measure/calculate the gradient of the tangent, it should give you 10.	B1 B1	Many did not state tangent but measure gradient over 0-5s which is wrong, some did not use diagram at all
1c	Initially, the weight is greater than air resistance. Thus there is a net downward force which makes the object accelerates downwards. As the speed increases, the air resistance increases. Air resistance increases till it equals weight. At this point, there is no NET force and there is no acceleration. The body will drop with constant/terminal velocity. The distance travelled is the area under the graph. We could estimate the area under the curve using trapezium rule	B1 B1 B1 B1 B1	Badly done. Did not link back to forces Some wrongly stated to multiply speed with time and many stated instead of describe
2a	Taking moments about c.g., $F_{front} * 7 = F_{back} * 5$ $F_{front} / F_{back} = 5 / 7$ Judging from the ratio, the lift from the back is higher	M1 A1	Some wrongly took moments about X Well done
2b	The lift force at the back will pass through the point X. It doesn't generate any moments about X and thus we cannot calculate its value	B1 B1	
2c	So that the helicopter can lift a heavier load / so that the helicopter can fly faster/ more stable or more control over tilt	B1	Only one got the standard answer of lifting heavier load
3a	W = mg 1.8 = 0.1768 g g = 10.2 N/kg	M1 A1	Students encounter conversion error
3b	volume = 4.01 * 2.04 * 1.12 = 9.162048 cm^3 Density = mass / volume = 176.8 / 9.162048 = 19.3 g/cm^3	B1 M1 A1	 3sf error
3c	No, the density measured is 19.297 and not 19.281 so there might be some impurities in it.	B1 B1	Some wrongly assume to be pure gold as the density is similar

Qn	Answers	Marks	Remarks
4ai	correct points plotted at ($0.5V_0$, $2P_0$) and ($2V_0$, $0.5P_0$)	B1	Many drew straight lines and did not get first point
4aii	curve through points of decreasing gradient	B1	
4b	when the temperature increases, the molecules move faster	B1	Did not explain but merely state
	The molecule will hit the piston with more force and affects the pressure reading	B1	
4c	molecules hit sides / piston	B1	
	more molecules hit per second / hit more frequently	B1	Did not use molecule ideas to explain
	molecular impacts create large(r) force (upwards on piston)	B1	
5a	Any TWO of: • undeviated ray through centre of lens • ray parallel to axis through point 3 cm from lens on right after lens • ray through point 3 cm to left of lens parallel to axis after lens	M2	Some have problems with the scale resulting in inaccurate answers
	rays converge and vertical image drawn and labelled I	A1	
5b	real image (can be) formed on screen; virtual image not found on screen;	B1	Some stated that real image form in front and behind(inaccurate language use)
5c	place object within focal length; between lens and focal point/principal focus	B1	
5d	Rays drawn to intercept at a point behind the eye	B1	
6ai	2 + 4 = <u>6.00 Ω</u>	B1	3sf error
aii	1/R = 1/R1 + 1/R2 (algebraic or numerical)	C1	
	<u>2.00 Ω</u>	A1	
b	I = V/R (algebraic or numerical)	C1	
	<u>6.00 A</u> [allow ecf]	A1	
c	4 / (4+2) x 12	C1	
	<u>8.00 V</u>	A1	
7a			One label poles of coil not iron
	Correctly labelled poles	B1	
7b	The irons will be attracted to each other	B1	Use inaccurate language like move back and forth
7c	The magnetic field will be constantly changing	B1	Some stated magnetic field reverse only
7d	The magnetic field will be greater	B1	

Qn	Answers	Marks	Remarks
8a	magnetic field exist between the magnets	B1	Generally well done
	when coil is rotated, the lines of (magnetic) flux/field lines which it cuts changes and induced an emf	B1	
b	pass current / connect coil to output / prevent wires tangling	B1	
c	(induced) voltage or current opposes the change (producing it)	B1	
d	The period will be longer / The frequency will be shorter	B1	
9a	Ultrasound are <u>sound waves that has a frequency above 20 kHz</u> that is <u>inaudible to the human ear</u>.	B1 B1	Generally well done
b	Time taken = 0.1 s	B1	Students have problem reading scale
	Distance = speed x time Distance = 1500 x 0.1	M1	Many wrongly use v=fλ
	Distance = <u>150 m.</u>	A1	
c	The reflected pulses will take <u>longer time to return</u>. Thus, the pulses must be sent less frequently or <u>else a new pulse would be sent before the reflected pulse has arrived</u>.	B1 B1	
d	The reflected pulses will take a longer time to return	B1	
	The amplitude of the reflected pulses will be even smaller	B1	Many missed the point on amplitude
e	No, the echo of sound would be hard to detect as there are noise in the surroundings due to the marine animals	B1	
10a	As the <u>temperature rises from 0 degrees to 80 degrees</u>, the <u>resistance value drops from 35.89 ohm to 3.310 ohm</u>.	B2	Many did not put numeric values in their description
b	At 15 degrees, resistance = 20.91ohms At 60 degrees, resistance = 5.43 ohms		Students who did not use potential divider formula found it hard. Students could get the values of resistance but not the voltage
	Min voltage = 5 / (5+20.91) x 6 = 1.16 V	B1	
	Max voltage = 5 / (5+3.31) x 6 = 3.61 V	B1	
	Range = <u>1.16 – 3.61 V</u>	B1	
ci	The voltage would be out of range	B1	
cii	The voltmeter produces a small reading which is inaccurate	B1	
d	2 = 5 / (5 + R) x 6 R = 10 ohm	M1	Many wrongly rounded down to 35 degrees
	Looking at the table, the alarm will go off at more than 35°	A1	
e	The temperature may hit 40 degrees on certain hot days	B1	Students did not get this correct

Qn	Answers	Marks	Remarks
11a	The shiny layer would reflect heat/infrared radiation back down onto the food	B1	Students who choose this did well
11b	Metal are good conductors of heat. Food in contact with the metal grills would have charred lines because apart from radiation, the heat in the metal grill is conducted quickly to the food. Whereas, the other parts of the food only receives heat through radiation only.	B1 B1	
11c	(E =)Pt or 200 × 120 24 000 J	C1 A1	
11d	(E =) mcT or 100 × 4.2 × 20 (energy to raise temperature) 8400 J (E =) mL or 5 × 2250 (energy to boil water) 11 250 J Total energy = 19650 J = 19700 J	B1 B1 B1	
11e	Energy is lost to the environment Heat energy is absorbed by the beaker	B1 B1	
11a	Due to the resistance of cables, there will be power/energy/heat loss or voltage drop or current low in cables/wires	B1 B1	Students who choose this did well
11b	low(er) current in line resulting in less energy losses/less voltage drop voltage enough to supply energy to all the lamps to run at optimum brightness.	B1 B1	
11c	Step-up transformer	B1	
11d	Turns ratio = Np/Ns = Vp/Vs = 230 / 115 000 = 1/500	M1 A1	
11e	$V_pI_p = V_sI_s$ 230 x 43 000 = 115 000 x I_s I_s = 86.0 A	M1 A1	3sf
11f	Energy may be lost in terms of eddy magnetic field in the core of the transformer or lost by magnetic flux leakage	B1	