Anglican High School
Secondary Four
Preliminary Examination 2014

CANDIDATE NAME

CLASS | | INDEX NUMBER | |

PHYSICS
Paper 1 Multiple Choice

5059/1
7 Aug 2014
1 hour

Assessment noted by :

Name of Parent/Guardian

Signature of Parent/Guardian

Date :

Additional Materials:
Multiple Choice Answer Sheet (OMS)
Soft Pencil

READ THESE INSTRUCTIONS FIRST

DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO.

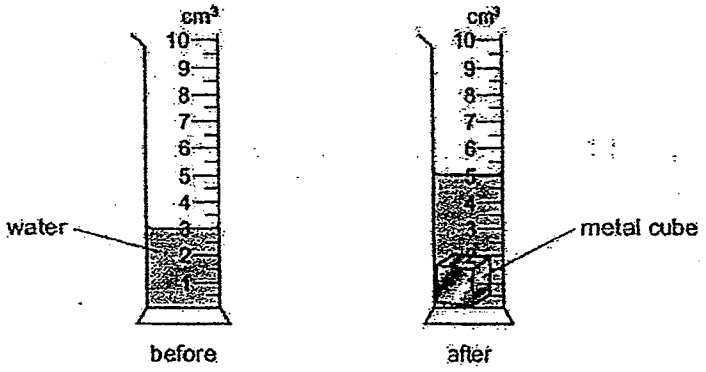
Write in soft pencil.
Write your name, index number and class on all papers you hand in.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions.
For each question, there are four possible answers **A, B, C and D.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done on this question paper.

Take $g = 10\ m/s^2$ unless otherwise stated.

1. The diagrams show the readings on a measuring cylinder before and after a small metal cube is added.



How many more identical cubes can be added to the cylinder, without causing the water to overflow?

A. 1 B. 2 C. 3 D. 4

2. Which statement is incorrect by a factor of 100 or more?

A. The length of a football field is about 1×10^2 m.
B. Light travels at about 3×10^8 m/s to reach us from the Sun.
C. Atmospheric pressure is about 1×10^7 Pa
D. The life-span of a man is about 2×10^9 s.

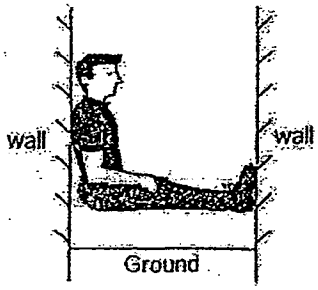
3. Which person is experiencing an acceleration?

A. a driver of a car that is braking to stop at traffic lights
B. a passenger in a train that is stationary in a railway station
C. a shopper in a large store ascending an escalator (moving stairs) at a uniform rate
D. a skydiver falling at constant speed towards the Earth

4. Balanced forces are acting on a moving body.
What happens to the direction of movement and to the speed of the body?

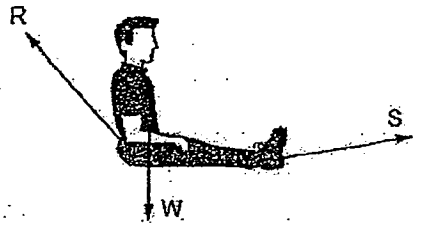
	direction of movement	speed
A.	changes	changes
B.	changes	does not change
C.	does not change	changes
D.	does not change	does not change.

5. A man of weight W presses firmly against two walls and is at rest in the position shown below. Contact forces acting on the man's back (R) and on his feet (S) support the weight of the man.

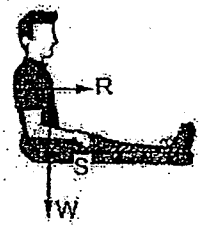


Which of the following shows the correct free-body diagram of the forces acting on the man?

A

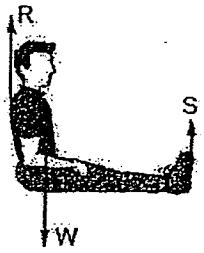


B

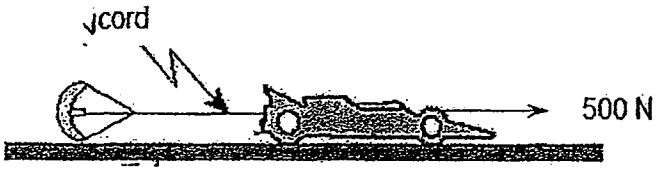


C

D



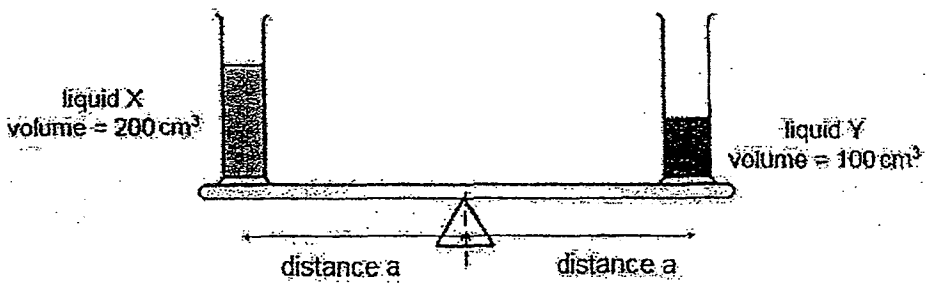
6. The engine of an 800 kg sports car exerts a constant forward force of 500 N on the car. When the parachute is opened, the car decelerates at 2.5 m/s^2 while the engine continues to provide the forward force of 500 N.



What is the tension in the cord at this instance? (Assuming that there is no other resistive force)

A. 5.0×10^2 N
B. 1.5×10^3 N
C. 2.0×10^3 N
D. 2.5×10^3 N

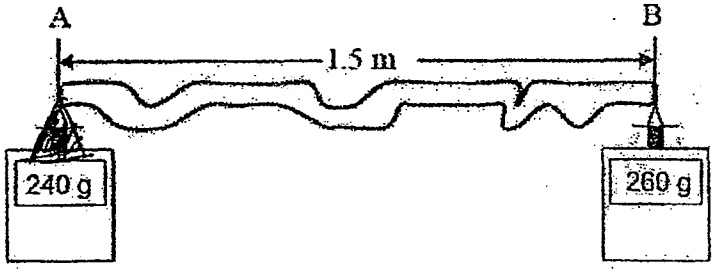
7. Two identical measuring cylinders containing different liquids are placed on a simple balance. They balance as shown.



How does the density of X compare with the density of Y?

A. density of X = ½ × density of Y
B. density of X = density of Y
C. density of X = 2 × density of Y
D. density of X = 4 × density of Y

8. An irregularly shaped rod of length 1.5 m is balanced on two top-pan balances as shown in the diagram below. The balances give readings of 240 g and 260 g. What is the distance of centre of gravity of the rod from end A?



A. 0.715 m B. 0.720 m C. 0.765 m D. 0.780 m

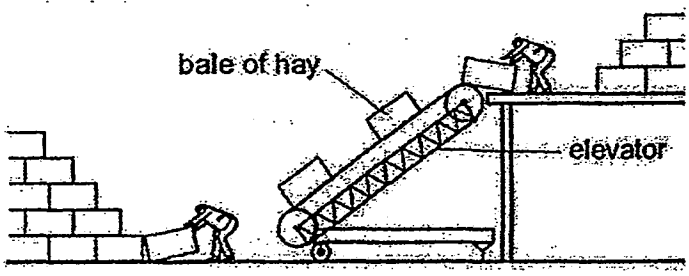
9. Nuclear fission is a process where nuclear energy is released when a heavier nucleus splits up into two or more lighter nuclei. A power station uses nuclear fission to obtain energy for daily use. In this process, nuclear energy is first changed into

A. thermal energy.
B. chemical energy.
C. gravitational energy.
D. electrical energy.

10. A body of mass 3.0 kg is dropped with an initial downward velocity of 2.0 m/s from a height of 5.0 m above the ground. Air resistance is negligible.
Which one of the following statements is not true?

A. The total energy of the body is conserved.
B. The total energy of the body when it reaches the ground is 150 J.
C. The body gains 150 J of kinetic energy on reaching the ground.
D. Gravitational potential energy is converted to kinetic energy.

11. Two farmers use an electrically powered elevator to lift bales of hay. All the bales of hay have the same mass.



As sunset approaches, they increase the speed of the elevator so that more bales are lifted up in a given time.
How does this affect the work done in lifting each bale and the useful output power of the elevator?

	work done in lifting each bale	useful output power of the elevator
A.	increases	increases
B.	increases	decreases
C.	no change	increases
D.	no change	decreases

12. Hydroelectric, tidal and fossil fuel power stations generate electrical energy. Do these use renewable sources of energy?

	hydroelectric	tidal	fossil fuel
A.	no	yes	yes
B.	no	no	yes
C.	yes	no	no
D.	yes	yes	no

13. Fig 13.1 and 13.2 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.

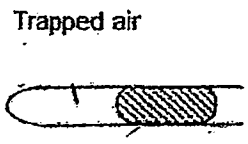


Fig. 13.1

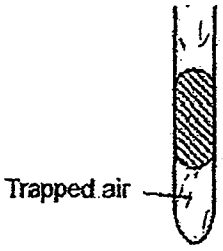
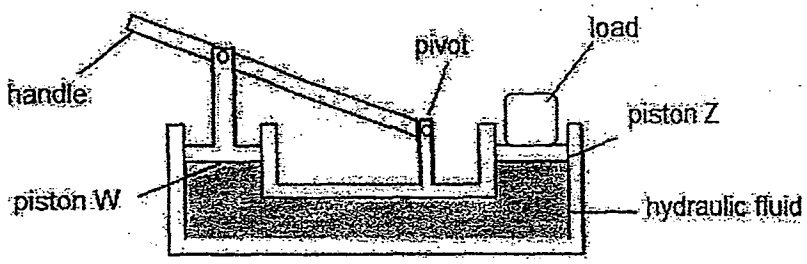


Fig. 13.2

The pressure of the column of trapped air in Fig 13.1 and 13.2 is given by

	Fig 13.1	Fig 13.2
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

14. The figure below shows a simple hydraulic jack.



Which change will result in the heaviest load being lifted with the same force applied at the handle?

	Diameter of W	***Diameter of Z***
A.	Halved	Doubled
B.	No change	Doubled
C.	No change	Halved
D.	Doubled	Halved

15. The volume of a gas is halved at constant temperature.
Which of the following changes is/are correct ?

(1) The average speed of the gas molecules becomes greater.
(2) There are more frequent collisions on the walls.
(3) The collisions on the walls are harder.

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

16. After a sheep has its wool cut off, it is harder for it to stay warm when the air temperature falls. How does the wool help the sheep to stay warm?

A. Air can circulate between the wool fibres and heat up the skin by convection.
B. The wool fibres are curly so it takes longer for heat to be conducted away from the skin.
C. The wool fibres conduct heat to the skin from the air outside.
D. Air trapped by the wool fibres reduces heat losses from the skin by convection.

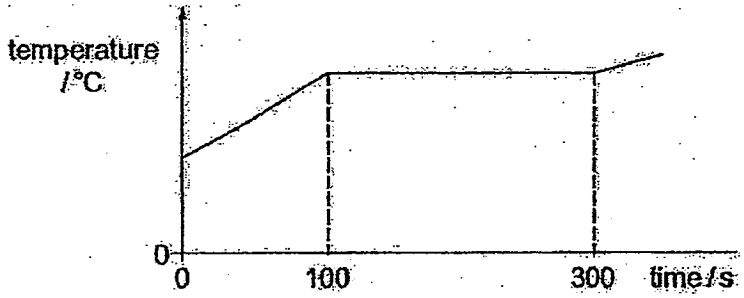
17. To mark a temperature scale on a thermometer, standard temperatures known as fixed points are needed.
Which of these is a fixed point?

A. room temperature
B. the temperature of pure melting ice
C. the temperature inside a freezer
D. the temperature of pure warm water

18. A tungsten wire has a resistance of 30 Ω at 0 °C and 50 Ω at 100 °C. What is the working temperature of the wire if its resistance is 45 Ω?

A. 25 °C B. 45 °C C. 75 °C D. 90 °C

19. A mass of 0.20 kg of a substance is initially solid. It is heated at a steady rate of 500 W. The graph shows how the temperature of the substance changes with time.



What is the specific latent heat of fusion of the substance?

A. 20 000 J / kg
B. 30 000 J / kg
C. 500 000 J / kg
D. 750 000 J / kg

20. Two copper blocks X and Y have masses M_X and M_Y respectively. In an experiment the blocks are heated. The results of the experiment are shown in the table below.

Block	Thermal energy supplied/J	Initial temperature/°C	Final temperature/°C
X	2000	-10	+30
Y	2000	-10	+10

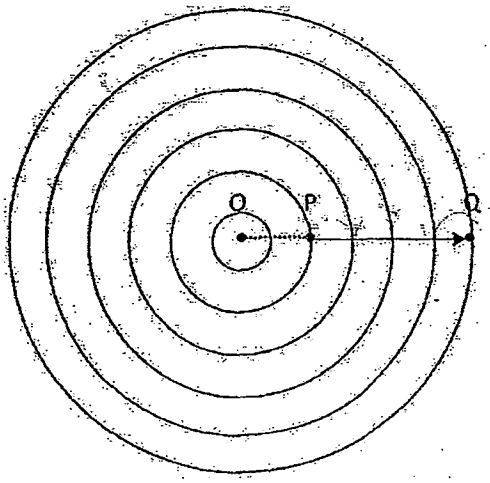
What is the value of M_X / M_Y ?

A. 0.3 B. 0.5 C. 2 D. 3

21. An object is placed 20 cm from a converging lens. Its image is formed 20 cm from the lens on the opposite side. What is the focal length of the lens?

A. 5 cm
B. 10 cm
C. 21 cm
D. 40 cm

22. The figure below shows circular wavefronts travelling from a point source O. If the time taken for a wavefront to travel from points P to Q is 12.0 s and the wavelength of the wave is 200 cm) what is the speed of the wave?



A. 0.67 m/s
B. 17 m/s
C. 1.0 m/s
D. 67 m/s

23. Which of the following is not an electromagnetic wave?

A. X-Rays
B. Visible Light
C. Ultrasound
D. Radiowaves

24. Which of the following statements about electromagnetic waves is **incorrect**?

A. Gamma rays have shorter wavelengths than ultraviolet rays.
B. Radiowaves are part of the electromagnetic spectrum.
C. Microwaves can be used for telecommunications.
D. X-rays travel faster in a vacuum than infra-red rays.

25. When sound wave travels from glass into air, how do the frequency, wavelength and speed of the wave change?

	Frequency	*Wavelength*	*Speed*
A.	no change	increases	increases
B.	increases	no change	decreases
C.	no change	decreases	decreases
D.	increases	no change	increases

26. What will happen if a negative charged metallic sphere is placed in an electric field?

A. The charged sphere will become positive.
B. The charge on the sphere will remain negative but become larger.
C. The charge on the sphere will remain negative but become smaller.
D. The charged sphere will experience a force.

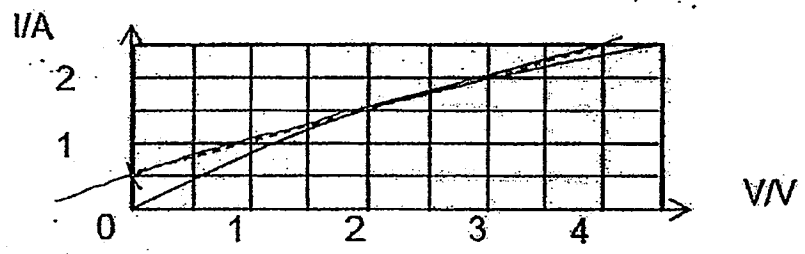
27. What is an equivalent unit for current?

A. Cs^{-1} B. Vs^{-1} C. Cs D. Vs

28. Wires of various lengths and circular cross-sectional areas were made of the same material. If the lengths and diameters of the wires are as shown below, which of these would provide the lowest resistance?

	Length/cm	Diameter/mm
A.	2.0	1.0
B.	3.0	2.0
C.	4.0	3.0
D.	8.0	4.0

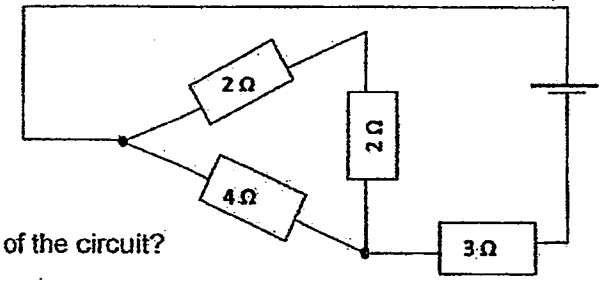
29. With the aid of a variable resistor, the p.d. across an incandescent bulb was varied and the current through the bulb was measured. The graph below shows how the current (I) varies with the p.d. (V). A tangent to the graph at V = 2 V is shown.



What is the resistance of the bulb when V = 2 V?

A. 2.00 Ω B. 1.33 Ω C. 0.75 Ω D. 0.50 Ω

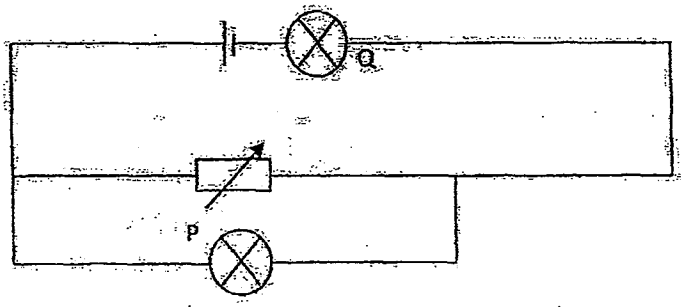
30. Four resistors are connected with the power supply as shown in the figure below.



What is the effective resistance of the circuit?

A. 1.2 Ω B. 3.5 Ω C. 5.0 Ω D. 11 Ω

31.



Which of the following statements is true for the circuit shown above when the resistance of the variable resistor is decreased?

A. P becomes dimmer.
B. P becomes brighter.
C. P remains as bright.
D. The potential difference across P remains unchanged.

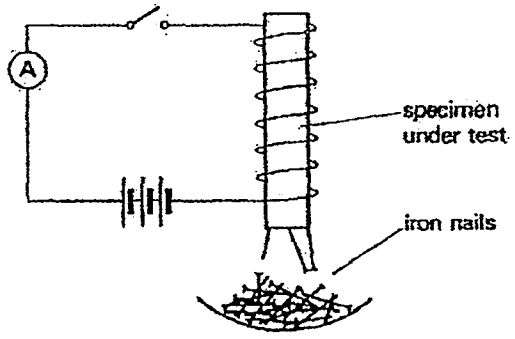
32. A small bulb rated at 6 V, 3 W and a large lamp rated at 240 V, 50 W are connected in series across a 240 V household power supply. What will happen when the circuit is switched on?

A. The bulb will emit very bright light and the lamp will operate normally.
B. The bulb will emit very little light but the lamp will operate normally.
C. The bulb will blow but the lamp will operate normally.
D. The bulb will blow and the lamp will not light up as current cannot flow.

33. The kilowatt-hour is a unit of

A. power B. energy C. charge D. voltage

34. Four different magnetic substances were tested using the apparatus shown in the diagram. The table below shows the number of iron nails each substance picks up when the switch is closed and when it is opened. Which substance would make the best permanent magnet?



	Number of nails picked up when switch is closed	Number of nails held when switch is opened
A.	35	4
B.	20	10
C.	20	20
D.	40	3

35. Diagram 1 shows a compass needle pointing to the Earth's north when there are no other magnets around it. The compass is then placed at a point Z near to a magnet surrounded by a soft iron ring it as shown in Diagram 2. Which of the following diagrams shows the possible orientation of the compass needle?

Diagram 1

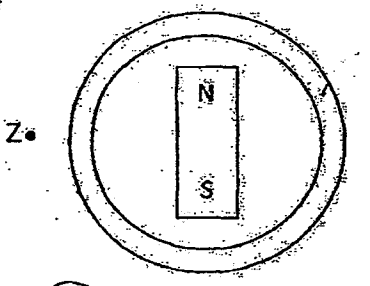
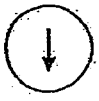


Diagram 2

A. 

C. 

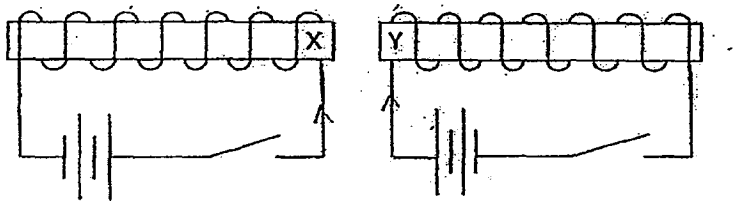
B. 

D. 

36. Which of the following is an example of induced magnetism?

A. A compass needle pointing north
B. A north pole attracting iron filings
C. A north pole repelling a north pole
D. The coil of a motor turning in a magnetic field

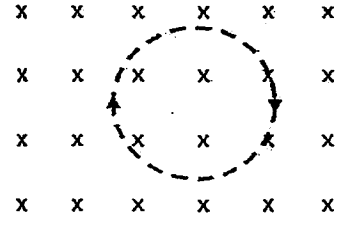
37. In the figure below, when currents to both solenoids are turned on, they will _____.



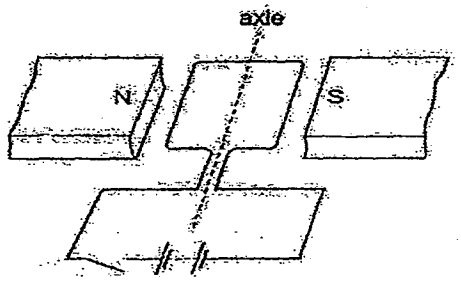
A. repel each other where X is the S-pole and Y is the S-pole
B. repel each other where X is the N-pole and Y is the N-pole
C. attract each other where X is S-pole and Y is the N-pole
D. attract each other where X is N-pole and Y is the S-pole

38. The diagram below shows the circular clockwise path of a particle in a field. Ignoring the effect of gravity, which of the following correctly describes a possible combination of the charged particle and the field?

	Field	Particle
A.	magnetic	positive
B.	electric	positive
C.	magnetic	negative
D.	electric	negative



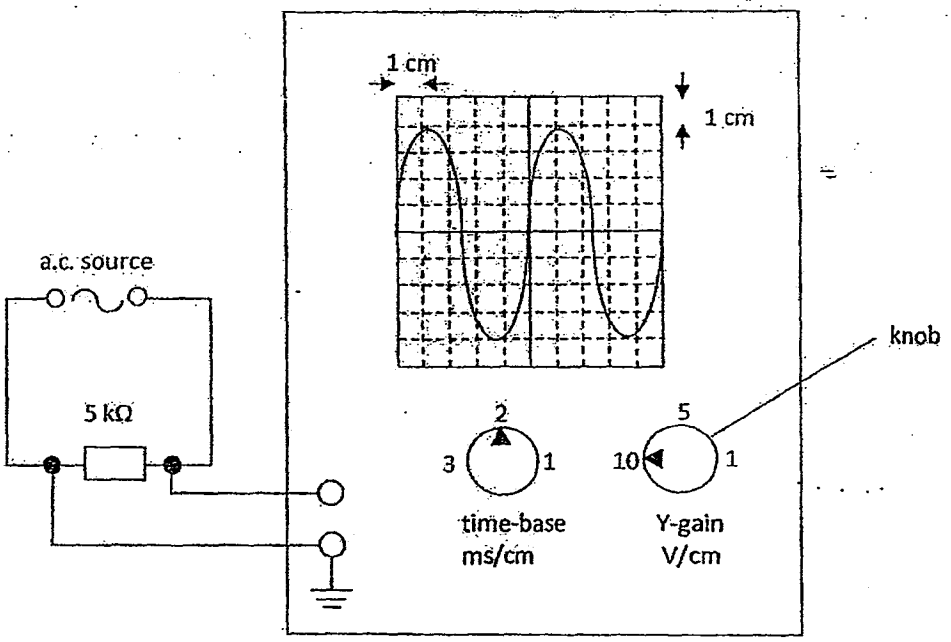
39. A simple model of a d.c. motor is made. By mistake, the split-ring commutator is left out as shown in the diagram below.



The coil starts in the horizontal position.
What happens to the coil when the switch in the external circuit is closed?

A. It does not move at all.
B. It moves upwards, out of the magnetic field.
C. It turns to the vertical position and eventually stops there.
D. It turns to the vertical position then comes back to the horizontal position.

40. The input terminals of a CRO are connected across a 5 kΩ resistor which is connected to an a.c. source. Two complete waveforms are displayed on the CRO screen. The CRO time-base and Y-gain settings are shown by arrowheads on the knobs.



Which of the following shows the peak current through the 5 kΩ resistor and the frequency of the a.c. source?

	peak current through 5kΩ resistor	*frequency of a.c. source*
A.	8 mA	100 Hz
B.	8 A	5 Hz
C.	4 A	5 Hz
D.	4 mA	100 Hz

-- END OF PAPER --

ANGLICAN HIGH.

Sec. 4 Physics Preliminary Examination 2014

Suggested Answers

Paper 1

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

Anglican High School
Secondary Four
Preliminary Examination 2014

Name : .....

Index Number : ..... Class : .....

PHYSICS
Paper 2 Theory

5059/02
2 Aug 2014
1 hour 45 minutes

Candidates are to give your answer on the Question Paper.

No additional materials are required.

READ THESE INSTRUCTIONS FIRST

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

Assessment noted by :

Name of Parent/Guardian

Signature of Parent/Guardian

Date :

For Examiners' Use	Marks
Section A	
Section B	
Wrong s.f.	
Total marks	

Section A
Answer **all** questions.

Section B
Answer **all** questions. Question 13 has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should be given to appropriate units and rounded off to the appropriate number of significant figures.
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.

Take g = 10 m/s^2 unless otherwise stated.

This Question Paper consists of **19** printed pages *including* this cover page.

[Turn over]

SECTION A (50 marks)

Answer **ALL** the questions in this section in the spaces provided.
(Take g = 10 ms^{-2} when needed)

1. (a) The graph in Fig. 1.1 shows how the velocity of a cyclist travelling along a straight road changes with time. The mass of the cyclist and the bicycle is 80 kg.

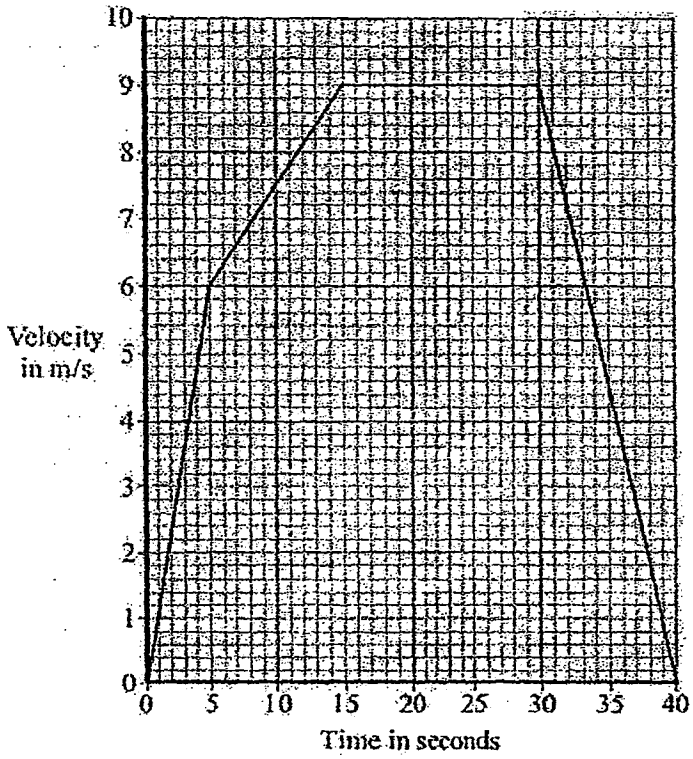


Fig. 1.1

(i) Calculate the acceleration and hence the resultant force needed to produce this acceleration for the first 5.0 s of his journey.

Acceleration = ...

Resultant force = ...[3]

(ii) Calculate the distance travelled by the cyclist when decelerating.

Distance travelled = ... [2]

(b) Fig. 1.2 below shows the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.

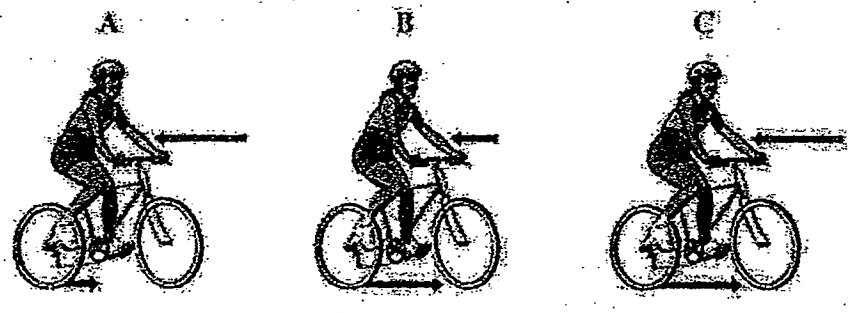


Fig. 1.2

(i) Which one of the diagrams, A, B or C, represents the forces acting when the cyclist is travelling at a constant speed of 9.0 m/s?

.....[1]

(ii) Explain the reason for your choice.

.....

.....

.....[2]

2. Fig. 2.1 shows a wind turbine.

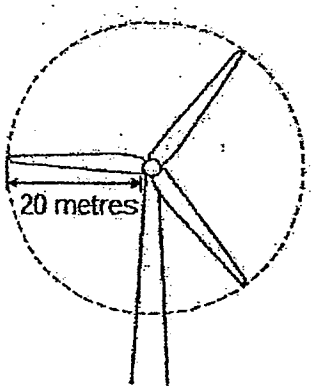


Fig. 2.1

(a) The blades of the turbine are 20 metres long. On average, 15 000 kg of air, moving at a speed of 12 m/s, hit the blades every second. Calculate the kinetic energy of the air hitting the blades every second.

Kinetic energy = ...[2]

(b) Part of the kinetic energy of the wind is transformed into electrical energy. Fig. 2.2 shows that, for the same wind speed, the power output of a turbine, in kilowatts, depends on the length of the turbine blades.

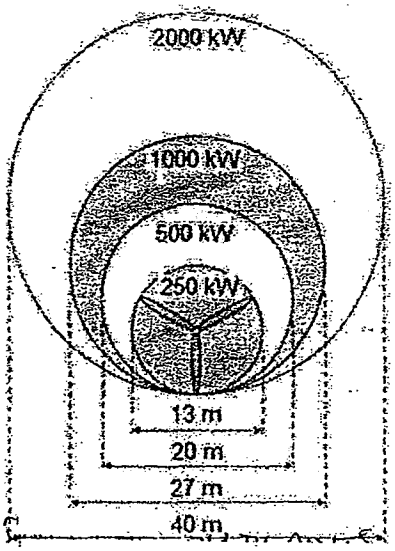


Fig. 2.2

Give a reason why doubling the diameter of the blades more than doubles the power output of a turbine.

.....

.....[1]

(c) The kinetic energy of the wind being transformed to electrical power is much less than the answer to (a). Explain how the principle of conservation of energy applies to this system.

.....

.....

.....[2]

(d) Give one environmental reason for using a wind turbine.

.....

.....[1]

(e) Suggest one factor that the owner will need to consider when deciding whether to install a wind turbine.

.....

.....[1]

3. Ms X bought a gold bracelet from a jeweller's shop. The jeweller claimed that the chain was 99.9% pure gold.
On reaching home, she decided to verify the purity of gold in the chain. She found the mass and volume of the chain to be 87.0 g and 5.9 cm^3 respectively.

(a) Define density.

.....

.....[1]

(b) Given that the density of copper is 8.92 gcm^{-3} and that of gold is 19.3 gcm^{-3},

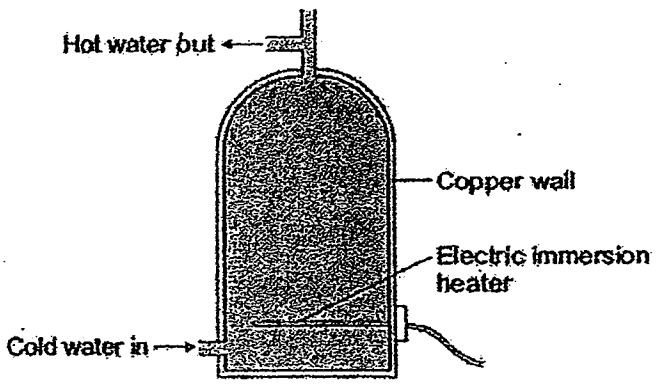
(i) calculate the mass of the gold in the chain.

mass of gold = ...[2]

(ii) Hence find the percentage of pure gold in the chain.

Percentage of pure gold = ...[1]

4. An electric immersion heater is used to heat the water in a domestic hot water tank. When the immersion heater is switched on the water at the bottom of the tank gets hot.



(a) Describe how energy is transferred by the process of convection from the hot water at the bottom of the tank to the cooler water at the top.

.....

.....

.....

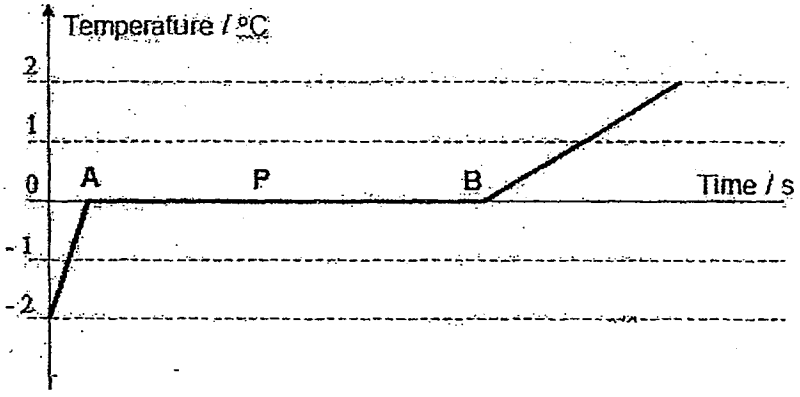
.....

.....[2]

(b) State the main process by which the energy is lost through the copper wall of the water tank.

.....[1]

5. Some pure ice placed in an insulated beaker is warmed up by a heater from a temperature of -2°C. The graph shows how its temperature varies with time. Assume that the rate of heat supply is kept constant.



The temperature of the ice remains constant at 0°C for some time, as shown from point A to point B in the graph, despite heat being continually supplied.

(a) State the content of the beaker at the time indicated by point P.

.....[1]

(b) Explain why the temperature rise from -2°C to 0°C is faster than that from 0°C to 2°C.

.....

.....

.....[2]

6. The speed of water waves depends on their wavelengths and the depths of water.

(a) Table 6 below gives the speed of water waves in metres per second for various wavelengths and for 4 different depths of water.

Depth / m	Wavelength / m					
	0.001	0.01	0.1	1	10	100
0.1	0.67	0.25	0.40	0.93	0.99	0.99
1	0.67	0.25	0.40	1.25	2.95	3.13
10	0.67	0.25	0.40	1.25	3.95	9.33
100	0.67	0.25	0.40	1.25	3.95	12.5

Table 6

(i) Describe in general terms, how speed varies with the wavelength, for a depth of 10 m.

.....

..... [1]

(ii) What is the frequency of a wave of wavelength 10 m at a depth of 1m?

Frequency = ... [2]

(b) A straight dipper is used in a glass tank to produce waves on one side of the tank. Wave fronts are seen to travel from one side of the tank to the other side. Describe and explain how a ping pong ball can be used to determine whether the waves are transverse waves.

.....

.....

.....

.....

..... [2]

(a) The refractive index of oil is more than the refractive index of water.

(i) What can you deduce about the speed of light in water compared to the speed of light in oil?

.....

..... [1]

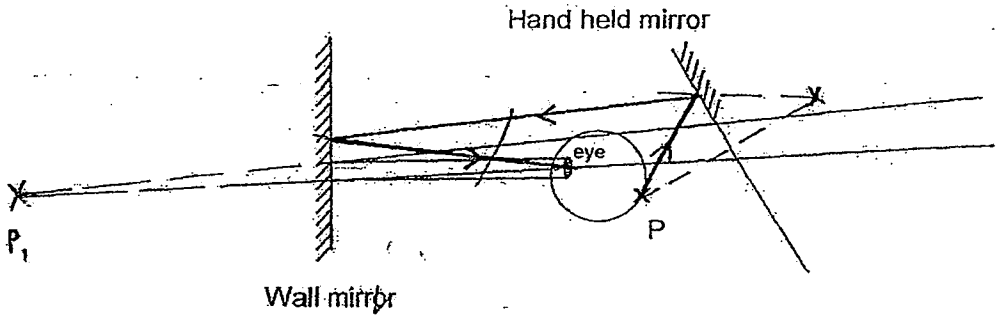
(ii) What can you deduce about the possible path(s) of a light ray when it passes from oil to water at an angle of incidence more than zero?

.....

.....

..... [2]

(b) Before going to school, Jane likes to check her attire with a wall mirror and a hand held mirror. The hand held mirror is tilted to make an angle with the wall mirror to view spot P, at the back of Jane's head. The plan (top) view is shown in the figure below.



By drawing appropriate light rays on the diagram, determine if Jane could see the image of spot P in the wall mirror.

..... [2]

8. (a) A hammer is used to strike one end of a 1.0 km long hollow metal pipe. A data logger connected with a sensitive sound detector at the other end registers two sounds at an interval of 2.7 s between them. (Take speed of sound in air = 330 m/s)

Explain why there are two sounds registered at an interval of 2.7 s apart?

.....

.....

(ii) Calculate the time taken for sound to travel 1 km in air.

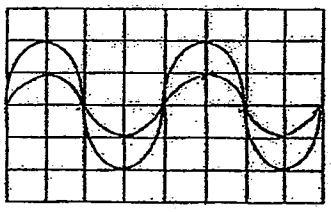
time taken = ... [1]

(iii) Hence calculate the speed of sound in the metal pipe.

speed of sound in metal pipe = ... [2]

(b) The hammer is then used to hit the pipe again. Fig. 8.1 shows the waveform that is registered by the data logger. The waveform represents the sound in the metal pipe.

Fig 8.1



On Fig 8.1, draw a new waveform to represent the new sound wave that is formed when the hammer is now hitting the pipe with a smaller force. [1]

9. (a) Three hollow copper spheres are placed near each other in air. The large sphere C carries a positive charge and the two small spheres A and B touch each other, as shown in Fig. 9.1 below.

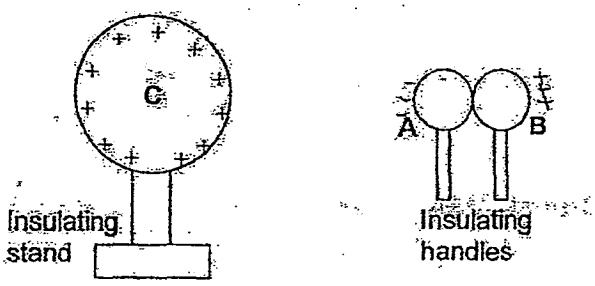


Fig. 9.1

(i) Describe the movement of charges that occur in A and B when both are brought close to but not touching Sphere C.

.....

.....

..... [2]

(ii) Sphere B is then brought near to the large positively-charged sphere C, using the insulated handle, and allowed to touch momentarily before being taken away.

State and explain what happens to the charge on sphere B.

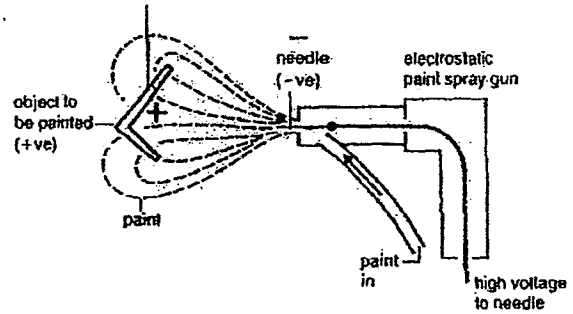
.....

.....

..... [2]

(b) Fig 9.2 shows paint spraying using an electrostatic spray gun.

Fig. 9.2



State 2 advantages of using this type of electrostatic spray gun.

.....

.....

..... [2]

10. Figure 10.1 shows a square coil rotating about an axis at right angles to a uniform magnetic field. A voltage V is induced in the coil as it rotates. The size of the angle between the PQ of the coil and the reference line is represented by θ.

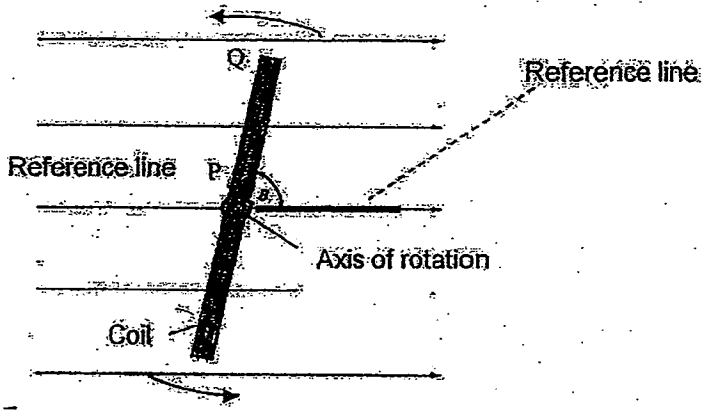


Fig 10.1

(a) State a value of θ for which V is zero.

.....

(b) Explain why V is zero for the value of θ stated in (ai)

.....

..... [1]

(c) On Figure 10.2, sketch a graph relating V and θ for one complete revolution of the coil.

[2]

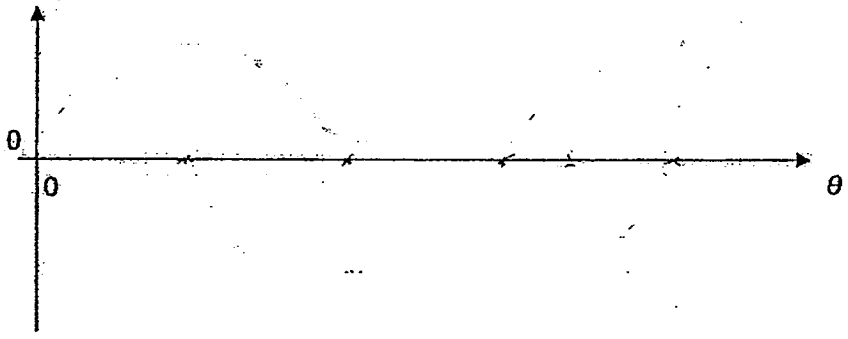


Fig. 10.2

SECTION B [30 marks]

Answer all the questions in this section.
Answer only one of the two alternative questions in Question 13.

11. Fig. 11.1 shows three cups A, B and C.

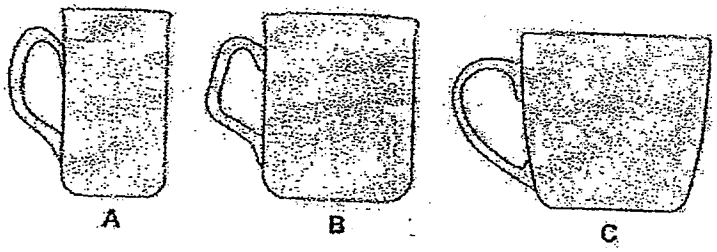


Fig.11.1

Energy is transferred from hot water in the cups to the surroundings.
Some students investigated how the rate of cooling of water in a cup depends on the surface area of the water in contact with the air.
They used cups A, B and C. They poured the same volume of hot water into each cup and recorded the temperature of the water at regular time intervals.
The results are shown on the graph in Fig. 11.2.

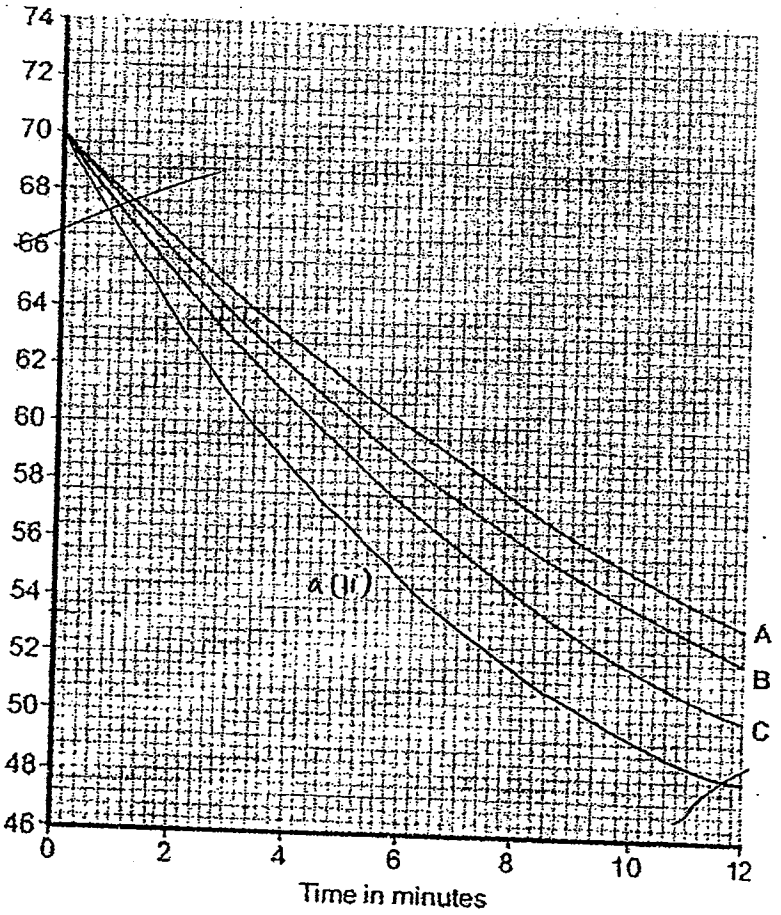


Fig. 11.2

(a) (i) Which cup, **A**, **B** or **C**, has the greatest rate of cooling?

Using the graph, give a reason for your answer.

.....

.....

.....[1]

(ii) The investigation was repeated using the bowl shown in Fig. 11.3. The same starting temperature and volume of water were used.

Fig. 11.3

Draw on the graph in part (a) another line to show the expected result. [2]

(iii) After 4 hours, the temperature of the water in each of the cups and the bowl was 20°C. Suggest why the temperature does not fall below 20°C.

.....

.....[1]

(b) (i) The mass of water in each cup is 200 g. Calculate the energy, in joules, transferred from the water in a cup when the temperature of the water falls by 8.0°C.
Specific heat capacity of water = 4200 J/kg°C.

Energy = ...[2]

(ii) Explain, using the kinetic theory, how evaporation causes the cooling of water.

.....

.....

.....

.....

.....[3]

12(a) Fig. 12.1 below shows an ideal transformer with two primary coils A and B and a secondary coil C. There are 1200 turns in each of coils A and B. The secondary coil C is connected to a lamp rated at 12 V, 36 W.

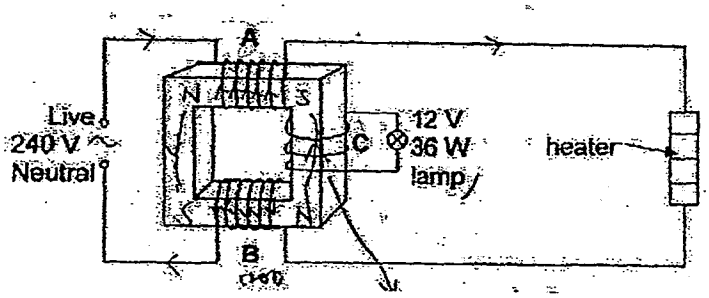


Fig. 12.1

(i) Explain how the potential difference across the lamp is set up.

.....

.....

.....

.....

.....

.....[2]

(ii) State the potential difference across the heater.

.....[1]

(iii) Determine the number of turns in the secondary coil C in order to light up the lamp normally.

Number of turns = ... [2]

(iv) State what will happen to the lamp if the direction of the winding of coil A is reversed. Explain your answer.

.....

.....

.....

.....[2]

(b) Fig 12.2 shows a magnetic relay which is used to switch on a motor labelled M.

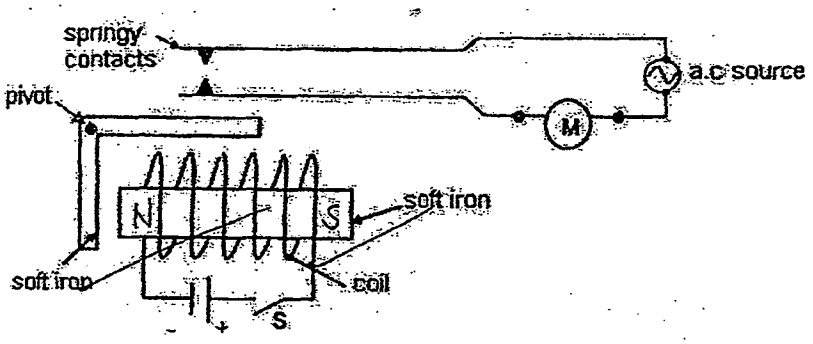


Fig. 12.2

(i) On Fig 12.2, label the polarities of the soft iron within the coil when switch S is closed. [1]

(ii) Describe how the relay switches on motor M.

.....

.....

.....

.....

.....

.....[2]

13. EITHER

A large crane has a mass of 8500 kg. Fig. 13.1 shows the crane on a muddy building-site.

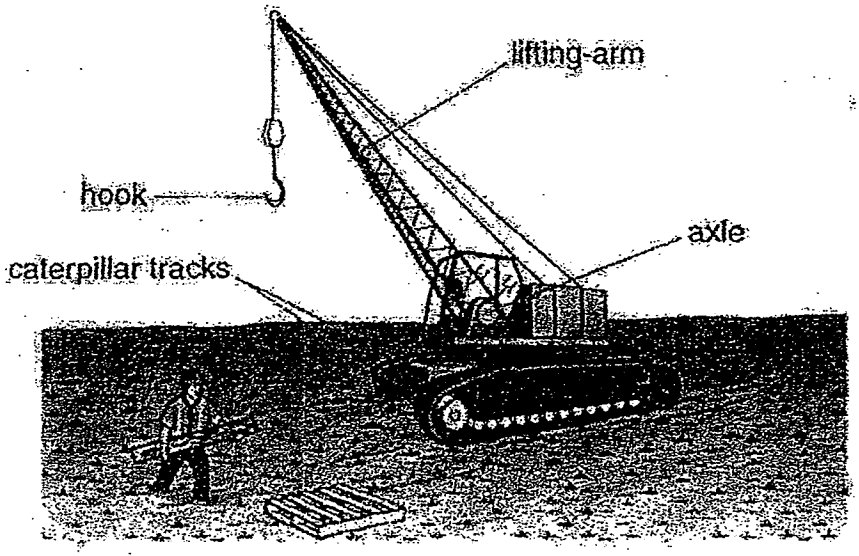


Fig. 13.1

(a) Calculate the weight of the crane.

weight = ... [1]

(b) The crane rests on two caterpillar tracks each of which has a contact area with the ground of 3.4 m^2.

(i) Calculate the pressure that the crane exerts on the ground.

pressure = ... [2]

(ii) As the crane driver walks towards the crane, he starts to sink into the mud. He lays a wide plank of wood on the mud and he walks along the plank.

Explain why he does not sink into the mud when he walks along the plank.

.....

.....

..... [2]

(c) When the crane lifts a heavy load with its hook, the load exerts a moment on the lifting-arm about the axle.

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

.....

.....[1]

(ii) Despite the moment exerted on the lifting-arm, the crane remains in equilibrium. This illustrates the principle of moment at work.

Describe an experiment to demonstrate the principle of moments.

In your account,

- draw a diagram of the apparatus,
- describe the procedure to be taken.

[4]

13. OR

(a) Fig 13.1 shows the inside of a mains-operated hair dryer. The fan can either blow hot or cold air. Fig 13.2 is a circuit diagram of the same dryer, showing how it is wired up for use.

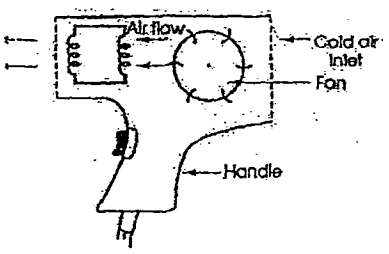


Fig 13.1

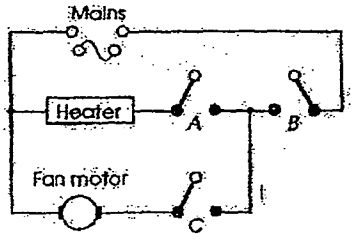


Fig 13.2

(i) Show, by placing ticks in the table below, which switches need to be closed to get the results shown [1]

Result	Switch A	Switch B	Switch C
A blow of hot air			
A blow of cold air			

(ii) Explain why the hair dryer is normally wired to a two-pin plug rather than a three-pin plug.

.....

.....

.....

.....

..... [2]

(iii) Explain clearly what you would expect to happen if the heater was on, and the fan failed to work.

.....

.....

.....

.....

..... [2]

(b) (i) Sketch a resistance against temperature graph to show how the resistance of a metallic conductor varies with increasing temperature. [1]

(ii) Explain why Ohm's law does not apply to this metallic conductor.

.....

..... [1]

(c) Fig 13.3 shows PQ, part of a circuit connected to an ammeter of resistance 5.0 Ω. The ammeter is able to measure a maximum current of 1A. The fuse has a rating of 3A.

Fig. 13.3

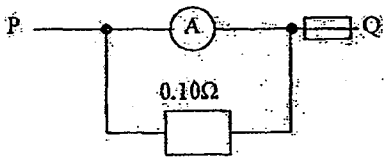


Fig. 13.4

A resistor of resistance 0.10 Ω is now connected across the ammeter terminals as shown in Figure 13.4.

Explain clearly (with appropriate calculations) why the fuse will blow even though the ammeter is showing a reading of 0.60 A.

.....

.....

..... [3]

End of Paper

☺☺

ANGLICAN HIGH.

Sec. 4 Physics Preliminary Examination 2014

Suggested Answers

Paper 1

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

Paper 2 - SECTION A

1(a)(i) acceleration ,$a = \frac{v-u}{t} = \frac{6-0}{5} = 1.2\ m/s^2$

resultant force needed = ma = 80 x 1.2 = 96 N

1(a)(ii) distance travelled = ½ x 9 x (40 - 30) = 45 m

1(b)(i) C

1(b)(ii) The forces in C are equal in magnitude and opposite in direction. Resultant force is zero, hence there is zero acceleration.

2(a) K.E. = ½mv^2 = ½ x 15000x 12^2 = 1080000J

2(b) - KE of the wind more than doubles
- mass of the air hitting the blades more than doubles
- area swept out by the blades more than doubles (increases by 4).
(Any one reason)

2(c) Some energy is converted to sound and thermal energy when the belt/motor heats up due to friction.
Total energy remains the same as kinetic energy of the wind has been converted to electrical energy as well as to sound and thermal energy.

2(d) - Less pollution OR Reduced carbon emissions (compared to fossil fuels).

2(e) - the output expected from the wind turbine
- whether location has suitable amount of wind
- cost of installing the wind turbine - whether the noise will affect the neighbours.
(Any one factor)

3(a) Density of a substance is defined as its mass per unit volume.

3(b)(i) Let x be the mass of gold in grams. Mass of copper = 87.0 – x

total volume of bracelet = $5.9 = \frac{x}{19.3} + \frac{(87-x)}{8.92}$

mass of the gold, x = 63.9 g

OR : Let y be volume of gold. Volume of copper = 5.9 - y

mass of bracelet = 87

$= 19.3y + 8.92(5.9 - y)$

volume of gold = 3.31 g

mass of gold = d x v = 19.3 x 3.31 = 63.9 g

3(b)(ii) % of gold = $\frac{63.9}{87} \times 100 = 73.4\%$

4(a) The water molecules near the immersion heater gain energy, becomes less dense and rises to the top. The colder, denser water at the top sinks and in turn gets heated up by the heater. The cycle repeats.

4(b) Conduction

5(a) A mixture of solid and liquid OR mixture of ice and water.

5(b) Specific heat capacity of ice is lesser than that of water.
Hence less energy is needed by the ice for the same temperature change.

6ai) In general, speed increases as wavelength increases.

6aii) Use the equation $v = f\lambda$ (speed = frequency x wavelength)

$f = v / \lambda$ (frequency = speed/wavelength)

$= 2.95/1$

$= 0.295$ Hz or 2.95×10^{-2} Hz

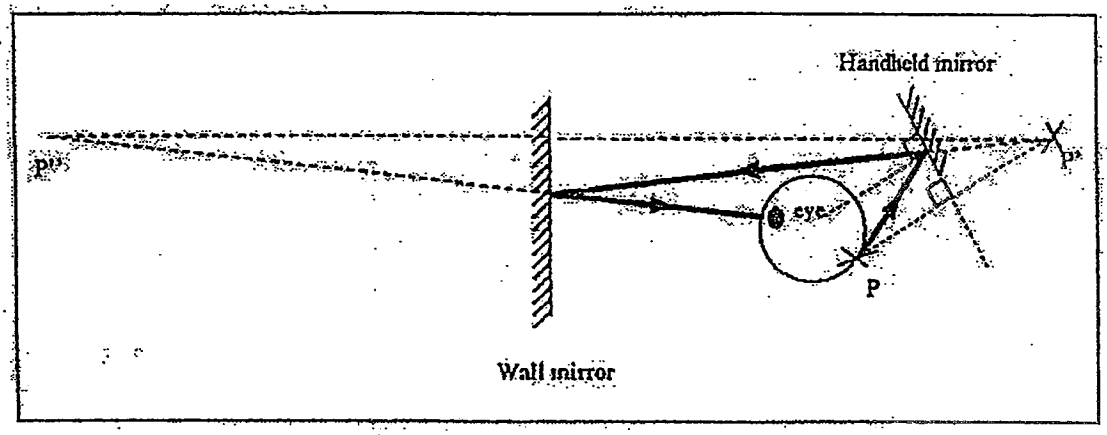
6b) Place the ping pong ball in the water and observe its motion.
The ping pong ball should bob up and down at the same location.
This shows that the water molecules/particles are not moving along with the waves but only oscillates in a direction that is perpendicular to the wave direction.

7ai) The speed of light in oil is less than the speed of light in water.
OR
The speed of light in water is greater than the speed of light in oil.

7aii) (Any Two of the following)
- When the angle of incidence is not zero but is less than the critical angle, the light rays will bend away from the normal after passing through oil.

- When the angle of incidence is greater than the critical angle, total internal reflection will take place.
- When the angle of incidence is equal to the critical angle, the ray will emerge at the boundary between the two liquids.

7b) Correct position of P' and P" , correct rays with arrows ; statement: She is able to see P.



8ai) Sound travels with different speeds in air and metal.
OR
One sound is transmitted through air while the other is transmitted through the metal pipe.

8aii) Time taken by sound in air = distance / speed
= 1000 / 330
= 3.0s (2 sf) OR 3.03 s (3 sf)

8aii) Time taken through metal pipe = 3.0 - 2.7 OR 3.03 - 2.7
= 0.3 or 0.33 s
Speed = distance/time
= 1000/0.3 OR 1000/0.33
= 3300 m/s (2 sf) OR 3030 m/s (3 sf)

8b) Same period/frequency AND smaller amplitude

9ai) Electrons in A and B move to the left hand side of sphere A leaving positive charges on right hand side of sphere B. (Note: Only electrons move; Protons do not move)

9aii) B becomes more positively charged.
Electrons move from B to C because C has a higher potential/C is more positive/C contains more positive charges. OR Charge redistribution occurs.

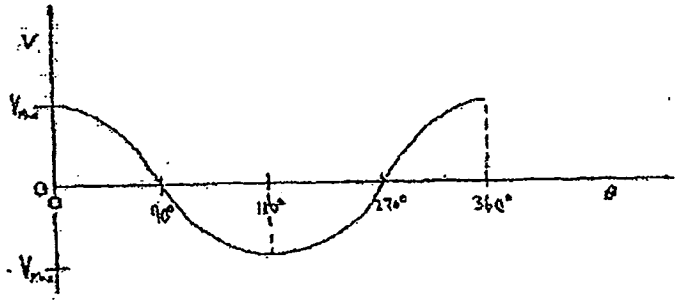
9b) Any of the two of the following:
Object will be painted evenly / even coat of paint

Paint droplets are attracted to all parts of the object / able to paint hard to reach areas.
Save on paint/more economical/more cost effective / all the paint droplets would stick to the object and there will be minimal wastage.

10 a) 90°

10b) Any of the following:
There is no change in the magnetic flux (linkage).
There is no change in the number of magnetic field lines cut by the coil.
There is no cutting of magnetic field lines by the coil.
The rate of change of magnetic flux (linkage) is zero.

10c)



SECTION B

11(a)(i) Cup C. It has the greatest decrease in temperature over the same period of time.

11(a)(ii) To be drawn on the graph :
A line similar to C starting at 70°C but with a steeper slope and with a temperature lower than 50°C at 12 min.

11(a)(iii) Because 20°C is at room temperature **OR** at 20°C, the water and the surroundings have reached thermal equilibrium.

11(b)(i) $Q = mc\Delta\theta$

$$= \frac{200}{1000} \times 4200 \times 8 = 6720 \text{ J}$$

11(b)(ii) Water molecules move continuously at different speeds.
The fastest moving molecules have enough kinetic energy to escape from the attraction of their neighbours and leave the surface of the liquid.
Therefore the mean / average kinetic energy of the remaining molecules decrease.
The lower the mean / average kinetic energy, the lower the temperature of the water.

12ai) The a.c. source produces a continuously changing magnetic flux in coils A and B. This continuously changing magnetic flux cuts coil C continuously. Hence an e.m.f. is induced in coil C across the lamp.

12aii) 240 V

12aiii) $V_s/V_p = N_s/N_p$ ===> $12/240 = N_s/1200 \times 2$

$N_s = 120$ turns

12aiv) The lamp would not light up as the number of turns in coil A and B are the same. The direction of the induced magnetic flux of coil A and B will be opposite and thus there is no net flux change linkage at coil C.

12bi) N [redacted] S

12bii) When switch is closed, the electromagnet gets magnetized by the current flowing through it and attracts the soft iron lever.
The soft iron lever rotates about its pivot and pushes the springy contacts together, closing the circuit and starting the motor.

13. EITHER

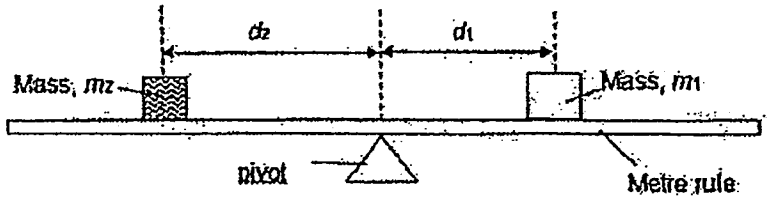
13(a) Weight = mg = 8500 x 10 = 85000 N

13(b)(i) Pressure = $\frac{F}{A} = \frac{85000}{3.4 \times 2} = 12\,5000\ N/m^2$

13(b)(ii) The plank has a greater surface area. The force acting per unit area is now lesser.

13(c)(i) The moment of a force is the product of the force and the perpendicular distance from the pivot to the line of action of the force.

13(c)(ii) Labelled diagram :



Procedure :

- Set up the apparatus as shown.
- Balance the metre rule at its centre of gravity.
- Place mass m_1 at a certain distance from the pivot on one side of the metre rule. Record distance d_1.
- Place another mass m_2 on the opposite side of the pivot to balance the metre rule. Record distance d_2.
- Repeat with different values of masses m_2 to obtain a total of 5 sets of readings of m_1, d_1 and m_2, d_2.
- For each set of readings, $m_1d_1 = m_2d_2$.

13. OR

13ai)

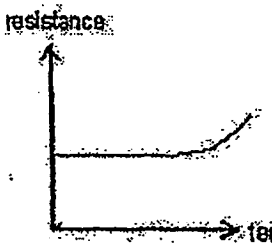
Result	Switch A	Switch B	Switch C
A blow of hot air	√	√	√
A blow of cold air		√	√

13aii) The live components inside a hair dryer are carefully shielded and isolated from the user by means of double insulation.
Hence, the assessable metal parts cannot become live unless the two independent layers of insulation fail at the same time.

OR
The outer casing of the hair dryer is made of insulator
There is no danger of the casing becoming live.

13aiii) The heat generated by the heater would not be effectively removed.
This may cause the exterior cover of the dryer to melt.

13bi)



13bii) Ohm's Law only applies to metallic conductors at constant temperature.

13c) pd across ammeter = IR = 0.6 x 5.0 = 3V
total current through PQ = $V/R_{eff} = 3/(1/5.0 + 1/0.10)^{-1} = 30.6A$

OR
From V= IR, I is proportional to 1/R
$I_{new} / I_{old} = R_{old} / R_{new}$
$I_{new} = (5.0/ (1/5.0 + 1/0.10)^{-1}) \times 0.6$
$= 30.6A$

The ammeter is only reading part of the current that flows through PQ.
The total current flowing through the resistor is greater than 3A, hence it will blow.