AHMAD IBRAHIM SECONDARY SCHOOL
GCE 'O' LEVEL PRELIMINARY EXAMINATION 2016

PHYSICS (SPA)

Sec 4 Express
5059 / 1

Date: 17 Aug 2016
Duration: 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name and register number on the 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** and **D**. Choose the one you consider to be correct and record your choice in soft pencil on the separate sheet.

Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

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.

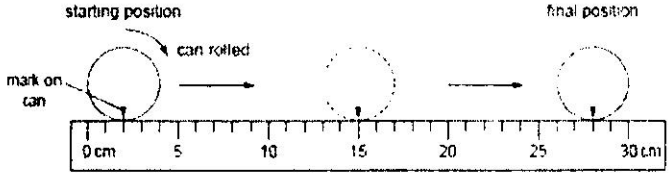
This question paper consists of 19 printed pages.

Answer **ALL** the questions in this section.

1 Which unit is equivalent to the coulomb?

A ampere per second
B joule per volt
C watt per ampere
D watt per volt

2 A cylindrical can is rolled along the ruler shown in the diagram.

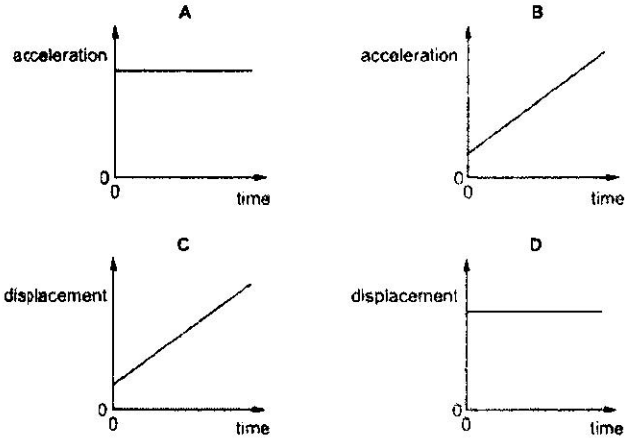


The can rolls over twice.

What is the circumference (distance all round) of the can?

A 13 cm **B** 14 cm **C** 26 cm **D** 28 cm

3 Which graph represents the motion of a car that is travelling along a straight road with a speed that increases uniformly with time?



4 A train is travelling along a horizontal track at constant speed. Two of the forces acting on the train are shown in the diagram.

A force of air resistance is also acting on the train.

What is this air resistance force?

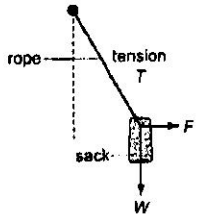
A 40 000 N backwards

B 80 000 N backwards

C 40 000 N forward

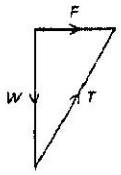
D 80 000 N forward

5 A heavy sack of weight *W* hangs from the end of a rope. The sack is pulled sideways by a horizontal force *F* and is held stationary. The tension in the rope is *T*.

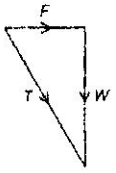


Which force diagram gives the correct value and direction for the tension T?

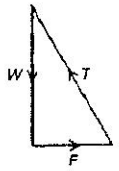
A



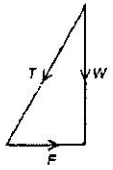
B



C



D



6 An airplane drops a 100 kg food package from a height of 400 m.
After falling for 2.0 s, the package reaches a terminal velocity and parachutes down at a steady speed, reaching the ground after falling for 30 s.

What is the net force on the package as it falls, just before it hits the ground?

A 0 N **B** 200 N **C** 2000 N **D** 20 000 N

7 An object is brought to planet P from planet Q. The gravitational field strength on the surface of planet P is twice of that on the surface of planet Q. No air resistance acts on the object at planet P and Q.

Which statement is incorrect?

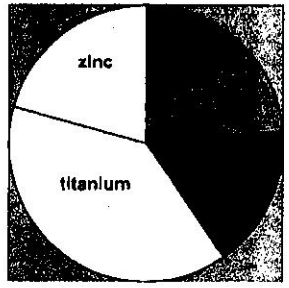
A The object's acceleration during free fall on planet P is twice of that on planet Q.

B The object's gravitational potential energy on planet P is twice of that on planet Q when the object is placed at the same height above ground.

C The object on planet P would have more reluctance to move from its original stationary position as compared to on planet Q.

D The object on Planet P would need twice the force to be lifted up as compared to on planet Q.

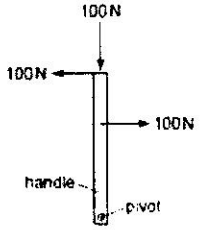
8 An equal mass of four different metals was mixed together to form an alloy. The chart shows the proportions by volume of each of these metals.



Which metal is the least dense?

A antimony **B** iron **C** titanium **D** zinc

9 The diagram shows a handle with three forces, each 100 N, applied to it. The handle is free to move.



What is the effect of the forces on the handle?

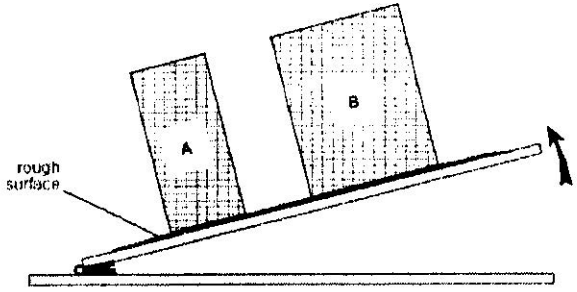
A The handle will move downwards.

B The handle will not move.

C The handle will turn anticlockwise (to the left).

D The handle will turn clockwise (to the right).

10 The diagram shows two wooden blocks standing on a hinged board with a rough surface.



The board is slowly tilted in anticlockwise direction. The blocks do not slip.
Which of the following statements is correct?

A A topples first because it is lighter than block B.

B B topples first because it is heavier than block A.

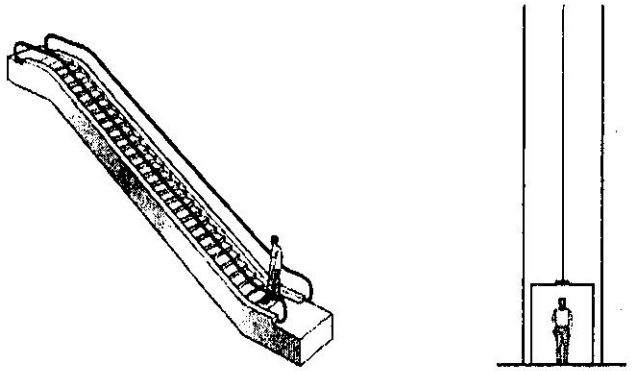
C A topples first because its weight acts outside its base with a smaller angle of tilt.

D B topples first because its weight acts outside its base with a smaller angle of tilt.

11 A motor drives a pump that raises 0.20 m^3 of water up by 5.0 m in 10 minutes. If the efficiency of the pump is 75 %, what is the power generated by the motor?
Take density of water to be 1000 kg/m^3.

A 12.5 W **B** 22.2 W **C** 556 W **D** 1330 W

12 An escalator (moving stairs) and a lift (elevator) are both used to carry passengers from the same underground railway platform up to street level.



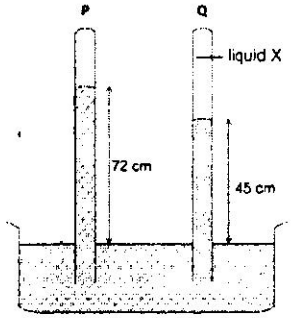
escalator lift

The escalator takes 20 seconds to carry a man to street level.
The useful work done is *W*. The useful power developed is *P*.
The lift takes 30 seconds to carry the same man to street level.

How much useful work is done by the lift, and how much useful power is developed by the lift?

	useful work done by lift	useful power developed by lift
A	more than *W*	less than *P*
B	more than *W*	*P*
C	*W*	less than *P*
D	*W*	*P*

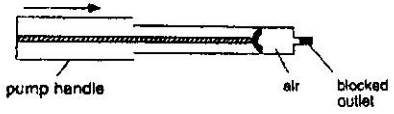
13 The diagram shows two vertical tubes **P** and **Q**, each closed at the upper end. The pressure in the space above the mercury meniscus in tube **P** is 5 cm Hg. The space above the mercury meniscus in tube **Q** is filled completely with a liquid X of unknown density.



Calculate the pressure due to liquid X in tube **Q**.

A 5 cm Hg **B** 10 cm Hg **C** 31 cm Hg **D** 32 cm Hg

14 The outlet on a bicycle pump is blocked.



The pump handle is pushed in slowly. The temperature remains constant.

Why does the pressure of the air in the pump increase?

A The air molecules have greater average speed.

B The air molecules all travel towards the outlet.

C The air molecules hit the walls of the pump more frequently.

D There are now more air molecules to hit the walls of the pump.

15 What surrounds the bulb of a thermometer when marking the upper and lower fixed points?

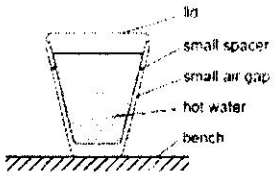
	upper fixed point	lower fixed point
A	boiling water	pure melting ice
B	boiling water	salt and ice
C	steam	pure melting ice
D	steam	salt and ice

16 The resistance of an alloy wire is 25 Ω when it is placed in a cup of melting ice. At room temperature of 28 °C, the resistance is 38 Ω.

If the wire is put in boiling water, what will be the resistance?

A 28 Ω **B** 46 Ω **C** 71 Ω **D** 152 Ω

17 Two plastic cups are placed one inside the other. Hot water is poured into the inner cup and a lid is put on top, as shown.



Which statement is correct?

A Heat loss by radiation is prevented by the small air gap.

B No heat passes through the sides of either cup.

C The bench is heated by convection from the bottom of the outer cup.

D The lid is used to reduce heat loss by convection.

18 A heater supplies 80 J of energy to a block of metal. The temperature of the block rises by 20 °C.

What happens to the block of metal when its temperature falls by 10 °C?

A Its internal energy decreases by 40 J.

B Its internal energy decreases by 160 J.

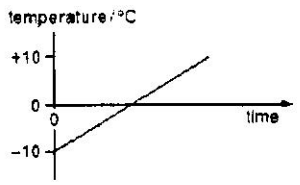
C Its internal energy increases by 40 J.

D Its internal energy increases by 160 J.

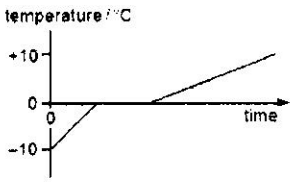
19 Ice at –10 °C is heated until it is water at +10 °C.

Which graph shows how the temperature changes with time?

A



B



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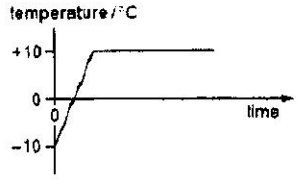
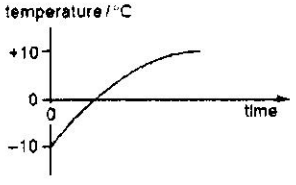
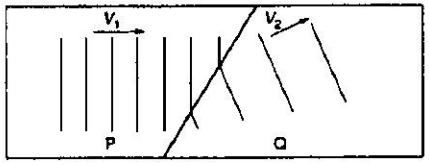


D



20 The diagram shows the waves in a ripple tank in which the water in parts P and Q is of different depths.

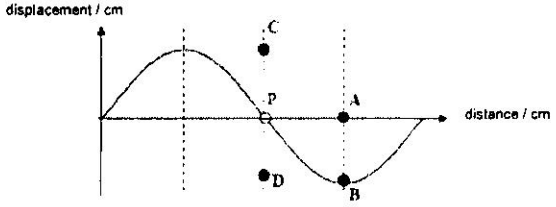
How do the depths and the speeds V_1 and V_2 of the waves compare in P and in Q?



	depth	speed
A	shallower in P	V_1 is smaller
B	shallower in P	V_2 is smaller
C	shallower in Q	V_1 is smaller
D	shallower in Q	V_2 is smaller

21 The following displacement–distance graph shows an instance of a transverse wave moving to the right.

Where will particle P be a quarter of a period after the instance shown?



22 Which of the following is **not** a property of microwaves?

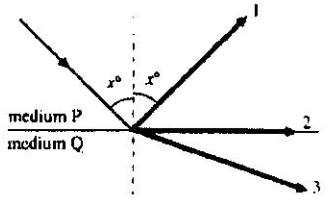
A They are used for radar communication.

B They are longitudinal waves with long wavelength.

C They can be absorbed by water in food.

D They have frequency lower than that of visible light.

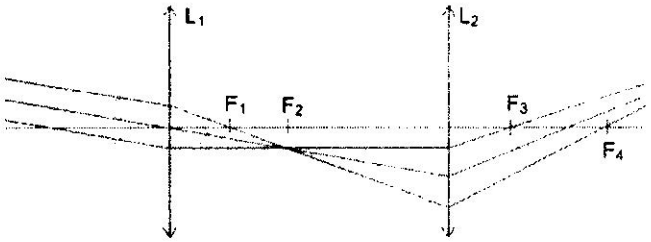
23 A light ray travels from a medium P to medium Q.
Given that medium P has a refractive index of 1.5 and medium Q has a refractive index of 1.2, which of the following rays is/are possible outcome(s)?



A 3 only **B** 1 and 3 only

C 2 and 3 only **D** 1, 2 and 3

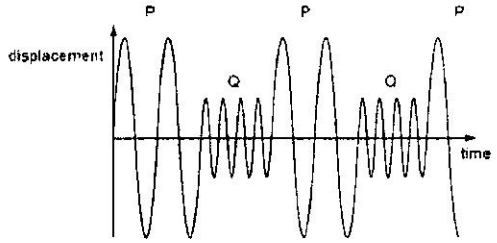
24 The figure below shows parallel rays from a distant object and passes through lens L_1 and L_2.



What are the principal foci of L_1 and L_2?

A F_2 for both lens
B F_1 and F_2
C F_2 and F_3
D F_1 and F_3

25 A police car siren emits two different sounds P and Q. These are produced alternately. The diagram represents the sounds emitted.



Which sound is the louder and which has the lower pitch?

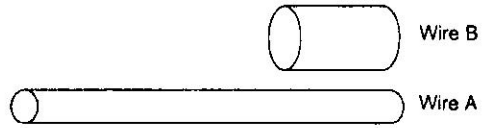
	louder	lower pitch
A	P	P
B	P	Q
C	Q	P
D	Q	Q

26 A plastic rod and a dry cloth are uncharged. The rod is now rubbed with the cloth and they both become charged. The rod becomes negatively charged because some charged particles move from the cloth to the rod.

What is the charge on the cloth and which particles moved in the charging process?

	charge on cloth	particles that moved
A	negative	electrons
B	negative	neutrons
C	positive	electrons
D	positive	neutrons

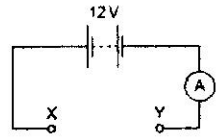
27 Two pieces of copper wire, A and B, have the same volume. The length of A is 3 times the length of B.



What is the value of $\frac{R_A}{R_B}$ where R_A and R_B are the resistances of wires A and B respectively?

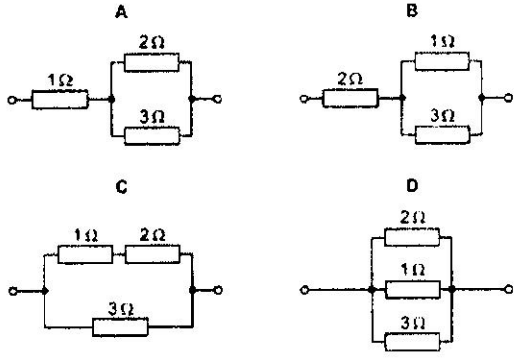
A 3.0 **B** 5.2 **C** 9.0 **D** 15.6

28 In the circuit shown, the battery and ammeter each has negligible resistance.

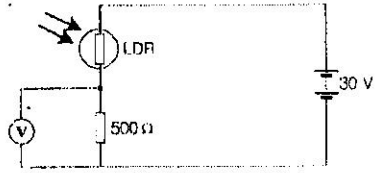


The following combinations of resistors are placed in turn, between the terminals X and Y of the circuit.

Which combination would give an ammeter reading of 8 A?



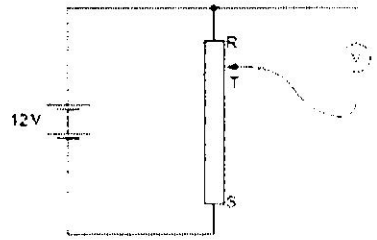
29 A light dependent resistor (LDR) and a 500 Ω resistor are connected across a 30 V source. The resistance of the LDR is 1000 Ω in the dark but drops to 100 Ω in bright light.



What is the voltmeter reading in the dark and in bright light respectively?

	in the dark	in bright light
A	10 V	25 V
B	15 V	15 V
C	20 V	5 V
D	25 V	10 V

30 A student connects a variable potential divider (potentiometer) circuit.



What happens to the reading on the voltmeter as the sliding terminal T is moved from R to S?

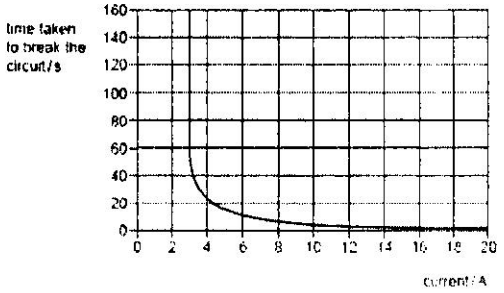
A It decreases from 12 V to 0 V.

B It increases from 0 V to 12 V.

C It remains at 0 V.

D It remains at 12 V.

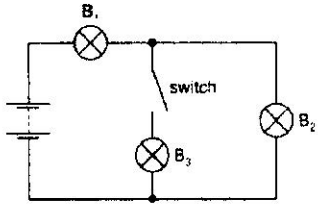
31 A circuit-breaker is designed to protect a circuit which usually carries a current of 2A. The time taken to break the circuit depends on the current, as shown in the graph.



What happens when the current in the circuit is 2 A and when the current is 18 A?

	when the current is 2 A	when the current is 18 A
A	the circuit breaks in less than 5 s	the circuit breaks in less than 5 s
B	the circuit breaks in less than 5 s	the circuit does not break
C	the circuit does not break	the circuit breaks in less than 5 s
D	the circuit does not break	the circuit does not break

32 B_1, B_2 and B_3 are three identical lamps. They are connected to a battery with zero internal resistance, as shown.



Initially the switch is closed. The switch is then opened and lamp B_3 goes out. What happens to the brightness of lamps B_1 and B_2 when the switch is opened?

	brightness of lamp B_1	brightness of lamp B_2
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

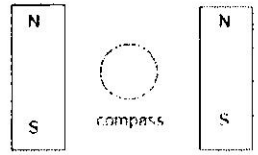
33 The duration of usage of several electrical appliances and their respective power ratings are shown in the table below.

appliance	**power rating / W**	**duration of usage / s**
electric iron	400	3600
rice cooker	5 000	1800
lamp	50	36 000

What is the cost of a unit (kWh) of electricity if the total cost of usage from the above table is $2.72?

A $0.01 **B** $0.08 **C** $0.80 **D** $9.25

34 Two equally strong bar magnets are placed side by side on a table. Their north poles point in the same direction, as shown in the diagram. A compass is placed exactly midway between them.



The north pole of the compass is shown by an arrow-head.

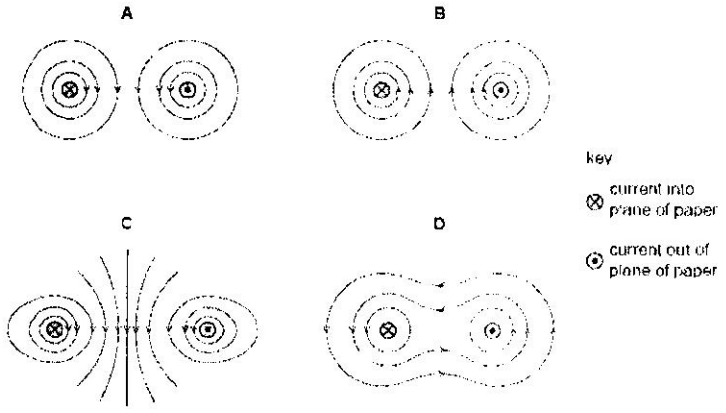
Which way will the compass point?

A  **B** 

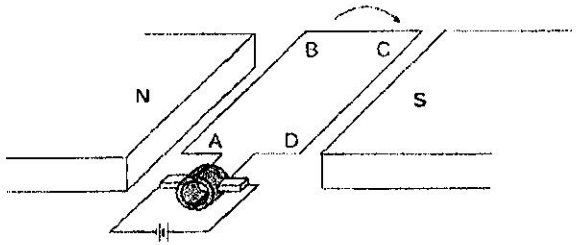
C  **D** 

35 Two straight electrical conductors are parallel to one another. Each carries a current, one into the plane of the paper and one out of the plane of the paper.

Which diagram shows the magnetic field around the two wires?

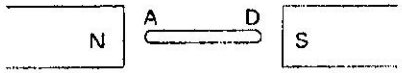


36 The diagram shows a d.c. motor. The coil ABCD rotates in a clockwise direction.

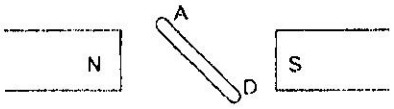


In which position will the coil experience zero turning effect from the interaction of the magnetic fields from both the current and the permanent magnet?

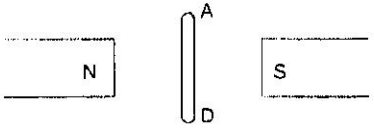
A



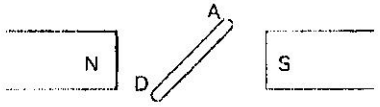
B



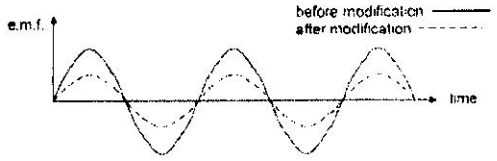
C



D



37 The variation of the e.m.f. produced by a simple a.c. generator against time, before and after modification, is shown below.



Which of the following could be the modification that was carried out?

A Weaker magnets were used.

B Speed of rotation was reduced.

C Direction of rotation of coil was reversed.

D Number of turns in the coil was increased.

38 A transformer has 15 000 turns on its primary coil and 750 turns on its secondary coil. Connected in this way, for what purpose could this transformer be used?

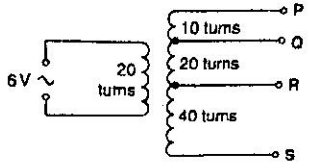
A to convert the 8000 V a.c. output of a power station to 160 000 V for long-distance power transmission

B to convert the 160 000 V d.c. supply from a power line to 8000 V for local power transmission

C to use a 12 V d.c. supply to operate a 240 V razor

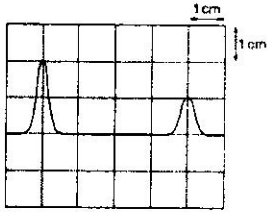
D to use a 240 V a.c. mains supply to operate a 12 V motor

39 The number of turns between each pair of output terminals of a transformer is shown in the diagram. Between which two terminals will the output be 12 V?



A P and Q **B** Q and R **C** R and S **D** P and R

40 A source of radio waves sends a pulse towards a reflector. The pulse returns from the reflector and is detected at the same point as the source. The emitted and reflected pulses are recorded on a cathode-ray oscilloscope (c.r.o.) as shown below.



The time base is set to 0.20 μs/cm.
Determine the distance between the source and the reflector.

A 120 m **B** 240 m **C** 120 km **D** 240 km

END OF PAPER

Setter: Mdm Latifah Noorahman

AHMAD IBRAHIM SECONDARY SCHOOL
GCE 'O' LEVEL PRELIMINARY EXAMINATION 2016

PHYSICS (SPA)

Sec 4 Express
5059 / 2

Date: 15 Aug 2016
Duration: 1 h 45 min

Name: .....( )

Class: .....

INSTRUCTIONS TO CANDIDATES

Do not turn over this paper until you are told to do so.
Write your name, class and register number in the spaces at the top of this page and on any writing papers used.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **all** three questions.
Write your answers in the spaces provided on the question paper.
Note that Question 12 has a choice of section to answer.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Omission of working for any calculation in section A and B will result in deduction of marks.
The use of calculator is allowed in this examination.

FOR EXAMINER'S USE	
P 1 MCQ	/ 40
P 2 Section A	/ 50
P 2 Section B	/ 30
P2 Total	/ 80

This question paper consists of 21 printed pages.

Section A

Answer **ALL** the questions in this section.

1 A student carries out an experiment using a simple pendulum to determine how the period of a pendulum varies with its length. Fig. 1.1 shows the apparatus.

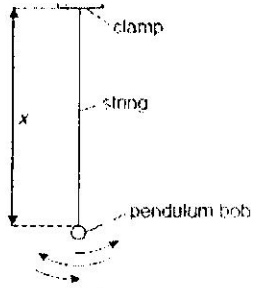


Fig 1.1

The student records the time *t* taken for 20 complete oscillations. She measured the *length x* for the length of the pendulum, as shown in the table below.

x / cm	t / s	T / s
90.0	38.5	

(a) Calculate the period T, of the pendulum.

period T =..... [2]

(b) Describe the mistake that the student made in determining the length of the pendulum.

.....

..... [1]

(c) The student was told that the period of the pendulum is independent of its mass. State what is meant by the *mass of the pendulum*.

.....

..... [1]

2 In Fig. 2.1, the sealed drum containing gas has a mercury manometer connected to it in order to indicate the gas pressure.

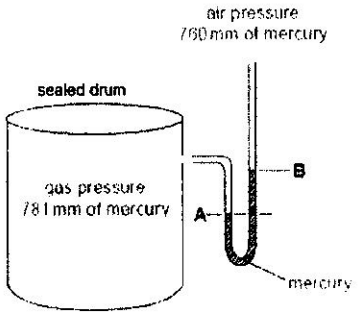


Fig. 2.1

For convenience, gas pressure is often expressed in mm of mercury.
The gas pressure is 781 mm of mercury and air pressure is 760 mm of mercury.

(a) State the difference in height between levels **A** and **B** on the manometer.

Difference in height = ... [1]

(b) The temperature of the gas rises.
State what happens to

(i) the gas pressure .....

(ii) the level A .....

(iii) the level B ..... [3]

(c) Explain our answers in (b), in terms of the gas molecules inside the drum and air molecules outside the drum.

.....

.....

.....

..... [2]

3 Fig. 3.1 shows steam passing into a jug to warm up some cold water. In this question, you may ignore any heating of the atmosphere.

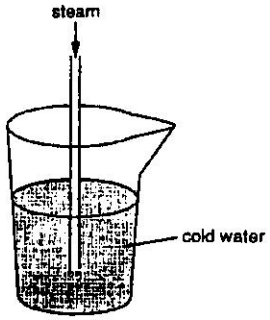


Fig. 3.1

Pure steam enters at 100 °C and the jug initially contains 500 g of water at 20 °C. Eventually, the water in the jug reaches a temperature of 100 °C.

The specific heat capacity of water is 4.20 J/(g°C) and the specific latent heat of vaporisation of water is 2250 J/g.

(a) State what is meant by *the specific latent heat of vaporisation of water is 2250 J/g.*

.....

..... [1]

(b) Explain why the mass of the water in the jug increases.

.....

..... [1]

(c) Calculate the energy needed to warm 500 g of water from 20 °C to 100 °C.

energy = ... [2]

(d) Calculate the final mass of water in the jug, when its temperature has reached 100°C.

mass = ... [2]

4 Fig. 4.1 shows an electrical circuit containing three resistors connected to a 10 V battery of negligible internal resistance.

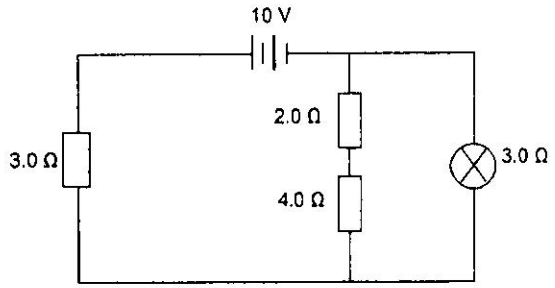


Fig. 4.1

(a) Calculate the effective resistance of the circuit.

effective resistance = ... [2]

(b) Calculate the current through the 3.0 Ω fixed resistor.

current = ... [1]

(c) Calculate the charge that flows through the battery in one minute.

charge = ... [2]

(d) Describe and explain the change on the brightness of the light bulb if the 3.0 Ω resistor is replaced with a 10.0 Ω resistor.

.....

.....

..... [2]

5 The diagram below shows a large conducting sphere **L** connected through a switch to the positive terminal of a supply of high voltage. A light conducting sphere **S** hangs from an insulating thread. Both spheres are initially uncharged.

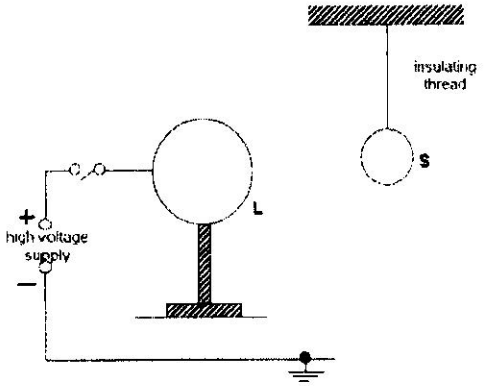


Fig. 5.1

(a) State the charge on sphere **L** when the switch is closed.

..... [1]

(b) On Fig. 5.1, draw the new position of sphere S on the insulating thread, and draw with labelled arrows, the forces acting on sphere S, when the switch is closed. [3]

(c) Explain the effect produced by sphere **L** on sphere **S** when the switch is closed.

.....

.....

.....

..... [2]

6 Fig. 6.1 represents the system used to transmit electricity from a power station to a factory.

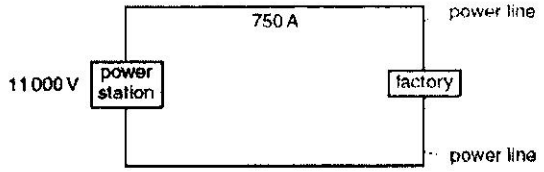


Fig. 6.1

The power station generates 11 000 V and supplies a current of 750 A. The total resistance of the power lines between the power station and the factory is 1.5 Ω.

(a) Calculate the power output of the power station.

power = ... [1]

(b) Determine the power loss at the transmission lines.

power loss = ... [2]

(c) Describe how the efficiency of the power transmission to the factory can be improved.

.....

.....

.....

..... [2]

7 The apparatus shown in Fig. 7.1 can be used to indicate when there is a force on the copper rod.

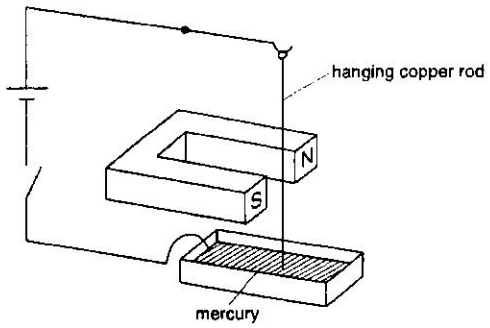


Fig. 7.1

(a) In the space below, draw the magnetic field pattern around the copper rod as seen from the top, when the switch is closed. [2]

(b) Suggest what is seen to happen to the hanging copper rod when the switch is closed. Explain your answer.

.....

.....

.....

..... [2]

(c) The cell is replaced with a low frequency a.c. supply and the switch closed. How does what is seen now differ from what you described in **(a)**?

.....

.....

..... [1]

8 Fig. 8.1 shows a drill that is being spun with a magnet attached to the drill bit. A coil of wire around a soft-iron core is placed above the rotating magnet. The ends of the coil are

connected to the Y-input of the cathode ray oscilloscope (CRO).

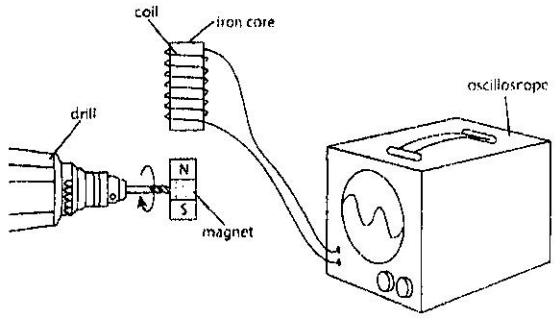


Fig 8.1

(a) Explain why there is current induced in the coil when the drill bit rotates.

.....

.....

.....

..... [2]

(b) On Fig. 8.1, draw the direction of the current in the coil as the North pole of the magnet approaches the coil. [1]

(c) Fig. 8.2 shows the display seen on the screen of the CRO as the magnet rotates. On the figure, draw the display when the speed of the drill bit is halved. [1]

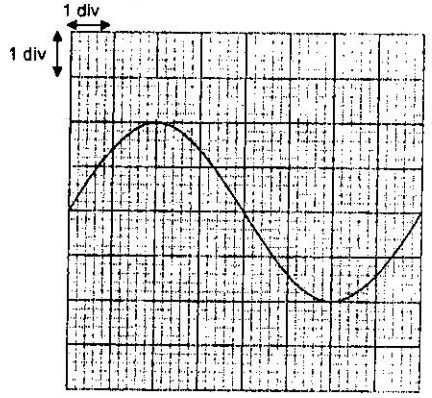


Fig. 8.2

(d) Describe the new trace on the screen if the soft-iron core is replaced by a copper core.

.....

..... [1]

(e) The drill rotates at a speed of 750 revolutions per minute.
Determine the time base frequency set on the CRO to produce the trace in Fig.8.2.

time base frequency = ... [2]

9 Fig. 9.1 shows ultrasound being used to study an unborn baby.

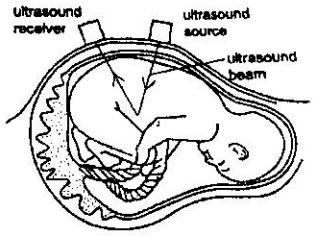


Fig. 9.1

(a) Explain how the vibration of the source produce waves of ultrasound and suggest how these waves are transmitted through the body tissue to the receiver.

.....

.....

.....

..... [2]

(b) Ultrasound used in medicine has a frequency which is about 100 times higher than the maximum frequency that can be heard by humans.

(i) Estimate the frequency that might be used for ultrasound in medicine.

frequency = ... [1]

(ii) The speed of ultrasound in the human body is 1500 m/s. Calculate its wavelength in the human body.

wavelength = ... [1]

Section B

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

10 Two electrical components **X** and **Y** are each tested in turn, by connecting them to a variable voltage supply. The voltage V across and the current I through the components are measured as the voltage is increased. At each stage, the temperature of the components is allowed to reach steady value before the meter readings are recorded. The resulting variation of voltage with current is shown in the table in Fig. 10.1.

	Component X	Component Y
V / V	I / mA	I / mA
0	0	0
0.4	10	10
0.8	20	20
1.2	32	30
1.6	47	39
2.0	66	47
2.4	98	54

Fig. 10.1

(a) Compare the variation of current I with V for the components **X** and **Y**.

.....

.....

.....

..... [2]

(b) Calculate the resistance of component **X** when V is 2.0 V.

resistance of **X** = ... [1]

(c) Use the data to explain how the resistance of component **X** changes with increasing voltage.

.....

.....

..... [2]

(d) Suggest what is component **Y**.

..... [1]

(e) Component **X** is a thermistor. It is connected in a circuit as shown below.
The resistances P and Q are 2000 Ω and 5000 Ω respectively.
A voltmeter is connected in parallel with the 2000 Ω resistor and the thermistor is connected In parallel with the 5000 Ω resistor, as shown in Fig. 10.2.

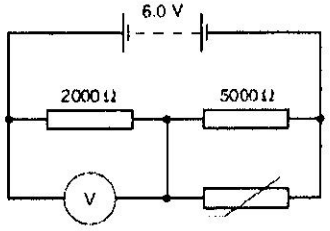


Fig 10.2

The battery has an e.m.f. of 6.0 V.

(i) State and explain qualitatively the change in the reading of the voltmeter as the temperature of the thermistor is raised.

.....

.....

..... [2]

(ii) The voltmeter reads 3.6 V when the temperature of the thermistor is 19 °C.
Calculate the resistance of the thermistor at 19 °C.

resistance = ... [2]

11 Fig. 11.1 shows a smooth metal block about to slide down BD, along DE and up EF. BD and DE are friction-free surfaces, but EF is rough. The block stops at F.

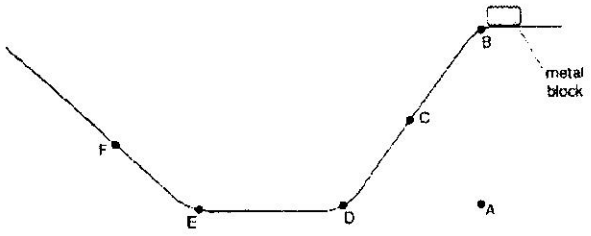


Fig 11.1

(a) The mass of the block is 0.2 kg. The vertical height of B above A is 0.6 m. The acceleration due to gravity is 10 m/s^2.

(i) Calculate the work done in lifting the block from A to B.

work done = ... [2]

(ii) At C, the block is moving at a speed of 2.5 m/s. Calculate its kinetic energy at C.

kinetic energy = ... [1]

(iii) Determine the vertical height of C above A.

height = ... [2]

(b) As it passes D, the speed of the block remains almost constant but the velocity changes. Using the terms *vector* and *scalar*, explain this statement.

.....

.....

..... [2]

(c) F is the point where the kinetic energy of the block is zero. In terms of energy changes, explain why F is lower than B.

.....

.....

.....

.....

..... [3]

12 **Either**

(a) An inventor is trying to make a device to enable him to see objects behind him. He cuts a square box in half diagonally and sticks two plane mirrors on the inside of the box.

A side view of the arrangement is shown in Fig. 12.1.

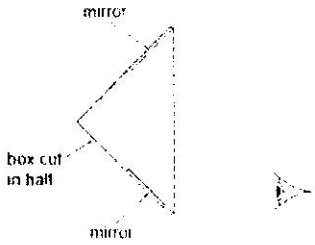


Fig. 12.1

Fig. 12.2 shows the arrangement, drawn larger.

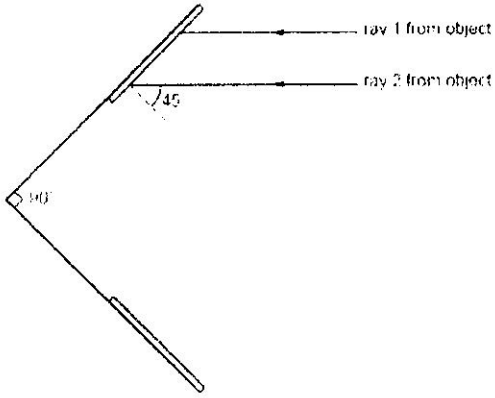


Fig. 12.2

Fig. 12.2 shows parallel rays from two different points on a distant object behind the man.

(i) Carefully continue the two rays until they reach the place where the inventor's eyes will be. [2]

(ii) Look at what has happened to the two rays.

Describe the image that the inventor sees.

.....

..... [1]

(iii) A rectangular glass block is placed between the mirrors as shown in Fig. 12.3.

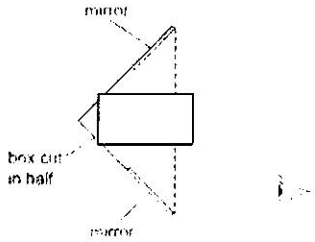


Fig. 12.3

Suggest changes to the image seen by the inventor, if any.

.....

..... [1]

(b) Figures 12.4 and 12.5 show a converging lens and a diverging lens respectively.

(i) Complete the figures to show the effect of each lens on the incident rays shown. [3]

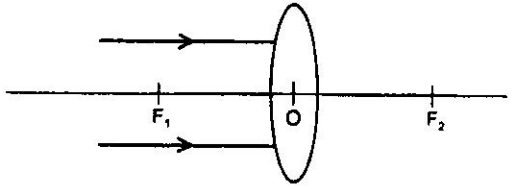


Fig. 12.4

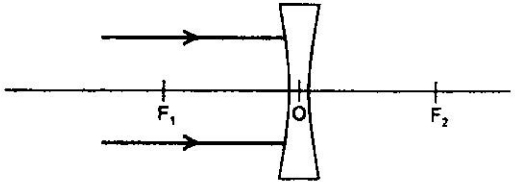


Fig. 12.5

(ii) A converging lens can form an image of an object when the distance of the object from the lens is greater or less than the focal length of the lens. Use the table below to compare the images formed under the two conditions. [3]

Description of image when the object distance is *greater* than the focal length	**Description of image when the object distance is *less* than the focal length**

12 **Or**

A trolley of mass 800 g is moving at a velocity u m/s to the right as it passes point P, as shown in Fig. 12.6.

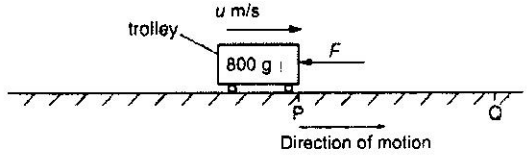


Fig. 12.6

A variable force F acts to the left on the trolley as it moves between points P and Q. Fig. 12.7 shows how F varies with time t.

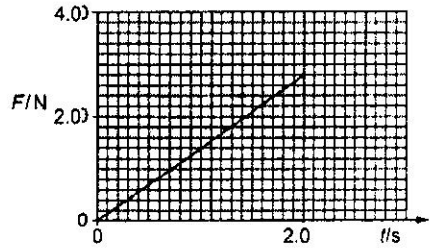


Fig. 12.7

The trolley comes to rest at point Q, 2.0 s later.

(a) State the resultant force on the trolley at P.

resultant force = ... [1]

(b) Using the graph on Fig. 12.7, describe how the resultant force on the trolley changes as it moves from P to Q.

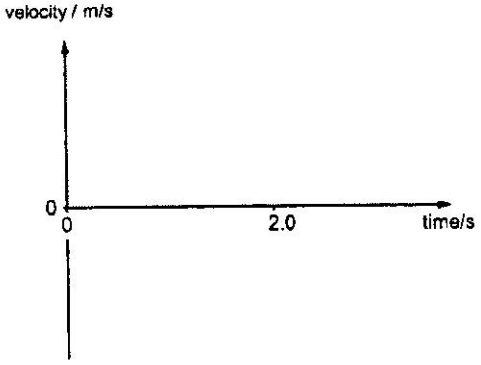
.....

..... [2]

(c) Calculate the acceleration of the trolley at 2.0 s.

acceleration = ... [2]

(d) On Fig. 12.8, sketch the velocity-time graph for the motion of the trolley between P and Q.



[2]

Fig. 12.8

(e) If the force F remains constant after 2.0 s,

(i) describe and explain the subsequent motion of the trolley,

.....

.....

..... [2]

(ii) sketch the velocity-time graph for the subsequent motion in Fig. 12.8 above. [1]

END OF PAPER

Setter: Mdm Latifah Noorahman

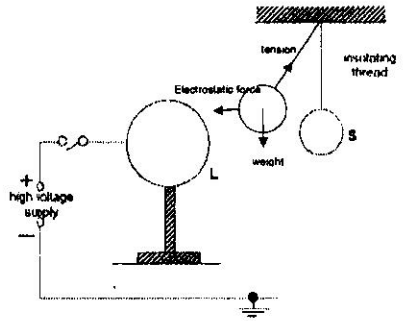
Ahmad Ibrahim Sec School
Preliminary Examination 2016
4E Physics 5059 Answers

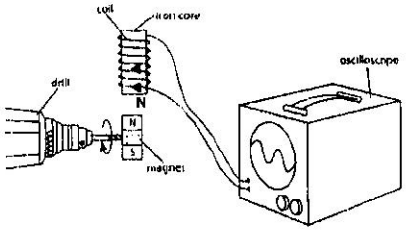
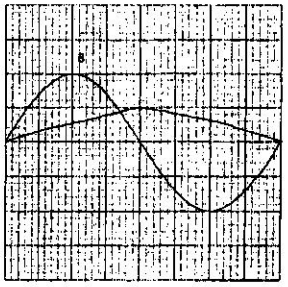
Paper 1

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

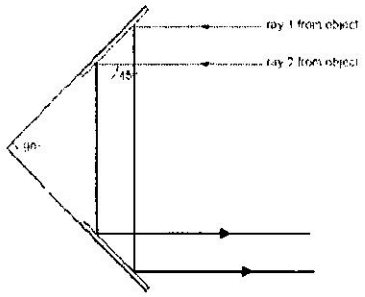
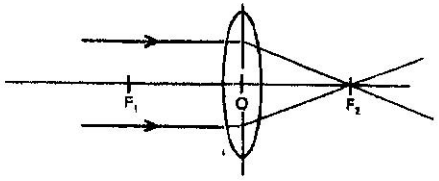
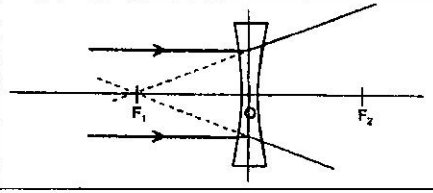
Paper 2

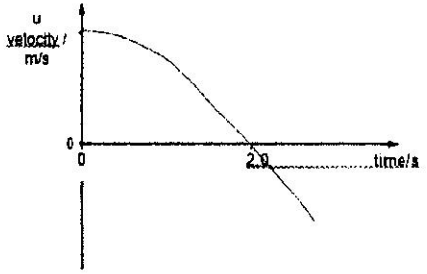
1(a)	T = 38.5 / 20 = 1.93 s
(b)	Length x is not the correct length of pendulum, the radius of the bob should be added (or length should be measured to the centre of the bob)
(c)	Mass of pendulum is the measure of the amount of substance in the pendulum.
2(a)	21 mm
(b)	(i) gas pressure increases (ii) the level A decreases (iii) the level B increases
(c)	When temperature rises, the gas molecules in the drum gain KE move faster, collide with more force or more frequently with the surface of mercury at A. No change in the rate of collision of the gas molecules outside on the surface of mercury at B. Since there is <u>increase in pressure difference</u>, mercury moves down from A and up at B.
3(a)	The amount of thermal energy needed to change the state of 1 g of water from liquid to gas without a change in temperature is 2250 J.
3(b)	The steam condenses into water at 100 deg Celsius and adds on to the mass of water in the jar
(c)	$Q = mc\Delta\theta = 500 \times 4.2 \times 80$ = 168 000 J
(d)	Heat absorbed by cold water = heat released by steam 168 000 = ml m = 168000 / 2250 = 74.7 g Final mass of water = 575 g

4(a)	$R_T = (1/6+1/3)^{-1} + 3$ = 5.0 Ω
(b)	I = V/R = 10 / 5.0 = 2.0 A
4(c)	Q = It = 2.0 x 60 = 120 C
4(d)	Dimmer. The p.d. across the bulb decreases, $P = V^2/R$ decreases OR The effective resistance of circuit increases, current in the circuit decreases, hence less current through the bulb.
5(a)	positive
5(b)	 B1 – pendulum at an angle towards L B2 – 3 labelled arrows correct directions
(c)	The electrons of S are attracted to / negative charge is induced on the left side of S, AND a positive charge is induced on the right side of S. [1] [Ecf from (a)] Attractive force is stronger than repulsive force as unlike charges are closer than like charges. [1]
6(a)	P = IV = 750 x 11000 = 8 250 000W
(b)	Power loss = $I^2 R = 750^2 \times 1.5$ = 843750 W = 844000 W
(c)	(1)Use a <u>step-up transformer</u> to <u>reduce the current transmitted</u> <u>(2) Increase the cross-sectional area of transmission wires to reduce the resistance,</u> so the <u>power loss will be reduced</u> <u>useful power / input power x 100% increases</u>

7(a)	Concentric circles (at least 3) with arrows pointing clockwise Increasing spacing away from centre
(b)	The copper rod moves (or swings) inwards / into the magnet / left **There is current in the rod, rod experiences a force in a magnetic field** / there is interaction between the magnetic field due to current in rod and the magnetic field of magnet Consider : Thumb to point to the force that results due to magnetic field indicated by the index (1st) finger, and the middle (2nd) finger to point in the direction of the current *at right angle to each other*
(c)	Moves in and out / oscillate due to current continually changing direction, force reverses in direction periodically
8(a)	As the drill bit rotates, the magnet rotates near the coil, there is a change in magnetic flux in the coil / the coil cuts the magnetic field lines, induces current in the coil
(b)	
(c)	
(d)	Amplitude of trace decreases but the number of cycles displayed on the screen remain the same.
(e)	f = 750 / 60 = 12.5 Hz T = 1 / f = 1/12.5 = 0.080 s Time base frequency = 0.080 s / 8 div = 0.010 s/div = 10 ms/div
9(a)	The source vibrates at a frequency higher than 20000 Hz. As the sound is transmitted into the body, it causes the particles of the skin and tissues to vibrate and transfer energy from one particle to another until they reach a boundary where some energy will be reflected back as echoes to the receiver.

(b)	(i) 100 x 20 kHz = 2 MHz or 2000000 Hz
	(ii) wavelength = speed / frequency = 1500 / 2×10^6 = 7.5×10^{-4} m
10(a)	for V = 0 to 0.8 V, current increases as V increases OR **I increases linearly with V** for V above 0.8 V, the increase in I per unit increase in V increases for X but decreases for Y.
(b)	resistance = V/I = 2.0 / 66 x 10^{-3} = 30.3 Ω
(c)	As V increases, current in X also increases, however, the increase in I per unit increase in V, increases. This means that the resistance of X, which is V/I is decreasing with increasing V OR Resistance of X decrease with increasing V. As shown in the table, R = V/I decreases from 40.0 ohm when V = 0.4V to 30.3 ohm when V = 2.0V to 24.5 ohm when V = 2.4V
(d)	Y is a filament lamp Should not be called light bulb.
(e)	(i) (as temperature rises), resistance of thermistor decreases ***either*** resistance of parallel combination decreases ***or*** p.d. across 5 kΩ resistor / thermistor decreases p.d. across 2000 Ω resistor / voltmeter reading increases (ii) if R is the resistance of the parallel combination, ***Either*** $3.6 = \frac{2000}{2000+R} \times 6$ R = 1330 Ω $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \rightarrow \frac{1}{1330} = \frac{1}{5000} + \frac{1}{T}$ T = 1.82 kΩ ***or*** current in 2 kΩ resistor = 1.8 mA current in 5 kΩ resistor = 0.48 mA current in thermistor = 1.32 mA T = 2.4 / 1.32 = 1.82 kΩ
11(a) (i)	Work done = (0.2 x 10) x 0.6 = 1.2 J
(ii)	KE = ½ mv^2 = ½ x 0.2 x 2.5^2 = 0.625 J
(iii)	GPE at C + KE at C = 1.2 J mgh + 0.625 = 1.2 h = (1.2 – 0.625) / (0.2 x 10) = 0.288 m
(b)	velocity is a vector quantity whereas speed is a scalar quantity **direction changes (as it passes D),** so velocity changes
(c)	There is friction while moving on EF Work done against friction

	kinetic energy changes to thermal energy less kinetic energy at E changed to gravitational potential energy
12 E (a)(i)	one 90° deviation at 1st mirror, by eye two 90° deviations at 1st mirror, by eye emerging rays parallel to incident rays, by eye 
(ii)	upside down OR inverted OR same size OR virtual
(iii)	No change in the image seen, the rays incident on the surfaces of the prism are along the normal, the rays do not change direction.
(b)(i)	
	
(ii)	**Description of image when the object distance is *greater* than the focal length**: real; inverted **Description of image when the object distance is *less* than the focal length**: virtual; upright

	same size as object or magnified or diminished | magnified
12 Or (a)	0N
(b)	Resultant force increases at a constant rate in the negative direction OR Resultant force decreases at a constant rate from 0N to -2.8N
(c)	$a = F_{net} / m = - 2.8 / 0.8$ $= - 3.5\ m/s^2$
(d) (e)(ii)	
(e)	(i) The trolley moves in reverse direction with a constant acceleration because resultant force is now constant at – 2.8 N. (ii) see graph above

Answer **all** questions.

1 Fig. 1.1 and Fig. 1.2 show micrometer screw gauge readings with the jaws closed and when measuring a marble respectively.

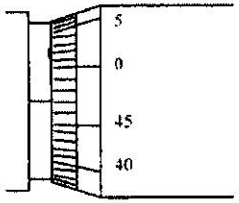


Fig. 1.1

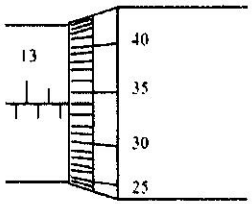


Fig. 1.2

What is the actual diameter of the marble?

A 15.31 mm
B 14.87 mm
C 14.81 mm
D 14.37 mm

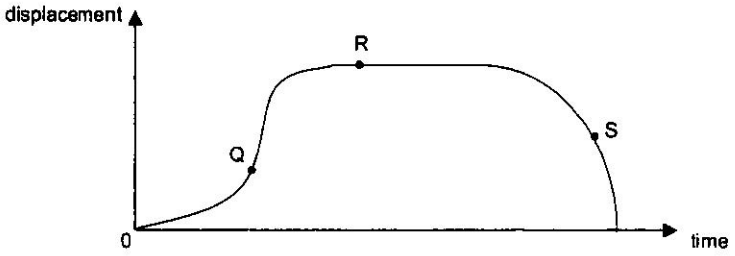
2 An astronaut has a mass of 60 kg on Earth. He can jump 2.0 m high on the surface of earth. Assume that the acceleration due to gravity on the Moon is 1.6 ms^{-2}. Which of the following statements regarding the distance he can jump on the Moon and the corresponding reason are correct?

	distance he can jump on the Moon	reason
A	lower than 2.0 m	his weight is more than on Earth
B	lower than 2.0 m	his mass is more than on Earth
C	higher than 2.0 m	his weight is less than on Earth
D	higher than 2.0 m	his mass is less than on Earth

3 Two objects X and Y are identical in size and shape but X has 3 times the mass of Y. When they are both released at the same time from the same height in a vacuum container, they reach the floor of the container at the same time. Which of the following statements is NOT correct?

A On reaching the floor, the speed of X is the same as the speed of Y.
B On reaching the floor, the kinetic energy of X is greater than that of Y.
C The size of the force acting on X is the same as the size of the force acting on Y.
D The rate of change of velocity is the same for X and Y.

4 The diagram shows a displacement-time graph of the journey of a car.



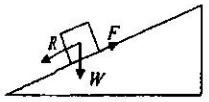
Which of the following statement(s) is/are true?

I At S, the car is travelling back to its start point.
II At Q, the car is travelling at a constant speed.
III At R, the car is travelling at a constant speed.

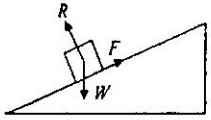
A I only
B I and II only
C I and III only
D I, II and III

5 A box of weight W is held stationary on a rough sloping surface. If F is the friction force and R the normal contact force, which of the diagrams below best represents the forces acting on the box?

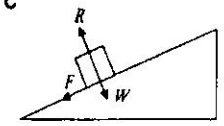
A



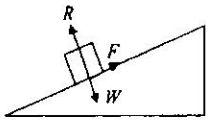
B



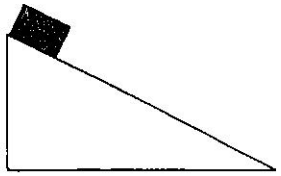
C



D



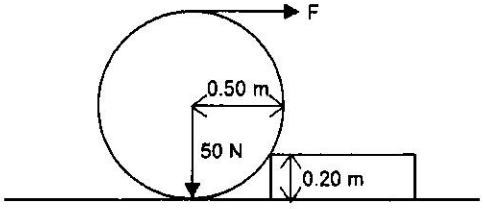
6 A box accelerates down a rough slope as shown.



What is the effect of friction on the motion of the box?

A The box slows down.
B The box moves with lower acceleration.
C The box moves with higher acceleration.
D The box continues to move with the same acceleration

7 A 50 N cylinder is pulled by a horizontal force F to climb a step 0.20 m high. The cylinder has a radius of 0.50 m.



What is the minimum value of force F required?

A 25 N
B 20 N
C 12.5 N
D 10 N

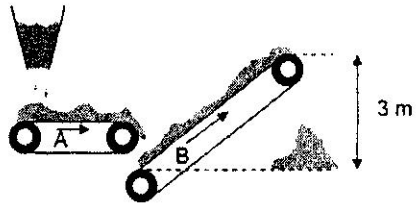
8 Which of the following objects, when displaced, is seen to be in neutral equilibrium?

A A heavy weight suspended on a string.
B A pencil balanced on its sharp tip.
C A cone resting on its slant edge.
D A pyramid resting on its base.

9 A ball is released from a height h above a table. Assuming that air resistance is negligible and 50% of its kinetic energy is lost at each bounce, what will be the height reached by the ball after the second bounce?

A h
B h/2
C h/4
D h/8

10 The diagram shows sand being dropped from conveyor belt A to conveyor belt B at a steady rate of 3.0 kg/s. Both conveyor belts move with a speed of 2.0 m/s.



What is the power supplied by the motor for belt B?

A 12 W
B 30 W
C 60 W
D 90 W

11 Fig. 11.1 and Fig. 11.2 show air trapped in a capillary tube by a small mercury plug. The length of the mercury plug is 10 cm. The atmospheric pressure is 76 cm Hg.

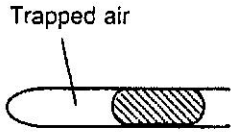


Fig. 11.1

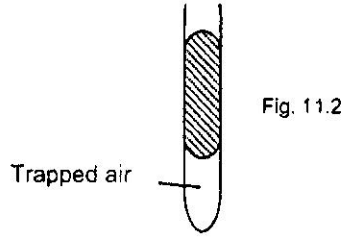
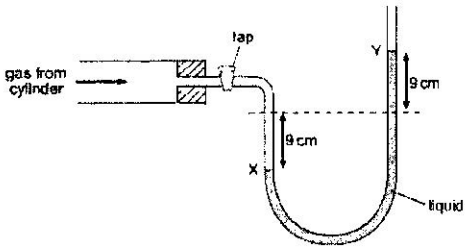


Fig. 11.2

Which of the following describes the pressure of the column of trapped air in Fig. 11.1 and Fig. 11.2?

	pressure in Fig. 11.1	pressure in Fig. 11.2
A	10 cm Hg	76 cm Hg
B	10 cm Hg	86 cm Hg
C	76 cm Hg	10 cm Hg
D	76 cm Hg	86 cm Hg

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

13 A partially inflated balloon is placed under a bell jar as shown in Fig. 13.1. A vacuum pump is turned on for several minutes and the volume of the balloon increases as shown in Fig. 13.2.

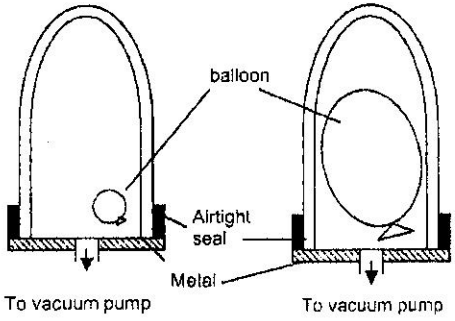


Fig. 13.1

Fig. 13.2

Which pressure changes occur within the bell jar and within the balloon?

	pressure change in bell jar	pressure change in balloon
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

14 In Brownian motion experiment involving smoke particles in the air, heavy particles settle quickly but very small particles remain suspended for a long periods of time. This is because

A very small particles have low inertia and therefore are easily affected by the bombardments of the air molecules.
B the Earth's gravitational field does not act on very small particles.
C the small smoke particles have the same density as air.
D air pressure has a greater effect on smaller particles.

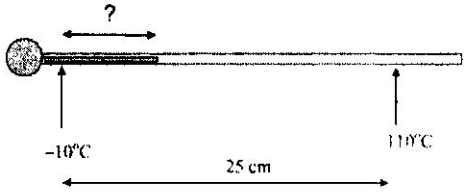
15 In a vacuum flask, which is the component that reduces radiation?

A the silvered wall
B the stopper
C the vacuum between the walls
D the foam supporting the walls

16 A thermocouple thermometer attached to a millivoltmeter reads 5.0 mV when the junctions are immersed in pure melting ice and in pure boiling water. When one of the junctions remains in pure melting ice and the other one in an unknown liquid, the reading is 2.0 mV. What is the temperature of the unknown liquid?

A 30 °C
B 40 °C
C 50 °C
D 60 °C

17 The diagram shows a mercury-in-glass thermometer. The distance between the -10 °C and the 110 °C markings is 25 cm.



At 38 °C marking, how long should the mercury thread be?

A 7.9 cm
B 10 cm
C 12 cm
D 14 cm

18 Latent heat of fusion is the energy required to change a solid into liquid. What does this energy do?

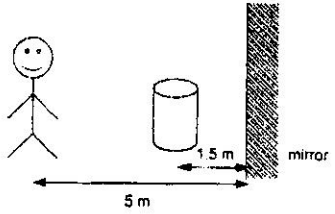
A It increases the average speed of the solid molecules.
B It increases the vibration between the solid molecules.
C It increases the average separation of the solid molecules.
D It increases the forces of attraction between the solid molecules.

19 An 80 g block of ice at -10 °C is placed on a hot plate heated rated at 5 A, 100 V. The specific latent heat of fusion of ice is 336 $kJkg^{-1}$ and the specific heat capacity of ice is 2.1 $kJkg^{-1}K^{-1}$ and the specific heat capacity of water is 4.2 $kJkg^{-1}K^{-1}$.

What is the total time taken for the ice to melt completely?

A 541 s
B 271 s
C 57 s
D 29 s

20 A man is standing 5 m away from a plane mirror and a cylindrical stool is placed in front of him as shown.



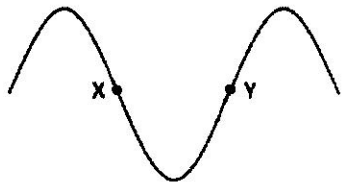
How far is the man's image in the mirror away from the stool?

A 3.0 m
B 3.5 m
C 6.5 m
D 8.5 m

21 When an object is placed 25 cm from a thin converging lens, a real image equal in size to the object is formed. The object is then moved 3 cm nearer to the lens. What will happen to the new image?

	image distance	image size
A	less than 25 cm from lens	magnified
B	more than 25 cm from lens	magnified
C	less than 25 cm from lens	diminished
D	more than 25 cm from lens	diminished

22 A transverse wave travels steadily from left to right as shown.



Which of the following concerning the directions of movement of the particles X and Y is true?

	X	Y
A	upward	downwards
B	downwards	downwards
C	downwards	upwards
D	to the right	to the right

23 A vibrator dipping into water in a ripple tank has period of $\frac{1}{6}$ s. The resulting wave has a wavelength of 0.02 m. What is the speed of the wave?

A 0.020 ms^{-1} **B** 0.12 ms^{-1} **C** 3.0 ms^{-1} **D** 6.0 ms^{-1}

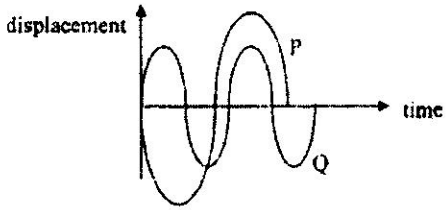
24 How do the wavelength, frequency and speed of ultraviolet light in vacuum compare with those of visible light?

	wavelength	**frequency**	**speed**
A	longer	higher	slower
B	longer	lower	same
C	same	lower	slower
D	shorter	higher	same

25 Which of the following does not make use of electromagnetic waves in its operation?

A a camera
B a radio set
C a microphone
D a television set

26 Two pure notes are produced and the resulting waveforms are superimposed on the same axes as shown below.

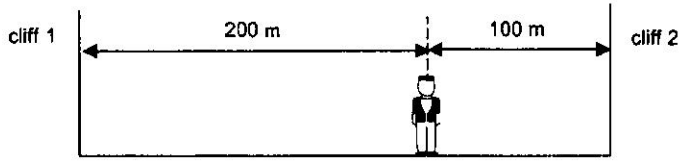


Which of the following statement(s) about P and Q is/are correct?

(1) P is louder than Q.
(2) P has a higher pitch than Q.
(3) P and Q have the same speed.
(4) Q has a lower frequency than P.

A (3) only
B (1) and (2) only
C (1) and (3) only
D (2) and (4) only

27 A man stands between 2 cliffs as shown in the diagram and claps his hands once.



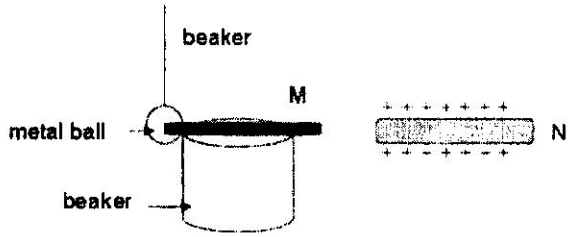
Assuming that the velocity of sound in air is 300 m/s, what will be the time interval between the first and second echoes?

A 2.00 s **B** 1.34 s **C** 0.66 s **D** 0.33 s

28 A rod which is an insulator carries a positive charge after it is rubbed with a woollen cloth. Which of the following explanation is correct?

A Electrons are transferred from the rod to the cloth.
B Electrons are transferred from the cloth to the rod.
C Positive charges are transferred from the cloth to the rod.
D Friction causes negative charges on the rod to become positive.

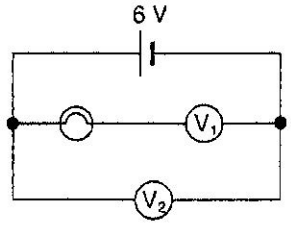
29 An uncharged conducting rod M is placed on top of a glass beaker. An uncharged metal coated ball hanging from an insulated string just touches one end of the rod. A charged metal rod N is brought to touch the other end of the rod M and then quickly removed.



What will happen to the metal coated ball?

A It remains still throughout.
B It moves away only when the two rods are touching.
C It swings back and forth while both rods are touching.
D It moves and stays away even after the rod N is removed.

30 In the given circuit, V_1 and V_2 are two identical voltmeters. What are the readings of the voltmeters and the brightness of the light bulb?

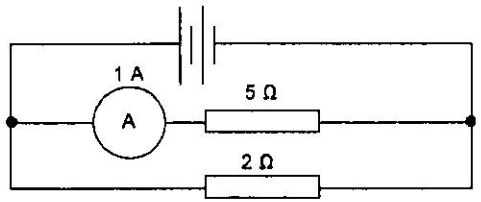


	reading of V_1	reading of V_2	light bulb
A	6 V	0 V	bright
B	6 V	6 V	dark
C	0 V	6 V	dark
D	3 V	6 V	bright

31 The resistance of an alloy wire is *R*. When the length and diameter of the alloy wire are both doubled, what is the resistance in terms of *R*?

A 8*R* **B** 4*R* **C** 2*R* **D** *R*/2

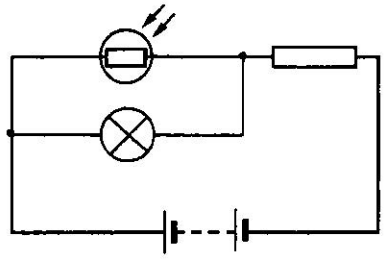
32 The following circuit is set up.



How much electrical energy is converted to other forms of energy in the 2 Ω resistor in 1 minute?

A 12.5 J
B 30 J
C 600 J
D 750 J

33 The diagram shows the connection of a fixed resistor, a bulb and a light dependent resistor (LDR). A weak light is falling on the LDR initially.



What happens to the brightness of the bulb when the brightness of the surrounding light increases?

A same brightness
B brightness increases
C brightness decreases
D bulb will not light up at all

34 The ratings of some electrical appliances are shown below.

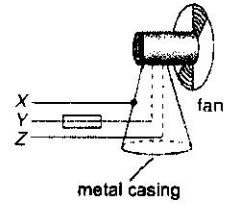
Electrical appliance	Rating
Television	135 W
Air conditioner	2.75 kW
Lamps	100 W

If the cost of 1 kWh electricity is 80 cents, what is the total cost of operating the following electrical appliances for 3 hours?

A $7.16
B $12.20
C $73.40
D $429.80

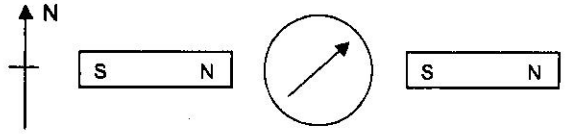
35 The diagram below shows the external wiring of an electric fan. Which of the following statements is/are correct?

I Wire *X* is always at a low potential
II The switch of the fan should be connected to wire *Y*.
III Wire *Z* is blue in colour.

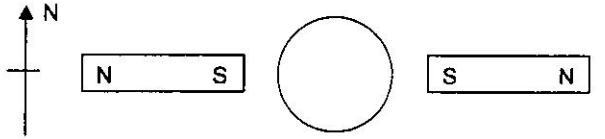


A I only
B I and II only
C II and III only
D I, II and III

36 The diagram shows a compass placed between two identical magnets in the Earth's magnetic fields.

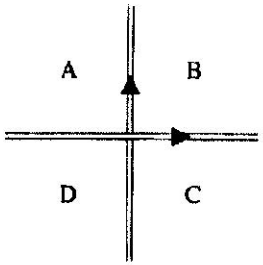


If one magnet is reversed as shown below, in which direction will the compass needle point?

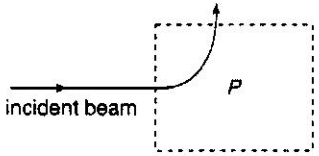


A **B** **C** **D**

37 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 out of the paper?



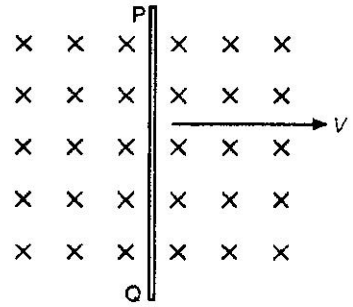
38 A beam of particles is directed towards a region *P* in which a magnetic field is applied. The beam is deflected as shown below.



What are the nature of the charged particles and the direction of the magnetic field?

	particles	direction of magnetic field
A	protons	into the page
B	protons	out of the page
C	electrons	into the page
D	neutron	out of the page

39 A rod is pulled to the right with velocity *v* through a magnetic field as shown.



Which of the following statements is/are correct?

I Q is at a higher potential than P.
II A current flows from Q to P in a rod if a wire is connected between P and Q.
III The induced e.m.f. increases when the velocity increases.

A III only
B I and II only
C II and III only
D I, II and III

40 The voltage of a 220 V a.c. supply is stepped down by a transformer if turn ratio is 1:18. When a portable CD player is connected to the transformer, it draws a current of 500 mA from the transformer. If the efficiency of the transformer is 80%, what is the power delivered by the power supply?

A 7.64 W
B 6.25 W
C 6.11 W
D 4.89 W

~ END OF PAPER ~