Candidate Name: _____

Class:	
Index No:	

Chong Boon Secondary School
Preliminary Examination 2017
Secondary 4 Express
Physics 5059/01

Paper 1

15 Sep 2017 (Friday)	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.

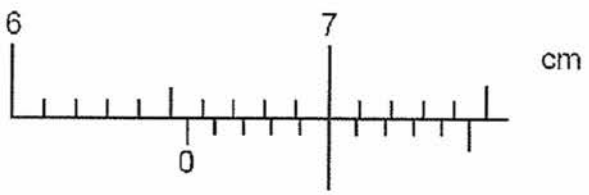
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use
40

1 When the ratchet head of the micrometer screw gauge turns 2 complete revolutions, what will be the distance between the anvil and the spindle?

A 0.50 mm B 1.00 mm C 2.00 mm D 4.00 mm

2 The diagram shows part of a vernier scale.



What is the reading on the vernier scale?

A 6.05 cm B 6.50 cm C 6.55 cm D 7.00 cm

3 A racing car accelerates at 3 m s^{-2} from a speed of 2 m s^{-1}.

If the total distance travelled is 66 m, what is the final speed of the racing car?

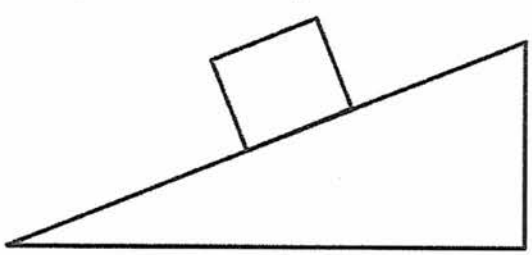
A 20 m s^{-1} B 25 m s^{-1} C 97 m s^{-1} D 99 m s^{-1}

4 An object is falling under gravity with terminal velocity.

What is happening to its velocity?

A It is decreasing to a lower value.
B It is decreasing to zero.
C It is increasing.
D It is staying constant.

5 A heavy box is being balanced on a slope as shown.



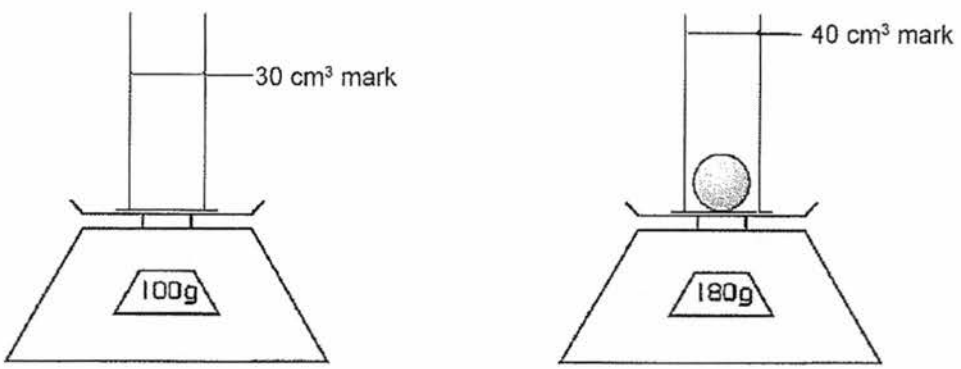
How many forces are acting on the box?

A 0 B 2 C 3 D 4

6 Which relationship defines gravitational field strength?

A mass x 10
B mass x weight
C mass / weight
D weight / mass

7 A measuring cylinder containing some water stands on a scale pan. A solid ball is lowered into the water.
The water level rises from the 30 cm^3 mark to the 40 cm^3 mark.
The scale reading increases from 100 g to 180 g.

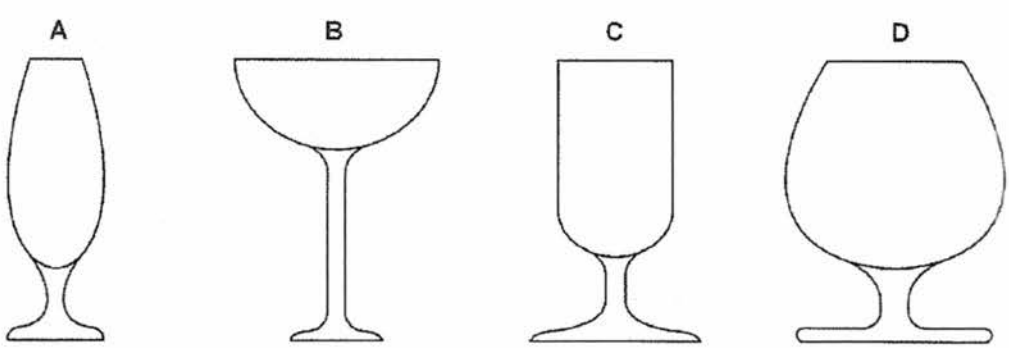


What is the density of the material of the ball?

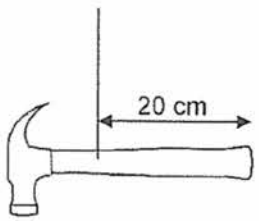
A 2.0 g cm^{-3} B 4.5 g cm^{-3} C 8.0 g cm^{-3} D 18 g cm^{-3}

8 The diagrams show the cross-sections of different glasses.

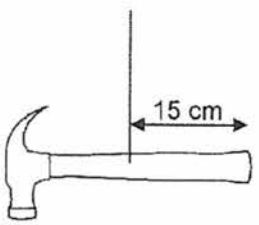
Which one is the least stable when filled with liquid?



9 A hammer weighing 2 N is being balanced at the suspended position shown.

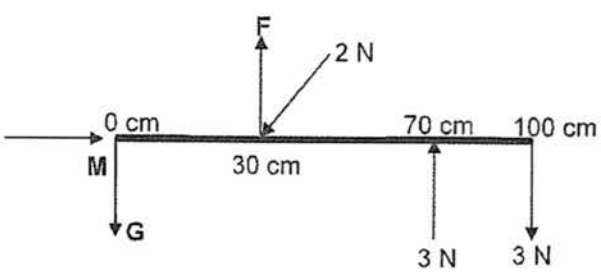


When the point of suspension is shifted to the position shown below, what is the most probable weight and position of a counterweight required to balance the hammer again?



	weight	position
A	1 N	5 cm to the left of the string
B	1 N	5 cm to the right of the string
C	2 N	5 cm to the left of the string
D	2 N	5 cm to the right of the string

10 A 1 m long light uniform beam is being balanced as shown below.



Calculate the force **G**.

A 3 N **B** 4 N **C** 5 N **D** 6 N

11 Which of the following units is a symbol for the unit of energy?

i J
ii kWh
iii W

A i only B i & ii only C i & iii only D i, ii & iii

12 A boy, who weighs 50 N, runs up a flight of stairs 6.5 m high in 7 seconds.

How much power does he develop?

A $\frac{6.5}{50\times7}$ W B $\frac{7}{50\times6.5}$ W C $\frac{50}{7\times6.5}$ W D $\frac{50\times6.5}{7}$ W

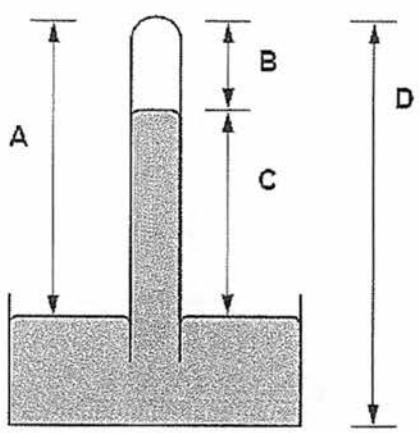
13 A 100 g object drops from a 10 m building.

What is the speed of the object when it is 4 m away from the floor?

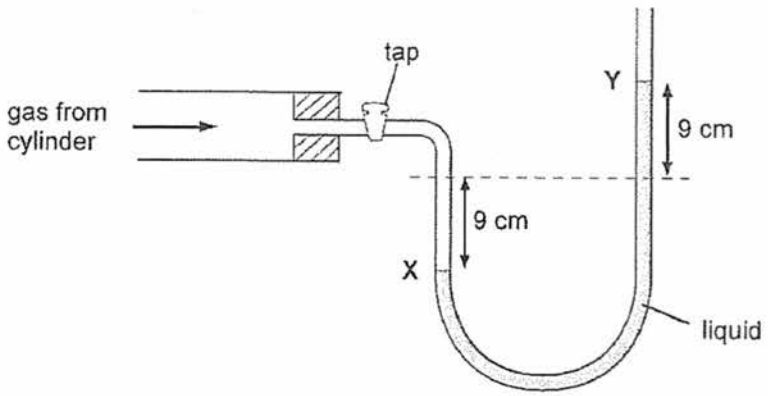
A 4 m s^{-1} B 6 m s^{-1} C 8.0 m s^{-1} D 11 m s^{-1}

14 The diagram shows a simple mercury barometer.

Which height is a measure of the atmospheric pressure?



15 The diagram shows the levels **X** and **Y** in a liquid manometer when the gas tap is opened.



What is the pressure of the gas in the cylinder?

A 9 cm of liquid above atmospheric pressure
B 9 cm of liquid below atmospheric pressure
C 18 cm of liquid above atmospheric pressure
D 18 cm of liquid below atmospheric pressure

16 A 2 cm mercury column is seen along a glass tube as shown in Figure 1. Given that the length of the trapped air is 8 cm and the atmospheric pressure is 75 cm Hg, what is the length of the trapped air when the glass tube is turned to the position shown in Figure 2?

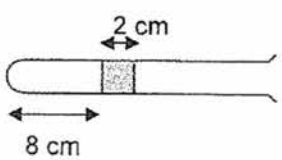


Figure 1

Figure 2

A 6.0 cm **B** 7.5 cm **C** 7.8 cm **D** 8.0 cm

17 A liquid is being heated.

Which statement is incorrect?

A The molecules expand.
B The molecules gain energy.
C The molecules move further apart.
D The molecules move faster.

18 Which of the following colours emits infra-red radiation best?

A black **B** grey **C** silver **D** white

19 During cold winter nights, the homeless people who sleep along the street cover themselves with newspaper to minimise heat loss from the body via

A conduction and convection.
B conduction and radiation.
C convection and radiation.
D conduction, convection and radiation.

20 What is 50 °C in Kelvin scale?

A 50 K B 273 K C 323 K D 423 K

21 Dexter tried to use a thermistor as a thermometer. He found that when the temperature was 200 °C, the resistance of the thermometer was 250 Ω and when the temperature was 50 °C, the resistance of the thermometer increased to 500 Ω.

What will the temperature be when the resistance of the thermistor is 300 Ω?

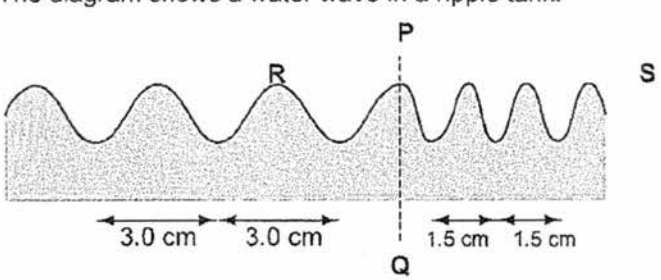
A 150 °C B 160 °C C 170 °C D 180 °C

22 A solid substance is heated strongly for some time.
At one stage, the energy given to the substance is used as latent heat of vaporisation.

At this stage, what change does the energy cause?

A It breaks the bonds holding the molecules together. Molecules escape from the liquid.
B It breaks the bonds holding the molecules together. The solid becomes liquid.
C It makes the molecules move faster but there is still a strong attraction between them.
D It makes the molecules move faster and so the temperature rises.

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

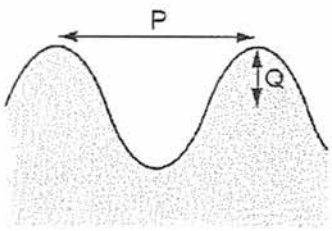


The wave has a speed of 12 cm s^{-1} at **R**.
The wave crosses a boundary **PQ** where the distance between crests changes from 3.0 cm to 1.5 cm.

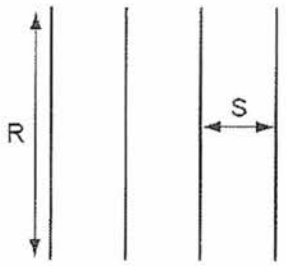
What is the speed of the wave at **S**?

A 3.0 cm s^{-1} B 6.0 cm s^{-1} C 12 cm s^{-1} D 24 cm s^{-1}

24 The diagrams show different views of a water wave in a ripple tank.



cross-section of wave

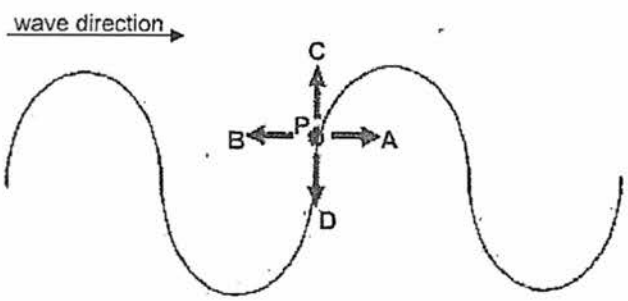


crests seen from above

Which letters represent a wavelength and a wavefront?

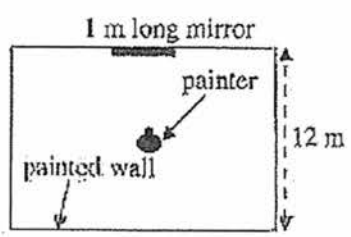
	wavelength	wavefront
A	P	R
B	P	S
C	Q	R
D	Q	S

25 A point P is marked on the rope before the rope is set to oscillate. At the particular instance shown below, what is the direction in which point P moves?



26 A painter standing in the centre of a rectangular room is looking into a 1 m long mirror at the opposite end of the room.

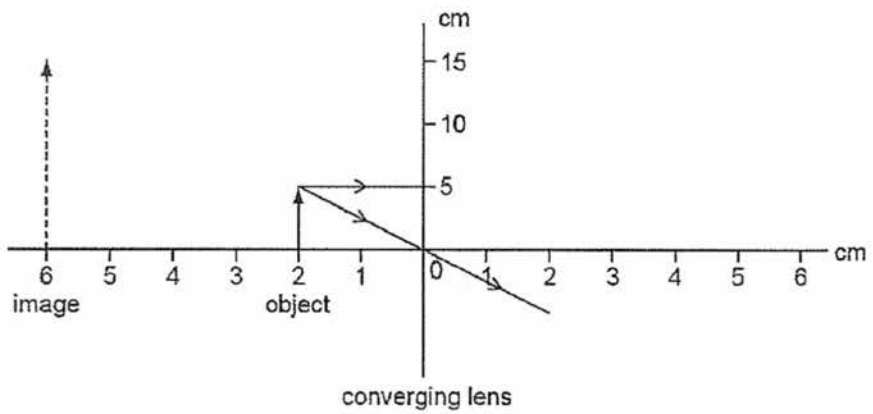
How much of the painted wall can he see through the 1 m long mirror?



A 1 m B 2 m C 3 m D 6 m

27 An object 5.0 cm high is placed 2.0 cm from a converging (convex) lens which is being used as a magnifying glass.

The image produced is 6.0 cm from the lens and is 15 cm high.



What is the focal length of the lens?

A 2.0 cm B 3.0 cm C 4.0 cm D 6.0 cm

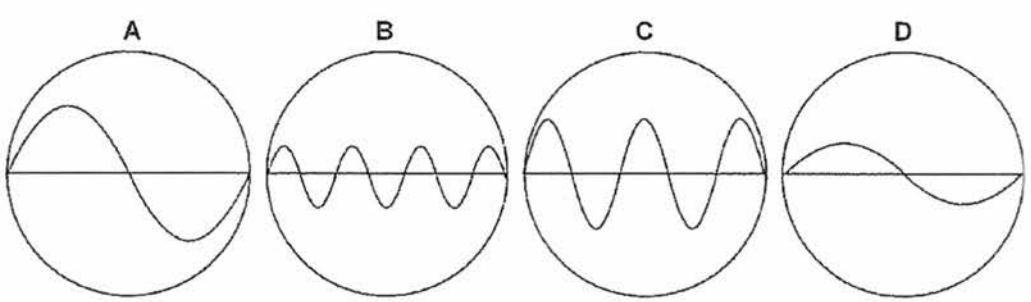
28 A hospital needs to sterilise medical equipment.

Which electromagnetic waves could be used?

A infra-red B microwaves C radiowaves D ultraviolet

29 The diagrams represent sound waves displayed on an oscilloscope.

Assuming the controls of the oscilloscope remain the same for each sound, which diagram represents the quietest sound with the highest pitch?



30 Two **identical** insulators carry charges of +1 C and -3 C respectively. What would be the final charge on the first insulator after they touch each other momentarily?

A –2 C B –1 C C 0 C D +1 C

31 Four processes are used to charge an isolated metal sphere.

i The sphere is earthed by touching it.
ii The earth connection is removed from the sphere.
iii A charged rod is brought close to the sphere.
iv The charged rod is removed.

In which order should these processes be carried out to charge the sphere?

	first ⟶			*last*
A	i	ii	iii	iv
B	i	iii	iv	ii
C	iii	i	ii	iv
D	iii	iv	i	ii

32 An electrical quantity is defined as 'the energy converted by a source in driving a unit charge round a complete circuit.'

What is this quantity called?

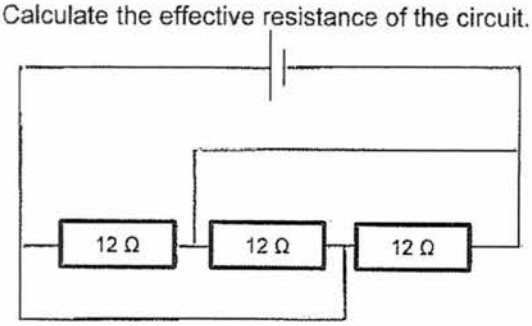
A current
B electromotive force
C potential difference
D power

33 3 J of energy is dissipated from a circuit when 6 C of charge flows through the cell.

What is the e.m.f. of the cell?

A 0.5 V **B** 2 V **C** 4 V **D** 18 V

34 Calculate the effective resistance of the circuit.



A 4 Ω **B** 12 Ω **C** 18 Ω **D** 36 Ω

35 If 1 kWh of electricity cost $0.20, how much does it cost to switch on a spotlight which is rated at 2 kW for 6 hours?

A $ 0.60 **B** $ 2.40 **C** $ 15.00 **D** $ 60.00

36 Jonathan connects the switch along the neutral wire of a fan. Which of the following statements is/are correct?

i The fan will not operate when the switch is closed.
ii The fan will still operate when the switch is opened.
iii The fan will still be connected to the high voltage source when the switch is open.

A iii only B i & iii only C i & ii only D i, ii & iii

37 Diagram 1 shows a potential divider circuit containing two 100 Ω resistors.

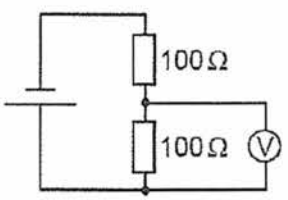


Diagram 1

One of the resistors is changed to 90 Ω, as shown in diagram 2.

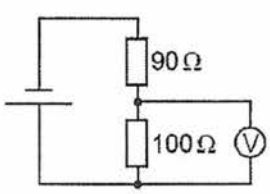


Diagram 2

How does the reading in the voltmeter change when this is done?

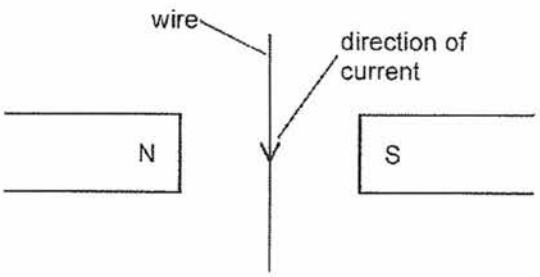
A It becomes zero.
B It decreases a little.
C It increases a little.
D It stays the same.

38 Delicate instruments are often placed in a 'box' to protect them from stray magnetic fields.

What is the material used for the box and why is it chosen?

A Aluminium is used because it is a non-magnetic material.
B Copper is used because it has a low electrical resistance.
C Polythene is used because it is a good electrical insulator.
D Soft iron is used because it is a magnetic material.

39 A current-carrying wire lies between the poles of two magnets, as shown.



What is the direction of the force on the wire?

A into the plane of the paper
B out of the plane of the paper
C towards the left
D towards the right

40 Diagram 1 shows the oscilloscope trace produced by an input of 2 V at 50 Hz.

Diagram 1

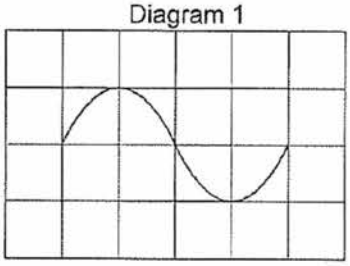
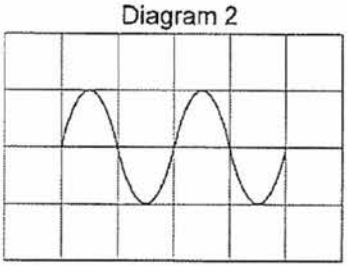


Diagram 2 shows the trace from a different input on the same oscilloscope.

Diagram 2



What is the value of the new input?

A 1V at 50 Hz
B 2V at 25 Hz
C 2V at 100 Hz
D 4V at 50 Hz

~END OF PAPER~

Candidate Name: _____

Class:	
Index No:	

Chong Boon Secondary School
Preliminary Examination 2017
Secondary 4 Express
Physics 5059/02

Paper 2

11 Sep 2017 (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 helicopter taking off vertically. It starts from rest at time t = 0 s, and has a constant upward acceleration of 0.80 m s^{-2}. The mass of the helicopter is 2000 kg. The acceleration due to free fall is 10 m s^{-2}.

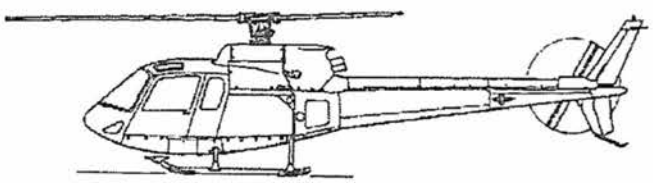


Fig. 1.1

(a) On Fig. 1.1, draw the forces acting on the helicopter. [1]

(b) Calculate the upward velocity of the helicopter at 25 s.

velocity = ... [2]

At 25 s, a box accidentally dropped from the helicopter. At this moment, the box has the same velocity as the helicopter as calculated in **(b)**.

(c) Given that the box eventually falls at terminal velocity, sketch the velocity-time graph of the box. [1]

(d) Explain, in terms of forces, how the acceleration changes when the box is initially dropped to the time when it falls at terminal velocity.

.....

.....

.....

..... [3]

2 A student measures the mass and volume of 3 plastic samples **A**, **B** and **C**.

These samples are made from **the same material** and are irregularly shaped.

Fig. 2.1 shows the results.

	A	B	C
mass / g	12.00	25.64	917.28
volume / cm^3	13.2	21.0	1008

Fig. 2.1

(a) One of the mass measurement for sample **A**, **B** or **C** is made with a faulty electronic beam balance.

Explain, using ideas on density, which reading could possibly be made by the faulty equipment.

.....

.....

..... [2]

(b) State and explain which measurement in Fig. 2.1 cannot be made using ordinary electronic beam balance found in the science laboratories.

.....

.....

..... [2]

2 Fig. 2.2 shows sample **D** which is a very thin rectangular sheet of material. A student tries to measure the thickness of sample **D** with a ruler, but the sheet is too thin to measure accurately.

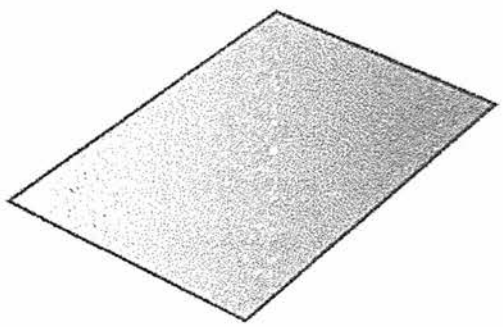


Fig. 2.2

Sample **D** is made with the same material as **A**, **B** and **C** and is measured to be 50.56 g

(c) Given that the length and breadth of the plastic sheet is 35 cm and 20 cm respectively, describe how you could determine the thickness of the plastic sheet.

.....

.....

.....

.....

..... [2]

3 Fig. 3.1 shows a freezer for keeping food frozen.

Fig. 3.1

The lid of the freezer is now closed and air at room temperature is trapped inside the freezer.

The freezer is switched on.

(a) Explain why it is more difficult to open the lid when the temperature inside the freezer drops.

.....

..... [2]

(b) Explain why the temperature inside the freezer doesn't rise much even if the lid of the freezer were to be left open for long periods of time.

.....

..... [2]

(c) State and explain a suitable colour for the outer surface of the freezer.

.....

..... [2]

4 X-rays are waves in the electromagnetic spectrum.

(a) State the name(s) of waves in the other part of electromagnetic spectrum that have shorter wavelength than X-rays.

..... [1]

(b) Explain why the waves in **(a)** will have a frequency higher than X-rays.

.....

..... [2]

(c) State an application of X-rays.

..... [1]

5 Fig. 5.1 shows the motion and arrangement of a liquid particles as drawn by a student.

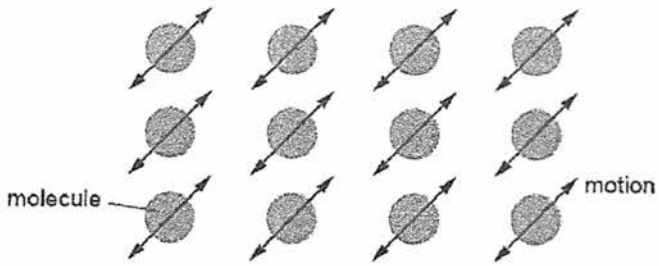


Fig. 5.1

(a) Describe how you would re-draw the diagram to make it more accurate.

.....

.....

..... [2]

(b) Describe how the movement and arrangement of particle would change as it is slowly heated from liquid to gaseous state.

.....

..... [2]

6 An ultrasonic sensor is a sensor that measures distance using sound. A short pulse of sound waves travelling at 333 m s^{-1} produces an echo from a wall. The echo arrives back at the sensor 0.12 s after the pulse is produced.

(a) Calculate the distance from the sensor to the wall.

distance = ... [2]

The wavelength of the sound wave is 30 mm.

(b) Calculate the frequency of the sound wave.

frequency = ... [1]

6 The sound wave produces compressions and rarefactions in the air as it passes.

(c) Calculate the distance between a compression and the nearest rarefaction.

distance = ... [1]

(d) State **two** reasons why such sensors must operate at ultrasonic frequencies.

.....

..... [2]

7 Fig. 7.1 shows a potential divider circuit made from a light-dependent resistor (LDR) and a rheostat that is set to 3.0 kΩ. The potential divider is connected in series with a 12 V d.c. power supply and a voltmeter is connected across the LDR.

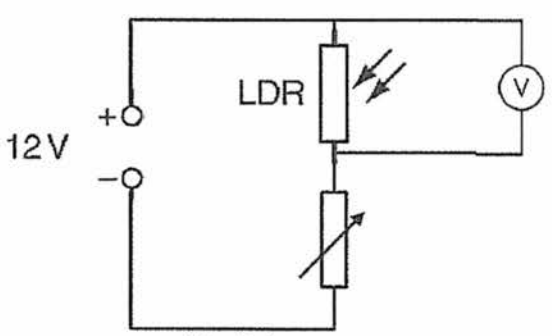


Fig. 7.1

A light shines on the LDR and the resistance of the LDR is 1.0 kΩ.

(a) Calculate

(i) the current in the circuit,

current = ... [2]

(ii) the voltage shown on the voltmeter.

voltage = ... [2]

7 (b) Describe and explain how the reading of the voltmeter would change when the light intensity decreases.

.....

.....

..... [2]

(c) Describe and explain the effect of increasing the resistance of the rheostat.

.....

.....

..... [2]

(d) Suggest a practical use for the circuit in Fig. 7.1.

.....

..... [1]

8 Given that two identical metal rods are attracted to each other.

(a) Without using any other instruments or equipment, describe and explain how you would

(i) show that both rods are magnets.

.....

.....

..... [2]

(ii) show that one rod is a magnet the other is a metal.

.....

.....

..... [2]

8 (b) Both rods are found to be magnets. Fig. 8.1 shows a coil **ABCD** placed in between the rods. The fixed paper clips allows current to pass into and out of the coil.

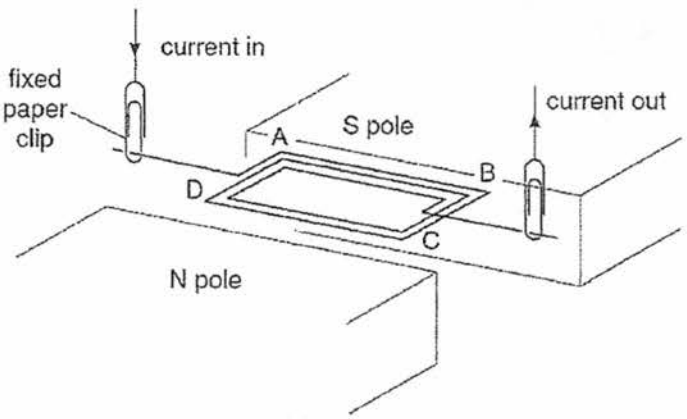


Fig. 8.1

(i) State and explain the direction of the force on side **CD**.

.....

.....

..... [2]

(ii) Describe and explain what will happen to **ABCD** in Fig. 8.1 when the current is left running.

.....

.....

.....

.....

..... [2]

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 It is a well-known fact that the maximum stopping distance travelled by a car depends on many factors. Two of the physical factors – road condition and the condition of the tyres – which determine whether the car stops or skids on braking is considered in this situation here.

Fig. 9.1 shows how the maximum possible friction between a car tyre and the road varies with the speed of the car, in wet road conditions.

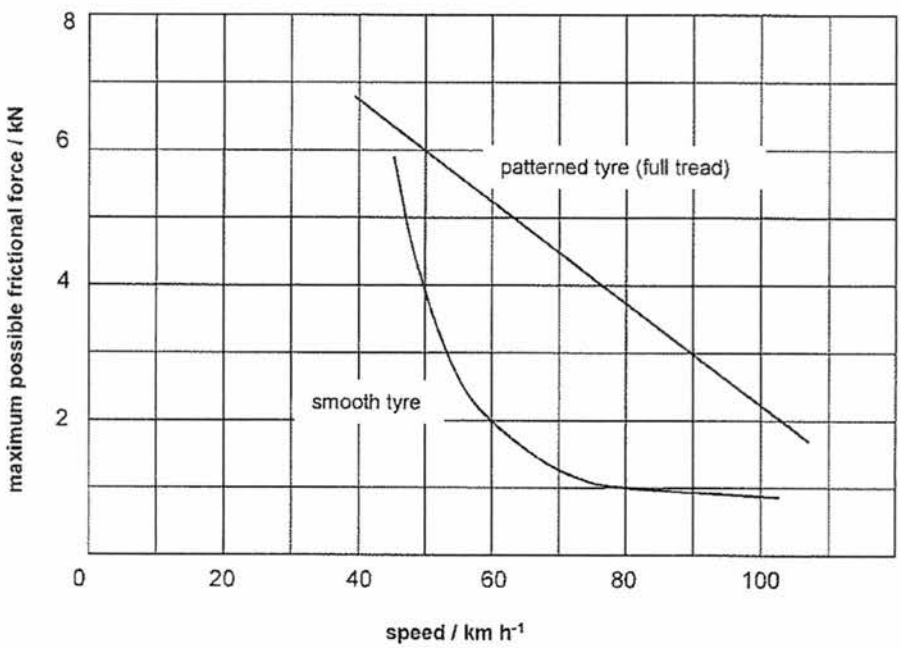


Fig. 9.1

(a) Describe how fig. 9.1 shows that using a patterned tyre is safer than using a smooth tyre.

.....

..... [1]

Fig. 9.2 shows the tread pattern of the patterned tyre.

Patterned tyre

(full tread)

Fig. 9.2

9 **(b)** With reference to Fig. 9.2, explain how does the tread pattern help the patterned tyre achieve a greater frictional force as compared to the smooth tyre in wet road conditions.

.....

..... [2]

In addition to the frictional forces between the tyres and the road, the car also experiences air resistance. The air resistance F_{air} experienced by a car at any speed v (in km h^{-1}) is given by the equation

$$F_{air} = kv^2, \text{ where } k \text{ is a constant.}$$

A car with **patterned tyres** is moving on a **wet** road at a constant speed of 50 km h^{-1}. The total mass of the car and its passengers is 900 kg.

(c) If the air resistance experienced by the car at that speed is 5.0 kN, determine value of the constant k.

k = ... [2]

The car's speed is now increased to a new constant speed of 90 km h^{-1} in 5 s.

(d) Calculate the acceleration of the car in m s^{-1} in the 5s when the speed is increasing.

acceleration = ... m s^{-1} [2]

(e) Calculate the driving/forward force of the car when it is travelling at a constant speed of 90 km h^{-1}.

driving force = ... N [3]

10 Fig. 10.1 shows the structure of a 1200 W electric kettle.

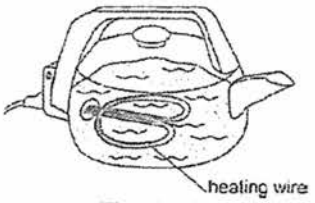


Fig. 10.1

(a) Explain why the heating wire must be at the base of the kettle.

.....

.....

..... [2]

Sammy uses the kettle in Fig. 10.1 to boil 1 litre of water at 20 °C. [1 ml = 1 cm^3]

(b) Given that the specific heat capacity of water is 4.2 J g^{-1} $°C^{-1}$ and the density of water is 1 g cm^{-3},

(i) calculate the time it takes for the water to reach 100 °C.

time = ... [2]

(ii) Explain what it means by *specific heat capacity of water is 4.2 J g^{-1} $°C^{-1}$.*

.....

..... [2]

(iii) State one assumption you made for your calculation in **(b)**.

..... [1]

10 Sammy then uses 200 ml of 100 °C water to make a cup of milo. Since the milo is too hot, she adds 50 g of 0°C ice cubes into the milo.

(c) Given that the specific latent heat of fusion of ice is 334 kJ kg^{-1} and the specific heat capacity of the milo is 4.2 J g^{-1} $°C^{-1}$, calculate the final temperature of the mixture.

temperature = ... [3]

11 **Either**

In a lighthouse, mirrors and lens are commonly used to focus the light in a certain direction. Fig. 11.1 shows a mirror on the wall behind a wall lamp. The mirror behind the lamp is modelled after lamps in a lighthouse.

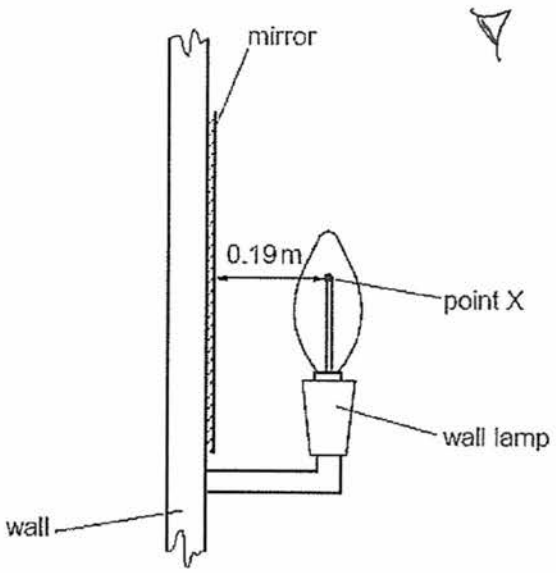


Fig. 11.1

X is a point on the filament of the lamp, 0.19 m in front of the mirror. Light from the lamp would reflect off the mirror on the wall

(a) On Fig. 11.1,

(i) draw and label the image of point **X**. [1]

(ii) draw a ray diagram to show how light rays reflects off the mirror into the eye. [2]

(b) Explain how does the mirror makes the lamp seem brighter.

.....

..... [2]

11 Another technique used to focus light in a certain direction is achieved by using converging lens as shown in Fig. 11.2.

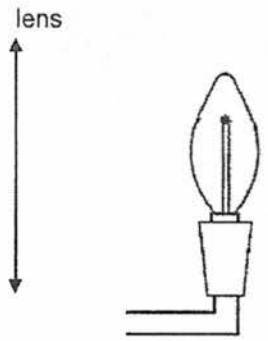


Fig. 11.2

(c) Complete the ray diagram in Fig. 11.2 to show how the lens help to focus the light in a certain direction. Also label the focal length on the diagram. [2]

(d) State and explain which type of lens is used.

.....

..... [2]

(e) State whether the lens used should have a long or short focal length.

..... [1]

11 Or

Fig 11.3 shows an electric dynamo which generates Alternating Current (A.C.) to power up the bicycle lamp when it is moving.

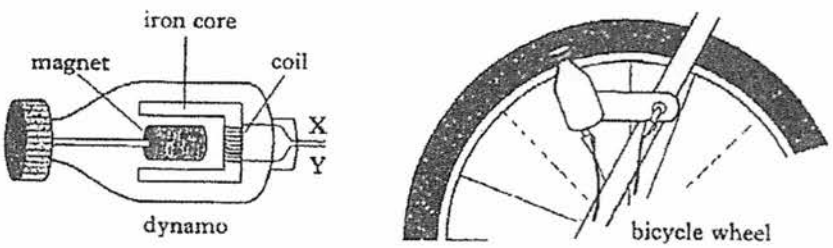


Fig. 11.3

(a) Describe two advantages of rotating the magnet instead of rotating the coil.

.....

..... [2]

(b) State how the current through **X** and **Y** will be affected when

(i) the soft iron bar is replaced by a plastic bar.

.....

.....

..... [2]

(ii) the number of turns in the coil in increased.

.....

.....

..... [2]

(iii) the cyclist cycle faster.

.....

.....

..... [2]

(c) Suggest and explain how you would modify the circuit so that a direct current is produced.

.....

..... [2]

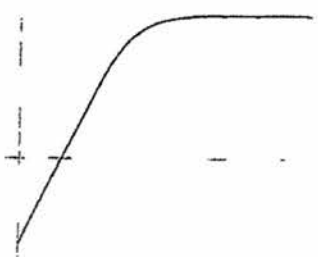
~ END OF PAPER ~

Marking Scheme for 4E Phy 2017 O level Prelim

Paper 1

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

Paper 2

Qn	Answers	Mark	Remarks
1a	Upward lift force and downward weight force with label	B1	Many miss out the lift force
1b	a = (v-u) /t or 0.8 = (v-0) / 25 v = 20 ms^{-1}	M1 A1	
1c		B1	Badly done Many started from 0 which is wrong
1d	initially acceleration > 10 m s^{-2} because there is weight acting on the box and air resistance (acting downward) as velocity increases, air resistance increases and the resultant downward force decreases, acceleration decreases when air resistance equals weight, resultant force = 0 thus acceleration = 0 (terminal velocity)	B1 B1 B1	Did not link to forces or use forces to explain
2a	B is wrong Density of A and C are the same (0.91 gcm^{-3}) while B is 1.22 gcm^{-3}	B1 B1	
2b	C will not fit in or volume too large	B1 B1	
2c	calculate volume of sheet using the measured density and mass get height by dividing volume with area of sheet	B1 B1	
3a	When temperature drops, pressure inside freezer drops. Pressure difference between the inside and outside gets greater and more force is required to overcome this pressure to open the freezer	B1 B1	Wrongly answered that particles contract, did not link to pressure concepts
3b	Cold air being denser will sink. Cold air will remain in freezer instead of rising out from the freezer	B1 B1	
3c	White. Poor radiator of heat so less heat radiated out	B2	Many gave contradicting answers e.g. good absorbers and emitter

Qn	Answers	Marks	Remarks
4a	Gamma wave	B1	
4b	All EM waves have same velocity. v = fλ, having higher frequency will lead to shorter λ.	B2	
4c	Medical diagnosis of bones	B1	
5a	Molecules should not be in orderly manner and closer to each other Motion should be random and not in the fixed direction	B1 B1 B1	Many miss out on the random direction
5b	Move faster More spaced apart, in random order	B1	
6a	Dist = spd x time or dist = 333 x 0.06 or dist = 0.5(333 x 0.12) Dist = 20 m	M1 A1	2/3sf
b	v = fλ or 333 = f(0.03) f = 11100 Hz	B1	2/3sf + units
c	15 mm	B1	
d	Noise pollution / disturb other humans Background noise doesn't affect operation	B1 B1	Miss out 2nd point
7ai	V=RI or 12 = I(4000) I = 3.0 mA	M1 A1	2/3sf
7aii	$V = \frac{R_{LDR}}{R_{rheostat}+R_{LDR}} \times V$ or $V = \frac{1000}{3000+1000} \times 12$ V = 3.0 V	M1 A1	2/3sf
7b	Voltmeter reading will slowly increase. Because $V_o = \frac{R_{LDR}}{R_{rheostat}+R_{LDR}} \times V_s$. When light intensity decreases, R_{LDR} increases and Voltage will increase accordingly to the formula	B1 B1	Did not use formula to explain
7c	It will make the circuit less sensitive/needs more changes in light intensity before voltmeter reading change by increasing $R_{rheostat}$, R_{LDR} must change even more before the voltage will make the corresponding change.	B1 B1	
7d	Light dependent switch/ street light/night lamp	B1	
8ai	Reverse one of the rod to see if it repels Only repulsion will prove that the rods are magnets	B1 B1	
8aii	Put metals in a T-shape. If the metals attract then the vertical rod is a magnet, If it doesn't attract, then the horizontal rod is the magnet Magnet is weakest at the centre	B1 B1	Badly done
bi	Downward force Flemings left hand rule	B1 B1	Many wrongly stated right hand rule
bii	ABCD cannot continue to make a full rotation and would eventually rotate until it becomes vertical Current doesn't change direction and thus the AB end would always experience an upward force while the CD end would always experience a downward force	B1 B1	Many state that the rotation will continue to roll

Qn	Answers	Marks	Remarks
9a	Graph for the patterned tyre is higher than the curve for smooth tyre / patterned tyre registers a higher friction compared to smooth tyre over different speeds.	B1	Did not link back to Fig9.1 as required
b	Grooves in patterned tyres channel water away from centre to its sides for more grip Smooth tyres (no channels) maintains a layer of water between tyre and road surface. Frictional forces in smooth tyres is therefore less.	B1 B1	
c	$F_{air} = kv^2$ or 5.0 kN = k(50 kmh^{-1})^2 $k = \frac{5.0 \quad kN}{2500 \; km^2h^{-2}}$ $= 2\times10^{-3} kN\, km^{-2}h^2$	M1 A1	2/3sf
d	90 km h^{-1} = 25 ms^{-1} , 50 km h^{-1} = 13.9 ms^{-1} a = (v-u) /t or (25 – 13.9) /5 a = 2.22 m s^{-2}	M1 A1	Did not convert to ms^{-1}
e	At 90 kmh^{-1}, Frictional force = 3.0 kN $F_{air} = kv^2$ $= (2\times10^{-3})(90)^2 \frac{kN}{km^2h^{-2}}(km^2h^{-2})$ $= 16.2\, kN$ Driving force = 16.2 kN + 3.0 kN = 19.2 kN	B1 M1 A1	Wrong application of resultant force and F = ma
10a	Hot water being less dense will rise. So that convection can take place in the kettle to heat up the water	B1 B1	
bi	$Q = mc\Delta\theta$ or 1200*t = 1000 *4.2*(100-20) t = 280 s	M1 A1	
bii	It takes 4.2 J of energy to raise the temperature of 1g of water by 1 degree	B1 B1	
biii	There is no heat loss to the environment / no electrical losses	B1	
c	Q = ml$_f$ (energy required to melt 50g of ice) Q = 0.05 *334 000 = 16 700 J Let final temp be T Heat loss by boiling water = heat gain melt ice + raise temp 200 *4.2 (100 – T) = 16 700 + 50*4.2*(T-0) 84000 - 840T=16700 + 210T T = 67300 / 1050 T = 64.1 °C	 M1 M1 A1	Miss out energy used to raise temp of ice water that has melted

Qn	Answers	Marks	Remarks
E 11a	Correct position of I	B1	
	Correct reflection	B1	
	Correct arrow direction	B1	
11b	less/no light is absorbed by the wall	B1	
	more light is reflected back to the eye	B1	
11c	correct ray of light	B1	
	correct label of focal length	B1	
11d	converging lens	B1	
	diverging lens will spread out the light and not converge/direct it into certain direction	B1	
11e	Short focal length	B1	
O 11a	Less wear and tear in wires	B1	
	No need for the use of slip rings	B1	
bi	Amplitude will be lesser	B1	Did not state frequency
	Frequency the same	B1	
bii	Amplitude will be greater	B1	
	Frequency the same	B1	
biii	Amplitude will be greater	B1	
	Frequency will be greater	B1	
c	Add a diode at X/ split ring	B1	
	Diode will prevent current from flowing from the other direction	B1	