XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN

Preliminary Examination 2017

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

PHYSICS 5059/01

Paper 1 Multiple Choice **24 August 2017**

Secondary 4 Express **1 hour**

Setter: Mr Kevin Chan
Vetter: Mr Zhuang Haoyang

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Question Paper and Answer Sheet in the spaces provided.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C**, **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	
Total	/40
Parent's Signature	

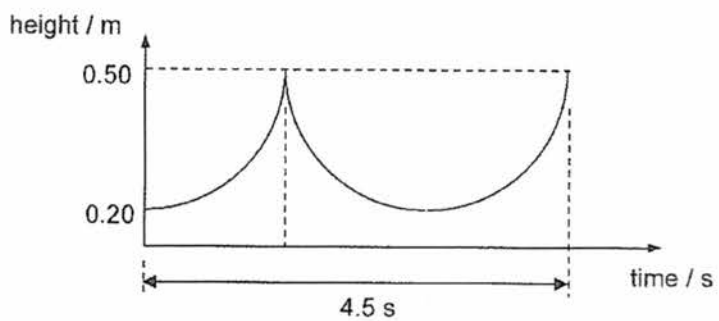
This document consists of **11** printed pages and 1 blank page.

1 Which instruments can accurately measure the thickness of a paper and the internal diameter of a cup?

	thickness of paper	internal diameter of cup
A	micrometer	ruler
B	vernier calipers	micrometer
C	micrometer	vernier calipers
D	ruler	vernier calipers

Refer to the graph below for **Questions 2** and **3**.

A graph of the height of a swinging pendulum bob against time is shown below. The pendulum bob has a mass of 200 g.



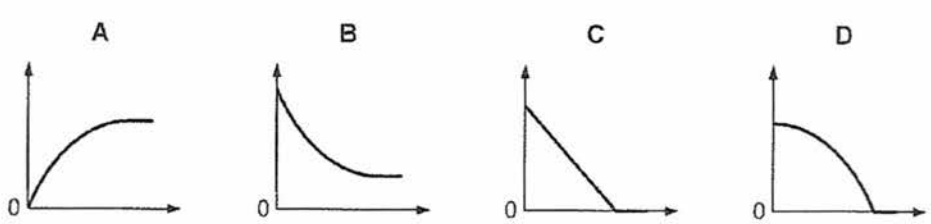
2 What is the period of the oscillation?

A 1.5 s B 3.0 s C 4.5 s D 6.0 s

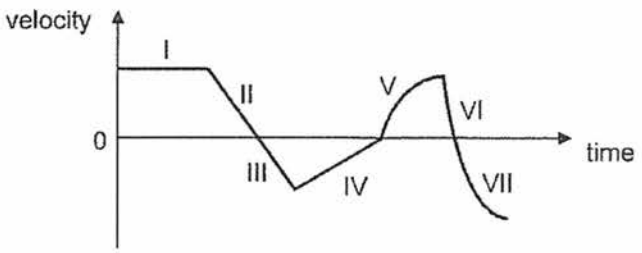
3 What is the maximum gain in gravitational potential energy of the pendulum?

A 0.40 J B 0.60 J C 0.80 J D 1.00 J

4 Which of the following distance-time graphs shows a car gradually slowing down until it stops?



5 The velocity-time graph of an object moving in a straight path is shown below. The graph is divided into seven sections from I to VII.



How many times does the car change direction?

A 3 B 4 C 5 D 6

6 A car is moving round a horizontal roundabout at constant speed. Which of the following remains constant throughout the motion?

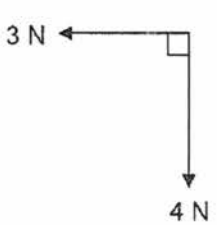
A acceleration of the car
B curved distance covered in a second
C velocity of the car
D resultant force on the car

7 A car of mass 800 kg is moving on a horizontal road. When the car is moving forward at a constant acceleration of 1.5 m/s^2, it encounters the combined forces of air resistance and frictional force from the road.

If the combined resistive forces are 500 N, what is the **forward driving force F** required to accelerate the car at 1.5 m/s^2?

A 300 N B 500 N C 1200 N D 1700 N

8 Two forces, 3 N and 4 N act at the centre of gravity of a solid object. The directions of the forces are shown on the right. The forces are **not** drawn to scale.



If a third force acts on the object such that the resultant force on the object is zero, which of the following represents the third force?

A

B

C

D

9 Which of the following rectangular objects has the lowest density?

Object	Length / cm	Breadth / cm	Height / cm	Mass / g
A	3	4	3	350
B	5	4	4	480
C	5	4	3	500
D	10	5	2	800

10 When a balloon is released, it rises in the air. It will eventually stop rising once it reaches a certain height H from the ground. Why is this so?

A The gravitational force acting on the balloon is higher at H than on Earth.

B The normal contact force on the balloon becomes zero.

C The density of the air in the balloon is the same as the density of the atmosphere at H.

D The size of the balloon decreases due to a decrease in its weight.

11 An astronaut lands on a planet which has a higher gravitational field strength than Earth. Which of the following will be the same as on Earth?

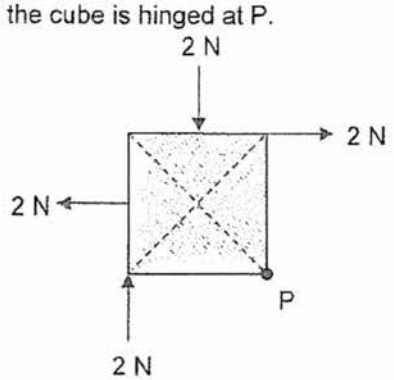
A The period of oscillation of a simple pendulum

B The ease of changing the motion of a swinging can filled with sand

C The height reached by the astronaut when he jumps with the same initial velocity

D The weight of the astronaut as measured by a spring balance

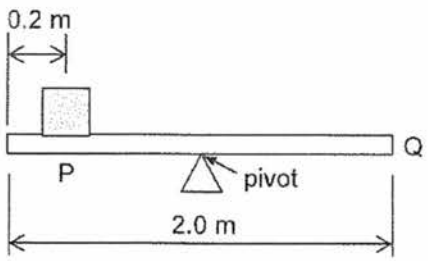
12 A cube of sides S m is subjected to four forces as shown below. All four forces have a magnitude of 2 N and the cube is hinged at P.



How many pairs of the forces above will give a net moment with a magnitude of S Nm?

A 2 B 3 C 4 D 5

13 The diagram below shows a uniform plank supported at the centre by a pivot. The plank is allowed to slide on the pivot. A load of 2.0 N is attached to the plank at P.



Which of the following actions can stabilise the plank horizontally?

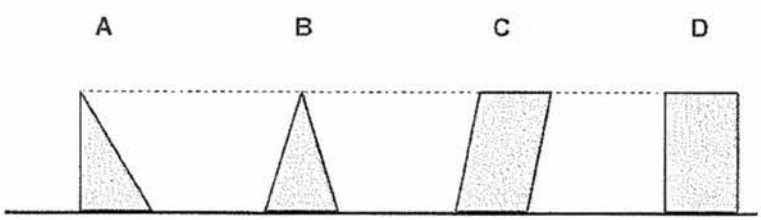
A Move the plank with the load slowly to the right until it stabilises.

B Move the plank with the load slowly to the left until it stabilises.

C Place a load of 4.0 N at a distance of 0.6 m to the right of the pivot.

D Suspend the plank at Q with a rope.

14 The diagrams below show cross-sections of four solid objects. Which object is the most stable?



15 Which of the following is the rate of the product of the force and the distance which is measured in the direction of the force?

A power **B** moment **C** work done **D** acceleration

16 A student is carrying a Science book while walking a distance of 8.0 m along a corridor. The weights of the student and the book are 500 N and 20 N respectively.

What is the work done by the student in carrying the book against gravity?

A 0 J **B** 160 J **C** 4160 J **D** 5200 J

17 When a force of 5.0 N is exerted on an object, the object moves at a constant speed of 0.20 m/s. What is the power exerted on the object if the object travels a distance of 50 m?

A 1.0 W B 25 W C 250 W D 500 W

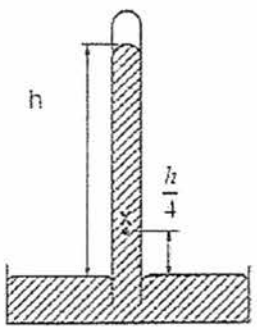
18 The height of a mercury barometer is h when the atmospheric pressure is 120 000 Pa. What is the pressure at X?

A 30 000 Pa

B 60 000 Pa

C 90 000 Pa

D 120 000 Pa



19 **Fig. 19.1** shows a J-shaped tube which contains 5.0 cm^3 of air trapped by the mercury. More mercury is poured into the open tube until the levels differ by 76 cm as shown in **Fig. 19.2**. If the atmospheric pressure is 76 cm Hg, what is the volume of trapped air in **Fig. 19.2**?

A 2.0 cm^3

B 2.5 cm^3

C 3.0 cm^3

D 3.5 cm^3

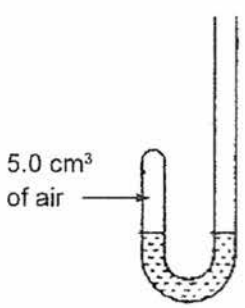


Fig. 19.1

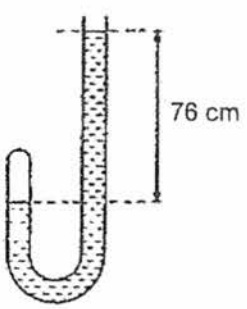


Fig. 19.2

20 A student is holding a large cube of sides 10.0 cm. A small cube of sides 5.0 cm is placed on top of the large cube. The mass of the large cube and small cube are 300 g and 120 g respectively. The student releases the large cube causing both cubes to fall towards the ground. Assume that the air resistance is negligible.

What is the pressure exerted by the large cube on to the small cube when they are falling?

A 0 N/cm^2 B 0.018 N/cm^2

C 0.030 N/cm^2 D 0.048 N/cm^2

21 When a gas is heated in a closed metal container, the pressure rises because the gas molecules

A expand.

B hit the walls of the container more.

C vibrate more often.

D hit the walls of the container less.

22 During a cold weather, underground water pipes which are made from iron will sometimes burst. This is because

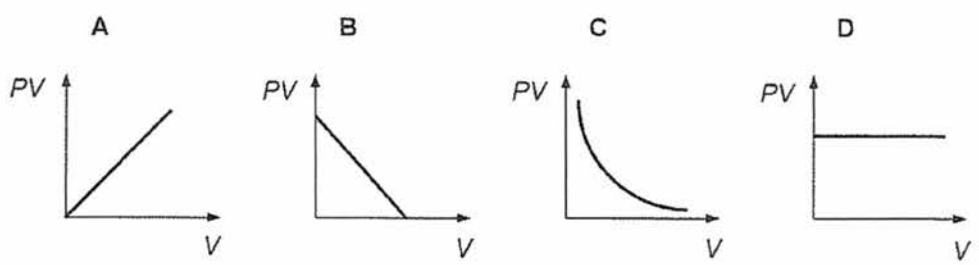
A the pipes contract on cooling which decreases the water pressure inside.

B the pipe expands when cooled from 4 °C to 0 °C.

C the iron pipes becomes brittle when subjected to a very low temperature.

D the formation of ice from water will increase its volume inside the pipes.

23 An experiment is conducted to determine the relationship between the volume V of a fixed mass of gas and the gas pressure P in a closed container. Which of the following PV against V graphs is correct?



24 A lump of 100 g ice at -10 °C is put inside a glass of 240 g water which is at a temperature of 60 °C. The following information is provided:

specific heat capacity of ice = 2100 J / kg.°C

specific heat capacity of water = 4200 J / kg.°C

specific latent heat of fusion of ice = 0.336 MJ / kg

What is the lowest temperature of the water in the glass that can be achieved?

A 16.4 °C B 17.3 °C C 18.8 °C D 40.9 °C

25 "When a substance is heated, the average kinetic energy of the particles in the substance remains constant. The particles begin to slide on each other."

What is the name of the process described above?

A Freezing B Melting C Condensation D Boiling

26 Which one of the following is in a correct descending order of the wavelengths?

A radio wave, visible light, x-ray B radio wave, x-ray, visible light

C x-ray, visible light, radio wave D visible light, radio wave, x-ray

27 A total of 16 wave crests pass through a point in the sea in a minute. The distance between two successive wave crests is 1.0 m. What is the speed of the wave?

A 0.23 m/s B 0.25 m/s C 0.27 m/s D 0.30 m/s

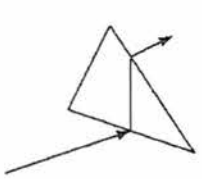
28 The pitch of a sound from a musical instrument P is higher than the pitch of a sound from another musical instrument Q. This means instrument P gives out waves

A which have a longer wavelength. B which have a shorter wavelength.

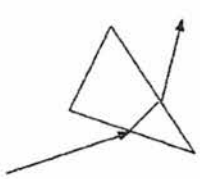
C which have a faster speed. D which have a slower speed.

29 Which of the following shows the correct ray of light passing through the glass prism?

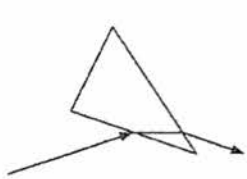
A



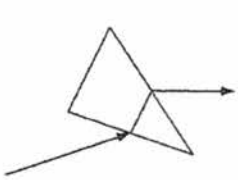
B



C



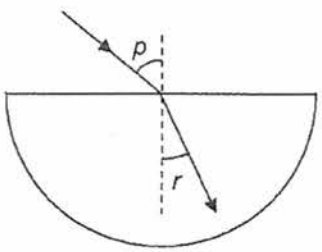
D

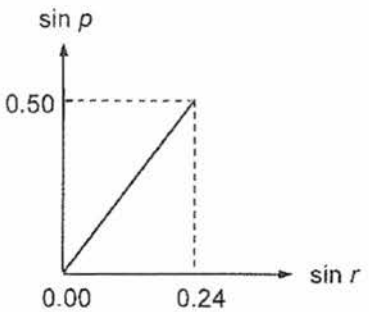


30 A monochromatic light refracts when it travels from water to air. Which of the following is correct about the speed and the frequency of the light ray?

	speed	**frequency**
A	remains the same	remains the same
B	increases	remains the same
C	decreases	increases
D	decreases	decreases

31 A light ray is refracted as it enters a semi-circular glass block as shown. A graph of sin p against sin r is plotted as shown.





What is the critical angle of the glass?

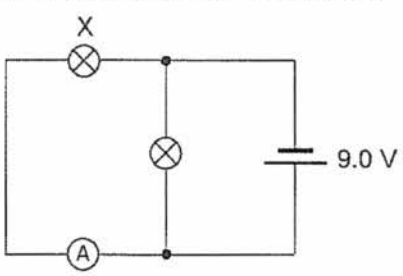
A 13.9° B 28.7° C 30.0° D 31.3°

32 An object is placed 1.0 m in front of a plane mirror. Which of the following is **not** a characteristic of the image in the mirror?

A real B virtual

C upright D same size as object

33 The diagram below shows a circuit which consists of a cell, an ammeter and two bulbs. The ammeter reading is 2.0 A and both bulbs are **not** identical.



What is the potential difference across the bulb X?

A 2.0 V B 4.5 V C 9.0 V D 18 V

34 Why is a fuse used in an electrical appliance?

A to earth the appliance

B to protect the user from being electrocuted

C to protect the appliance from being damaged

D to control the amount of current flowing through the appliance

35 A series circuit consists of two cells and two fixed resistors. The current in the circuit needs to be increased. Which of the following actions **cannot** do so?

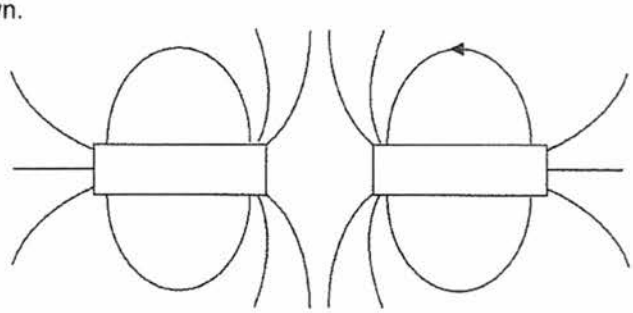
A replace the existing wires with thicker wires

B shorten the existing wires

C remove one of the resistors

D connect the two cells in parallel to each other in the circuit

36 The magnetic field lines of two bar magnets are shown below. The direction of one of the field lines is also shown.



Which of the following diagrams represents the correct arrangement of the magnets?

A 

B 

C 

D 

37 Which of the following materials is best suited for magnetic shielding?

A copper B nickel C iron D steel

38 Which of the following statements about a simple d.c. motor is **incorrect**?

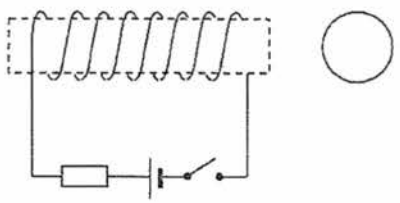
A The force on the coil will decrease when the number of turns of the coil is increased.

B When the magnetic field is reversed, so will the direction of the force produced.

C The split rings change the direction of current in the coil for every half a rotation.

D No force is produced when the coil is perpendicular to the magnetic field of the magnets.

39 The diagram below shows a solenoid. The solenoid is connected to a d.c. power supply. A magnetic compass is placed at the right side of the iron.



When the switch is turned on, which of the following statements is **false**?

A The needle of the compass will point to the left.

B When an iron bar is placed inside the solenoid, it becomes an electromagnet.

C Magnetic field is present around the solenoid and the connecting wires.

D When a bar magnet is placed inside the solenoid, it will be demagnetised.

40 The soft iron core in a simple transformer is laminated. Why is this so?

A To direct the changing magnetic field lines from the primary coil to the secondary coil

B To reduce the amount of thermal energy lost from the soft iron core to the surroundings

C To increase the number of magnetic field lines in the soft iron core

D To reduce the chance of a user from being electrocuted

End of Paper 1

XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN

Preliminary Examination 2017

CANDIDATE NAME

CLASS | | | | INDEX NUMBER | | |

PHYSICS 5059/02

Paper 2 Theory **21 August 2017**

Secondary 4 Express **1 hour 45 minutes**

Setter: Mr Zhuang Haoyang
Vetter: Mr Kevin Chan

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions.

Section B
Answer **all** questions. Question 12 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	
Section A	/50
Section B	/30
Total	/80
Parent's Signature	

This document consists of **18** printed pages.

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Section A
Answer **all** questions in this section.

1 Tej Deep claims that the following equations that involve physical quantities are valid.

Given that:

F = force x = distance v = velocity a = acceleration t = time m = mass

Show, by *considering the S.I. units of the physical quantities involved*, with *clear* working whether each of the following equations is **valid** or **invalid**.

(a) $v = at$

Answer = ... [2]

(b) $t = \sqrt{2x/a}$

Answer = ... [2]

(c) $F = mvx$

Answer = ... [2]

2 A displacement-time graph of a particle in linear motion is shown below.

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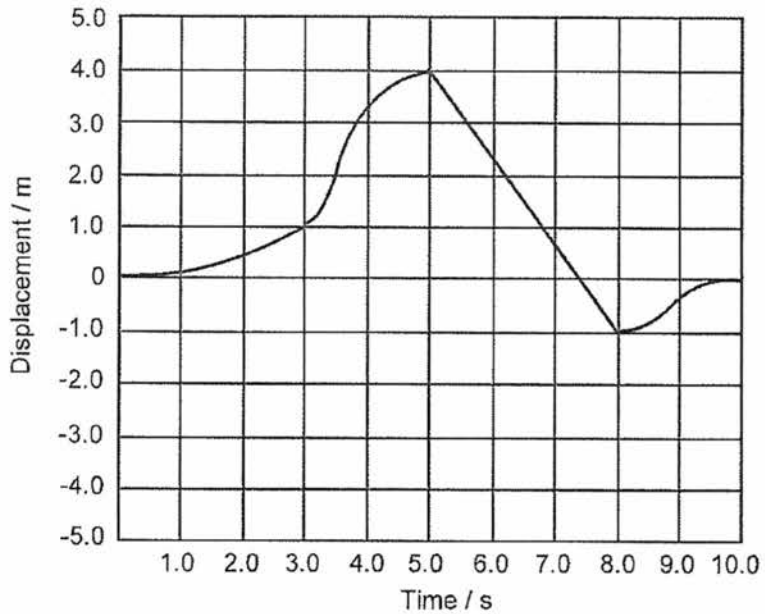

(a) How many time(s) is the particle instantaneously at rest?

..... [1]

(b) Write down the total distance travelled by the particle.

..... [1]

(c) When was the particle moving the fastest?

..... [1]

(d) How many time(s) is the particle at the starting point?

..... [1]

(e) Calculate the velocity of the particle at 7.0 s.

Velocity = ... [2]

3 A monkey has a firm hold on a light rope that passes over a frictionless pulley and is attached to a 20.0 kg bunch of bananas as shown below.

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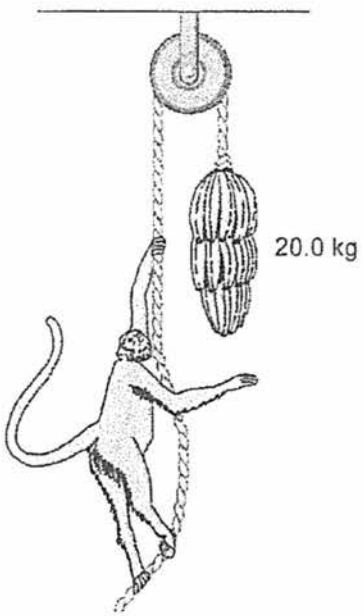

The monkey and the bananas are balanced.

(a) Write down the weight of the monkey.

..... [1]

(b) Upon seeing the delicious bananas, the monkey starts to climb the rope to get them. The monkey applied a force on the rope that caused itself to accelerate at 0.50 m s^{-2} upwards, all the while hanging on to the rope.

(i) Calculate the magnitude of the force that the monkey applied on the rope.

Force = ... [2]

(ii) Describe the motion of the bunch of bananas.

.....

..... [2]

4 The stability of a lorry of weight 50 000 N is tested as shown below.

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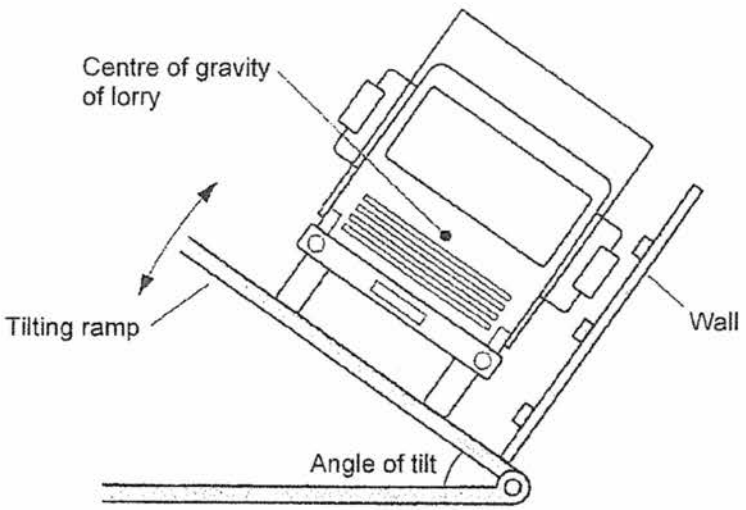

The ramp is titled as much as possible without the lorry falling over. The ramp is then fixed and the lorry remains at rest in the position as shown above.

(a) Explain why the lorry falls over if the ramp is tilted any further.

.....

.....

.....

..... [2]

(b) State how the position of the centre of gravity of the lorry affects the angle of tilt of the ramp.

.....

..... [1]

(c) Given that the lorry has six wheels and each wheel has a contact area of 0.058 m^2 with the ground, calculate the contact pressure of each wheel assuming the weight of the lorry is evenly distributed among the wheels.

Contact pressure of a wheel = ... [2]

5 In order to determine the rate at which a monkey loses thermal energy, it is placed in a chamber through which water is circulated as shown.

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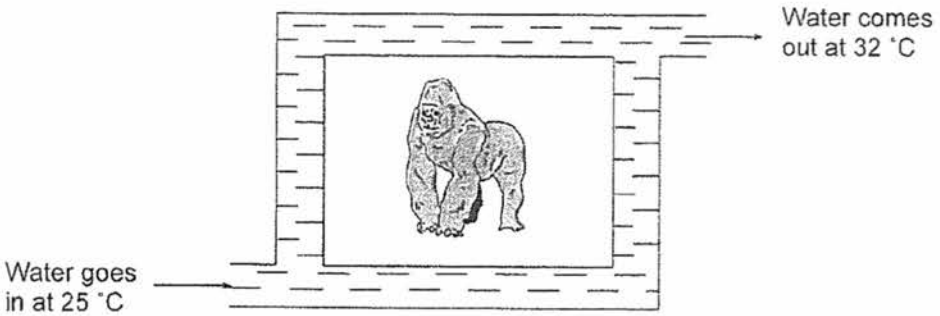

The steady outlet temperature was recorded as 32 °C when the rate of flow of water was 3.0 kg h^{-1} and the inlet temperature was 25 °C.

When another monkey was added to the same chamber, the rate of flow of water had to increase to 7.0 kg h^{-1}, in order to achieve the same inlet and outlet temperatures.

Assume that each monkey lost thermal energy at the same constant rate, and the rate of loss of thermal energy from the chamber by other means remains constant.

(a) Define *temperature*.

..... [1]

(b) The main process of heat transfer from the monkey is thermal radiation. Describe **two** factors, in general, that could increase the rate of thermal radiation from an object.

1. .....

.....

2. .....

..... [2]

(c) Calculate the rate of loss of thermal energy of the second monkey .
(Specific heat capacity of water = 4 200 J kg^{-1} K^{-1})

Rate of loss of thermal energy of the second monkey = ... [4]

6 Joanne observes the Brownian motion of smoke particles in air with a microscope.

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After the observation, she claims that as smoke is a gas, the smoke particles, according to the kinetic theory of matter, will move randomly with high speeds, thus resulting in the Brownian motion of the smoke particles.

(a) State whether Joanne's claim about the Brownian motion of the smoke particles is **correct** or **incorrect**. Explain.

.....

.....

.....

.....

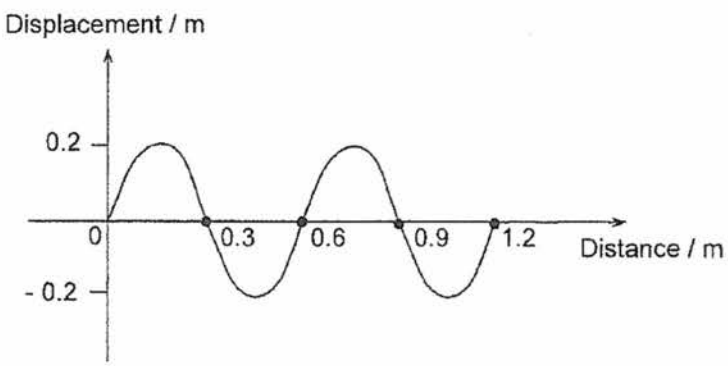
..... [3]

(b) Describe how the movement of the smoke particles would change if the temperature of the air increases.

.....

..... [2]

7 The figure below shows the displacement – distance graph of a transverse wave that travels along a rope at a particular instant of time.



The end of the rope moves through three complete oscillations every second.

(a) What is meant by a *transverse wave*?

.....

..... [1]

(b) State the frequency of the wave.

..... [1]

(c) Calculate the speed of the wave.

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Speed of the wave = ... [2]

(d) State whether sound wave is an example of a transverse wave or not.

..... [1]

8 An electron travels horizontally towards a vertical uniform electric field formed by a pair of parallel metal plates as shown in **Fig. 8**.

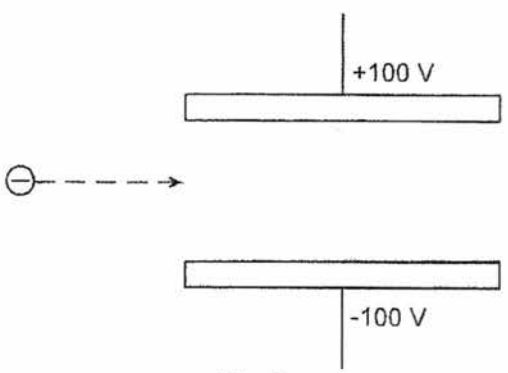

Fig. 8

(a) Define *electric field*.

.....

..... [1]

(b) On **Fig. 8**,

(i) draw the electric field pattern between the plates, [2]

(ii) complete the path of travel of the electron through the plates. [1]

9 **Fig. 9** shows a direct current passing through an electromagnet.

For Examiner's Use

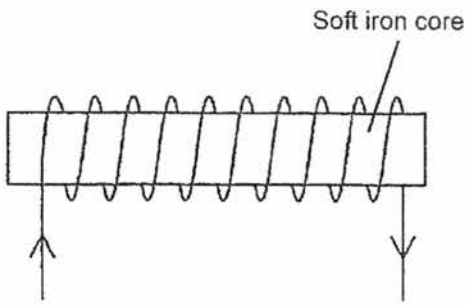

Fig. 9

(a) On **Fig. 9**,

(i) label N at the north pole of the electromagnet, [1]

(ii) draw the magnetic field pattern around the electromagnet. [2]

(b) What is the function of the soft iron core?

.....

..... [1]

(c) Describe **two** ways to increase the magnetic field strength of the electromagnet.

1. .....

.....

2. .....

..... [2]

(d) State the effect on the magnetic field strength if the soft iron core is replaced by a copper core of the same dimensions.

..... [1]

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Section B

Answer **all** questions from this section.
Answer only one of the two alternative questions in **Question 12**.

10 Source A

One end of a spring is fixed to a support. A mass is attached to the other end of the spring. The arrangement is shown in **Fig. 10.1**.

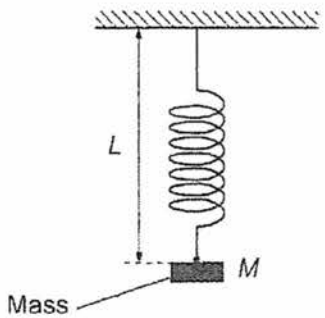

Fig. 10.1

The arrangement is used to determine the length L of the spring when mass M is attached to the spring. The procedure is repeated for different values of M. The variation of mass M with length L is shown in **Fig. 10.2**.

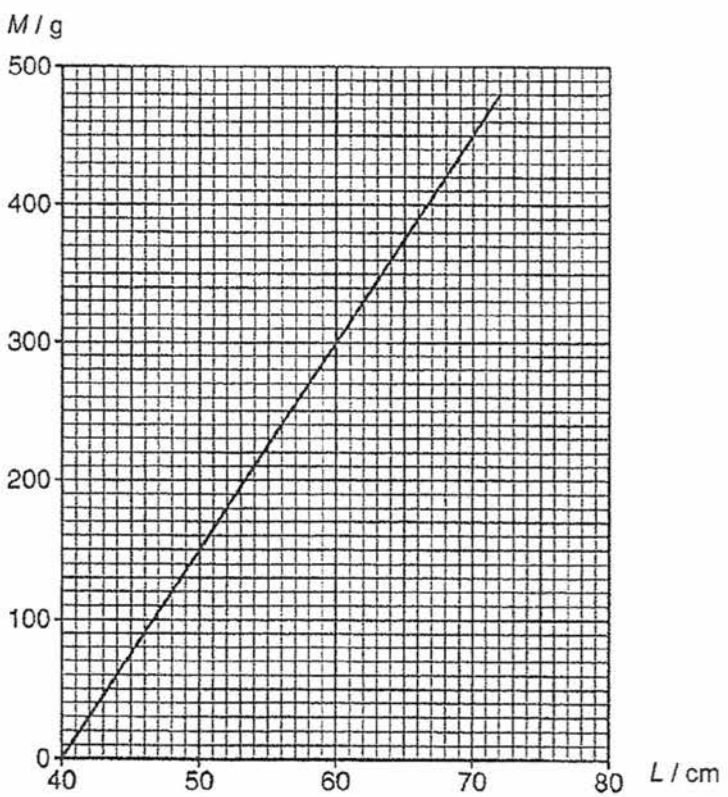

Fig. 10.2

Source adapted from: 2015 GCE A Level H2 Physics Paper 2

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Source B

Hooke's law is a principle of physics that states that the force F needed to extend or compress a spring by some distance X is proportional to that distance.

That is:

$$F = kX$$

where k is the spring constant.

Source adapted from: https://en.wikipedia.org/wiki/Hooke%27s_law

Source C

Elastic potential energy is the potential energy stored as a result of deformation of an elastic object, such as the stretching of a spring. It is equal to the work done to stretch the spring, which depends upon the spring constant k as well as the distance stretched.

The work done W to stretch the spring a distance X is given as:

$$W = \frac{1}{2}kX^2$$

where k is the spring constant.

Source adapted from: http://hyperphysics.phy-astr.gsu.edu/hbase/pespr.html

(a) By considering the equation shown in **Source B**, show that the spring constant k of the spring shown in **Fig. 10.1** is $k = \frac{Mg}{10(L-40)}$ where g is the acceleration due to free fall. Show your working clearly. [2]

(b) Calculate the value of k for the spring shown in **Fig. 10.1**. The SI unit of k must be shown clearly.

k = ... [2]

(c) Calculate the elastic potential energy stored in the spring shown in **Fig. 10.1** when it is extended to 70 cm.

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Elastic potential energy = ... [2]

(d) A mass of 300 g is attached to the spring shown in **Fig. 10.1**, and held at rest with length *l* of 40 cm. The mass is then released and the spring extends.

(i) State the energy changes in the mass-spring system as the mass falls towards its lowest position from its point of release. Numerical values are not required.

.....

.....

.....

.....

..... [2]

(ii) Use your answer in **(c)** to calculate the speed of the mass when the spring has extended by 30 cm from its point of release.

Speed of the mass = ... [3]

11 A battery of e.m.f. E and internal resistance r is connected to a variable resistor as shown in **Fig. 11.1**.

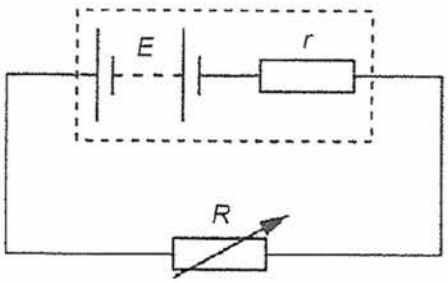

Fig. 11.1

The total power produced in the battery is P_T. The power dissipated in the variable resistor is P_R.

The variations of P_T and of P_R with resistance R of the variable resistor are shown in **Fig. 11.2**.

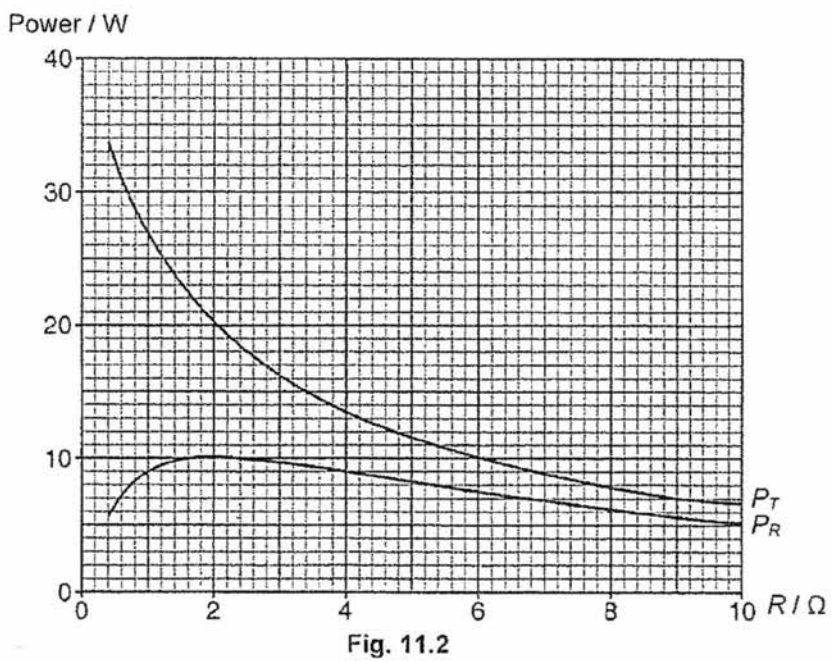

Fig. 11.2

(a) For resistance $R = 4.0\ \Omega$, use **Fig. 11.2**

(i) to show that the current in the circuit is 1.5 A, [2]

(ii) to determine the work done per unit charge across R,

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Work done per unit charge = ... [2]

(iii) to determine the e.m.f. E of the battery.

E = ... [2]

(b) Suggest what is represented by the quantity $(P_T - P_R)$.

.....

..... [1]

(c) Use the values of P_T and P_R at R = 4.0 Ω and the information in **(a)(i)** to determine the internal resistance r of the battery.

r = ... [2]

12 EITHER

For Examiner's Use

A spring hangs vertically from a fixed point. A copper plate is attached to the free end of the spring, as shown in **Fig. 12.1**.

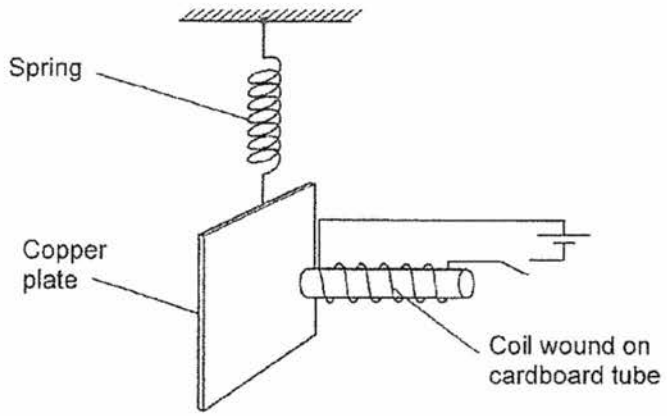

Fig. 12.1

One end of a coil of wire, wound on a cardboard tube, is placed near to the copper plate.

The copper plate is displaced vertically and then released. The variation with time t of the vertical displacement y of the plate is shown in **Fig. 12.2**.

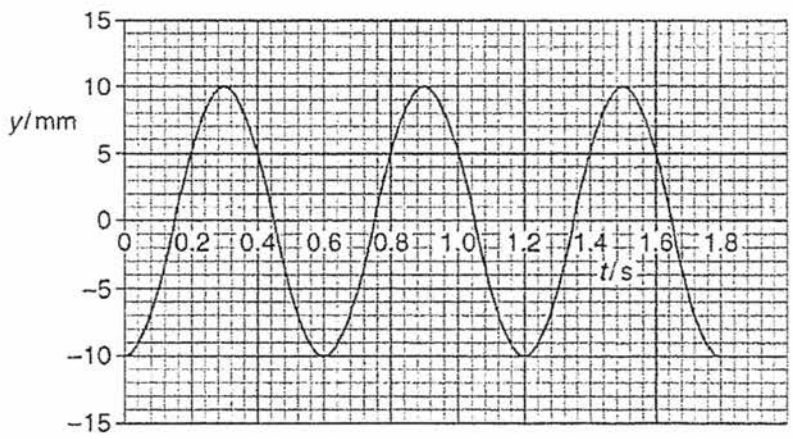

Fig. 12.2

(a) Calculate the frequency of the oscillation.

Frequency of oscillation = ... [2]

(b) Write down the amplitude of the oscillation.

..... [1]

(c) At time t = 1.8 s, the current in the coil in **Fig. 12.1** is switched on. The variation with time t of the subsequent oscillations of the plate is shown in **Fig. 12.3**.

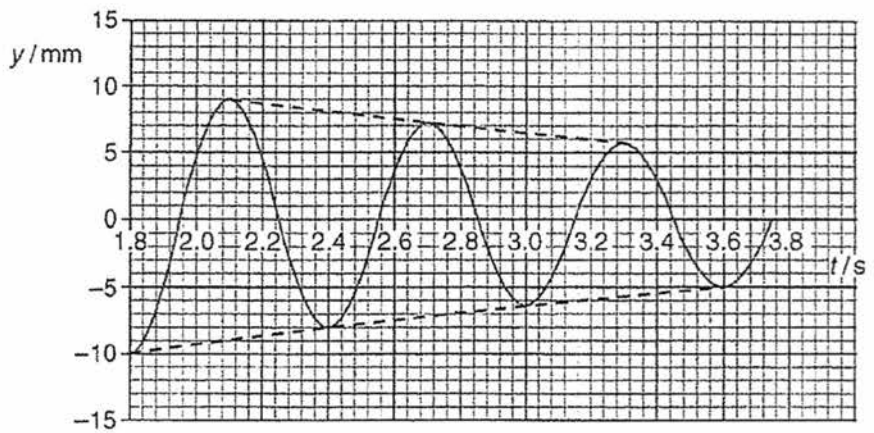

Fig. 12.3

(i) Explain why the amplitude of the oscillations is lower after the coil is switched on.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) It is observed that the amplitude of the oscillations decreases with a decreasing rate. Explain.

.....

.....

.....

..... [2]

12 OR

For Examiner's Use

Fig. 12.4 is drawn to scale. The focal length of the converging lens is 4.0 cm.

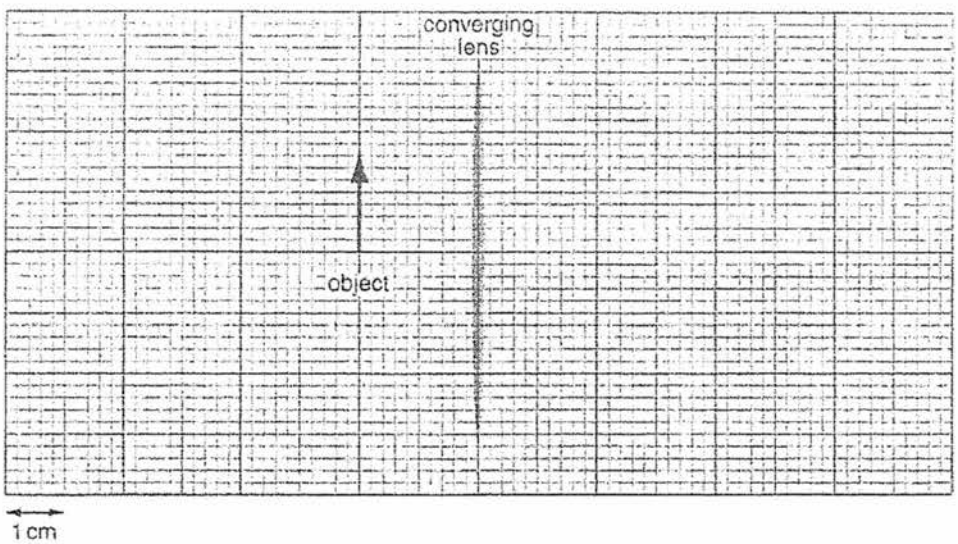

Fig. 12.4 (Drawn to scale)

(a) On **Fig. 12.4** draw two rays from the top of the object to locate the top of the image. Draw the image of the object. [3]

(b) Describe the characteristics of the image.

..... [2]

(c) The object is moved closer to the lens. State two changes that this causes to the image.

1. .....

.....

2. .....

..... [2]

(d) Given that the refractive index of the glass that is used to make the converging lens is 1.5, calculate the speed of light as it travels in the lens.

Speed of light in glass = ... [2]

(e) The colour of the image formed is the same as the object. What is the physical difference between blue light and red light?

.....

..... [1]

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End of paper

4E Prelim 2017 Physics P2

Paper 1 (40 marks)

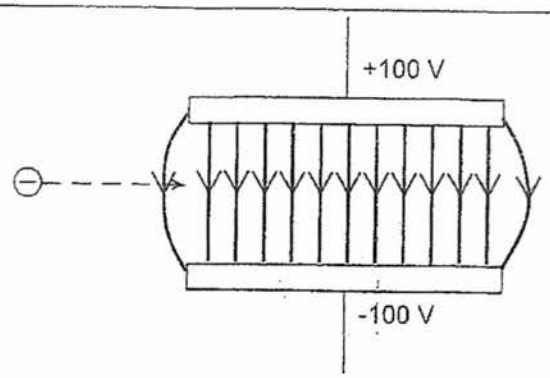
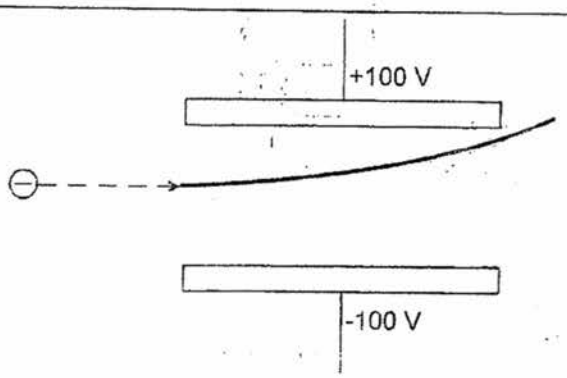
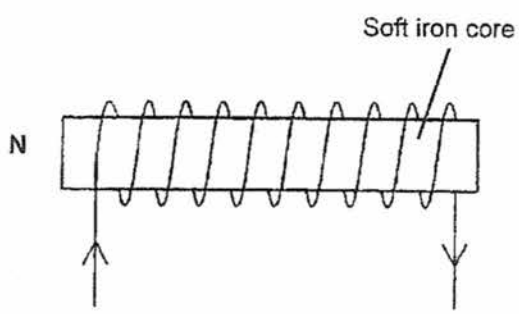
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40

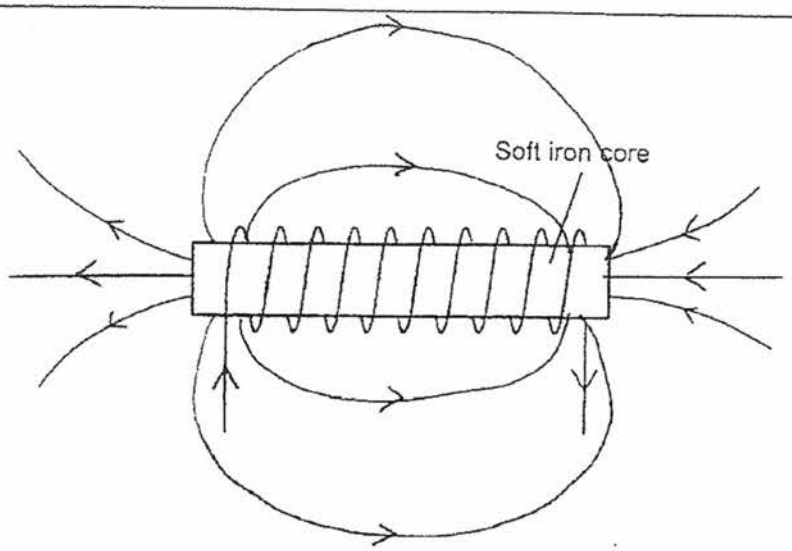
Paper 2 Section A (50 marks)

1a	LHS = m s^{-1} RHS = (m s^{-2}) × s = m s^{-1} (**valid**)	Working [1] Ans [1]
1b	LHS = s RHS = $\sqrt{m/(m \times s^{-2})} = \sqrt{s^2} = s$ (**valid**)	Working [1] Ans [1]
1c	LHS = N = kg m s^{-2} RHS = kg × m s^{-1} × m = kg m^2 s^{-1} (**invalid**)	Working [1] Ans [1]
	Total	[6]
2a	4	[1]
2b	10 m	[1]
2c	3.5 s	[1]
2d	3	[1]
2e	Velocity = $\frac{-1.0-4.0}{8.0-5.0} = \frac{-5.0}{3.0} \approx -1.7$ m s^{-1} (2 or 3 s.f)	Working [1] Ans [1]
	Total	[6]

3a	200 N (2 or 3 s.f)	[1]
3bi	Taking upwards as positive, $F_R = F + W$ $F = F_R - W = (20.0 \times 0.50) - (-200) = 10.0 + 200 = 210$ N (2 or 3 s.f)	Working [1] Ans [1]
3bii	The bunch of bananas will **accelerate upwards [1]** with an acceleration of **0.50 m s^{-2} [1]**.	[2]
	Total	[5]
4a	If the ramp is tilted any further, the **vertical line through centre of gravity of the lorry will lie outside its base [1].** The **weight of the lorry will cause a clockwise moment about the side of the lorry closer to the wall [1]**, causing the lorry to fall over.	[2]
4b	The lower the centre of gravity, the larger the angle of tilt. *OR* The higher the centre of gravity, the smaller the angle of tilt.	[1]
4c	$p = \frac{F}{A} = \frac{50000}{6 \times 0.058} \approx 140000$ Pa (2 or 3 s.f)	Working [1] Ans [1]
	Total	[5]
5a	Temperature is the measure of the hotness and coldness of a body. *OR* Temperature is a measure of the average kinetic energy of the particles in the body.	[1]
5b	**1.** The darker the colour of the body, the higher the rate of thermal radiation. **2.** The duller the surface of the body, the higher the rate of thermal radiation. **3.** The larger the surface area of the object, the higher the rate of thermal radiation. **4.** The higher the surface temperature of the surface of the object relative to the surrounding, the higher the rate of thermal radiation. **Any 2, **[1]** each*	[2]

5c	Rate of heat loss by chamber and a monkey = $\frac{m_{water} c_{water} \Delta\theta}{t}$ $= \frac{3.0 \times 4200 \times (32 - 25)}{3600}$ $= 24.5$ W **[1]** Rate of heat loss by chamber and 2 monkeys = $\frac{m_{water} c_{water} \Delta\theta}{t}$ $= \frac{7.0 \times 4200 \times (32 - 25)}{3600}$ ≈ 57.17 W **[1]** Rate of loss of thermal energy of the 2nd monkey = 57.17 – 24.5 ≈ 33 W **[2]** (2 or 3 s.f)	Working [3] Ans [1]
	Total:	[7]
6a	**Incorrect [1].** **Smoke is not a gaseous matter but a clutter of small solid particles [1].** The Brownian motion of the smoke particles are **caused by the uneven bombardment of the invisible air particles [1].**	[3]
6b	The smoke particles will **move faster [1] and more haphazardly [1].**	[2]
	Total	[5]
7a	Transverse wave is a wave motion such that **the vibration of the source is perpendicular to the direction of the propagation of the wave.**	[1]
7b	3 Hz	[1]
7c	$v = f\lambda = 3 \times 0.6 = 1.8$ m s^{-1} (2 or 3 s.f)	Working [1] Ans [1]
7d	Sound wave is **not** an example of a transverse wave.	[1]
	Total	[5]
8a	Electric field is a region where an electric charge experiences an electric force.	[1]

8bi	 *[1] for correct shape* *[1] for correct direction*	[2]
8bii		[1]
	Total	[4]
9ai		[1]

9aii	 *[1] for correct shape* *[1] for correct direction*	[2]
9b	It is used to concentrate the magnetic field lines, thereby increasing the magnetic field strength of the electromagnet.	[1]
9c	**1.** Increase the current flowing through the coil. **[1]** **2.** Increase the number of turns per unit length of the coil. **[1]**	[2]
9d	The magnetic field strength of the electromagnet will **decrease**.	[1]
	Total	[7]

Paper 2 Section B (30 marks)

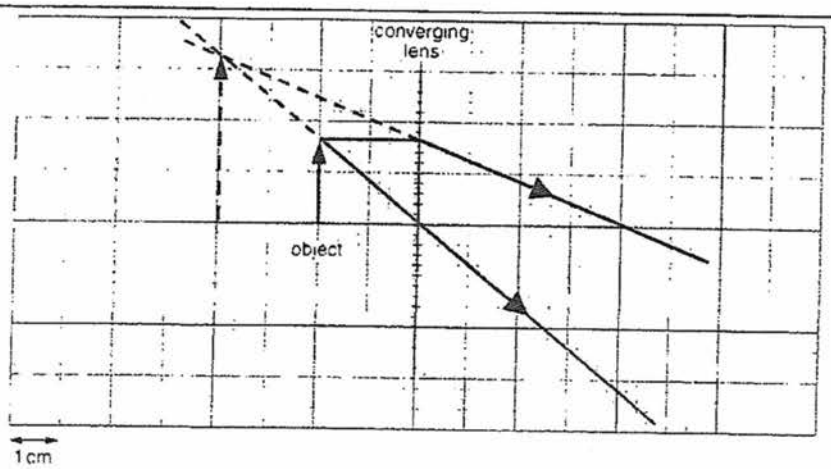
10a	$F = kX \rightarrow w = k\dfrac{(l-40)}{100}$ **[1]** $mg = k\dfrac{(l-40)}{100}$ **[1]** $\dfrac{Mg}{1000} = k\dfrac{(l-40)}{100} \rightarrow k = \dfrac{Mg}{10(l-40)}$ (shown)	[2]
10b	$k = \dfrac{Mg}{10(l-40)} = \dfrac{300 \times 10}{10(60-40)} = 15\ \text{N m}^{-1}$ (2 or 3 s.f)	Working [1] Ans [1]

10c	Elastic potential energy = $\frac{1}{2}kX^2 = \frac{1}{2}\times 15\times(\frac{70-40}{100})^2 = 0.675$ J (2 or 3 s.f)	Working [1] Ans [1]
10di	The **gravitational potential energy of the mass** at its point of release will be converted to the **kinetic energy of the mass** itself and the **elastic potential energy stored in the spring. [1]** As the mass reaches its lowest position, **all of its gravitational potential energy** will be converted to the **elastic potential energy stored in the spring. [1]**	[2]
10dii	Change in GPE = $mgh = \frac{300}{1000}\times 10\times\frac{30}{100} = 0.90$ J **[1]** KE = GPE – EPE $\frac{1}{2}mv^2 = 0.90 - 0.675$ $v = \sqrt{\frac{2\times 0.225}{300/1000}} \approx 1.2$ m s^{-1} (2 or 3 s.f) **[2]**	Working [2] Ans [1]
	Total	[11]
11ai	When $R = 4.0\ \Omega$, $P_R = 9.0$ W **[1]** $P_R = I^2R \rightarrow I = \sqrt{\frac{P_R}{R}} = \sqrt{\frac{9.0}{4.0}} = 1.5$ A (Shown) **[1]**	[2]
11aii	$V = IR = 1.5\times 4.0 = 6.0$ V (2 or 3 s.f)	Working [1] Ans [1]
11aiii	When $R = 4.0\ \Omega$, $P_T = 13.5$ W $P_T = EI \rightarrow E = \frac{P_T}{I} = \frac{13.5}{1.5} = 9.0$ V (2 or 3 s.f)	Working [1] Ans [1]
11b	The power dissipated in the internal resistance of the battery.	[1]
11c	$P_T - P_R = I^2r \rightarrow r = \frac{P_T - P_R}{I^2} = \frac{13.5-9.0}{1.5^2} = 2.0\ \Omega$ (2 or 3 s.f)	Working [1] Ans [1]
	Total	[9]

EITHER

12a	$f = \frac{3}{1.8} \approx 1.7$ Hz (2 or 3 s.f)	Working [1] Ans [1]
12b	10 mm	[1]
12ci	A **magnetic field is created around the coil** as the coil is switched on. **[1]** As the **copper plate, an electrical conductor, oscillates, it cuts the magnetic field of the coil. [1]** According **to Faraday's law of electromagnetic induction, an induced e.m.f will be created across the copper plate, thus creating induced eddy in the copper plate. [1]** According to **Lenz's law, the induced eddy current will created a magnetic field to oppose the change producing itself.[1]** **This will create a resistive force that will dampen the oscillation of the copper plate**, thereby reducing the amplitude of oscillations. **[1]**	[5]
12cii	As the amplitude decreases, **the copper plate will cut the magnetic field of the coil at a lower rate. [1]** This will result in a **lower resistive force created to dampen the oscillation. [1]**	[2]
	Total	[10]

OR

12b	 *for each correct ray drawn (dotted or solid where necessary with correct arrow), [1] for correct image drawn.*	[3]

12b	Upright, virtual, enlarged ***[1]*** *if only 2 is correct* ***[0]*** *if less than 2 is correct*	[2]
12c	**1.** The size of the image will reduce. **[1]** **2.** The image will be closer to the lens. **[1]**	[2]
12d	$n = \frac{c}{v} \rightarrow v = \frac{c}{n} = \frac{3.0 \times 10^8}{1.5} = 2.0 \times 10^8$ m s^{-1} (2 or 3 s.f)	Working [1] Ans [1]
12e	They have different frequencies. *OR* They have different wavelengths.	[1]
	Total	[10]