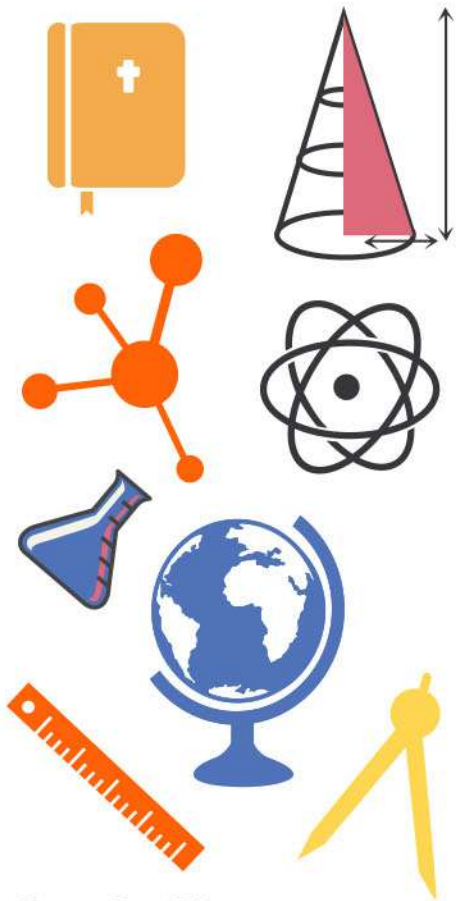


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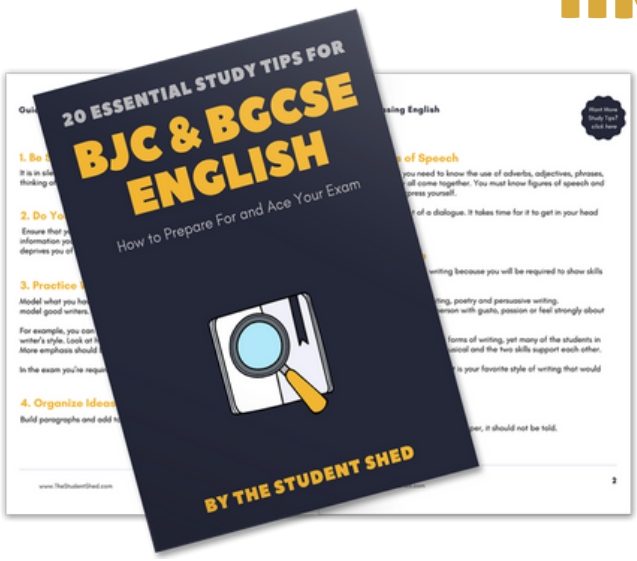


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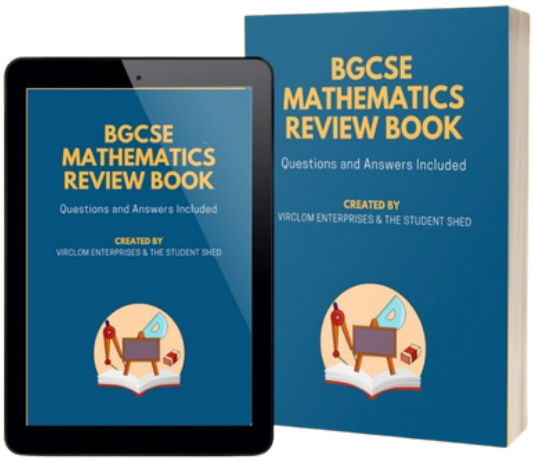


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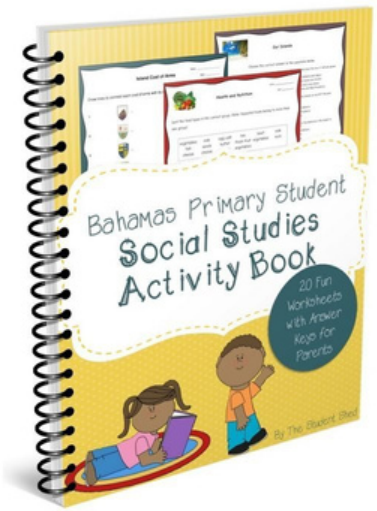


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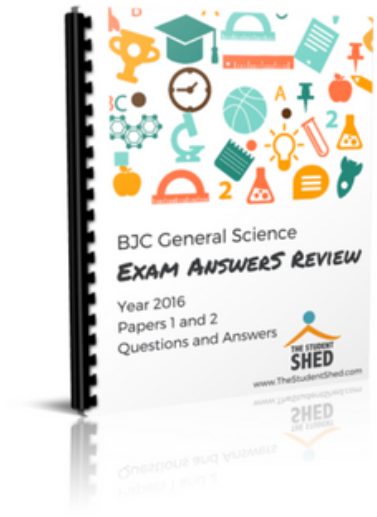


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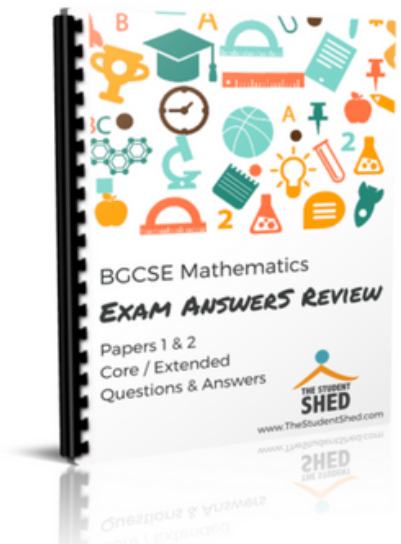


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3117/1 **BGCSE**

| School Number | Candidate Number |
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| Surname and Initials | |

# PHYSICS

**PAPER 1 3117/1**

**Thursday 26 MAY 2016 12:00 NOON–1:15 P.M.**

**Additional materials:**
**None**

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**BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION**

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

**All answers are to be recorded in this booklet.**

Write your school number, candidate number, surname and initials in the spaces provided above.

Answer as many questions as you can. For each question, four possible answers, A, B, C, and D are given.

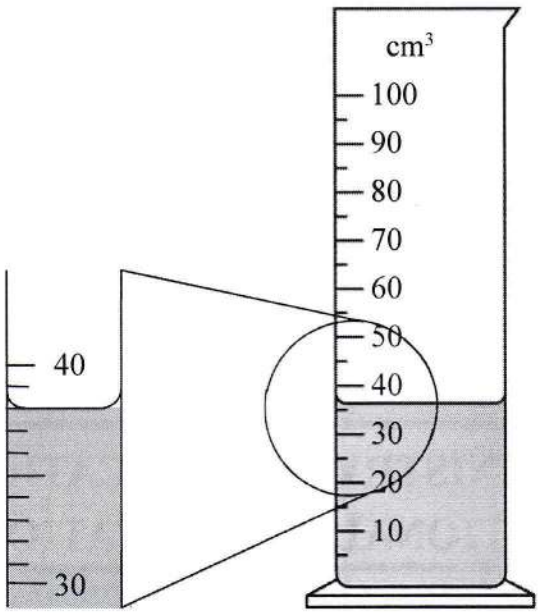
**Circle the letter by the response which you consider to be correct.**

Rough work paper should not be handed in.

| For Examiner's Use | |
|---|---|
| TOTAL | |

**This question paper consists of 19 printed pages and 1 blank page.**

1. A measuring cylinder is used to measure the volume of water collected during an experiment.




What is the volume of water collected?

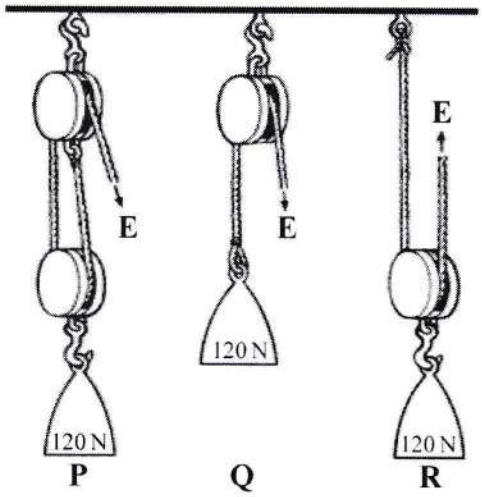
A. 35.0 $cm^3$
B. 36.0 $cm^3$
C. 38.0 $cm^3$
D. 39.0 $cm^3$

2. The table shows physical quantities and units commonly used in Physics.

Which row of the table shows a physical quantity matched with its SI unit?

| | **physical quantity** | **unit** |
|---|---|---|
| A. | mass | kilogram |
| B. | power | joule |
| C. | pressure | newton |
| D. | time | minutes |

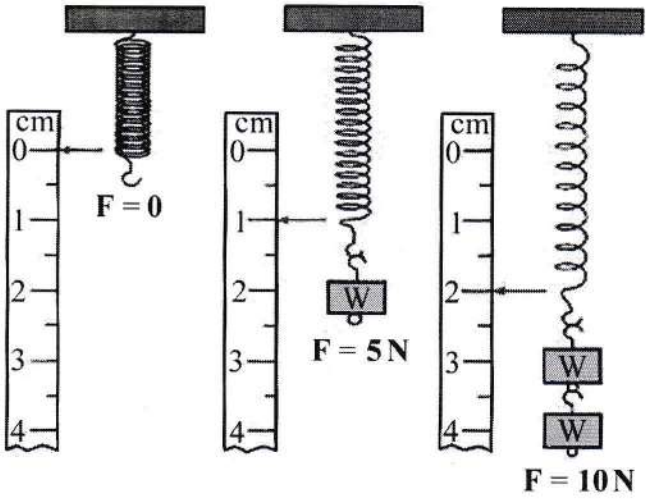
3. Three pulleys **P**, **Q** and **R** were used to lift 120 N loads.




Which pulley arrangement would require an effort of 120 N to lift the 120 N load? The weights of the pulleys are negligible.

A. **P** and **Q**
B. **P** and **R**
C. **Q** and **R**
D. **P**, **Q** and **R**

4. Forces are hung from a spiral spring in an experiment to investigate the effect of forces on extension. The spring used in the practical had an original length of 7 cm.




What is the total length of the spring when a force of 25 N is suspended from it?

A. 5.0 cm
B. 10.0 cm
C. 12.0 cm
D. 18.0 cm

5. A lunar rock weighs 24 N on the moon, where gravity is one-sixth of that on Earth.

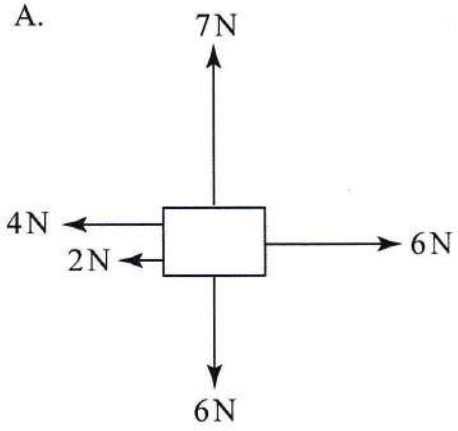
What would be the mass of the lunar rock, given that gravity on the surface of the Earth is 10 N/kg?

A. 2.4 kg
B. 4.0 kg
C. 14.4 kg
D. 24.0 kg

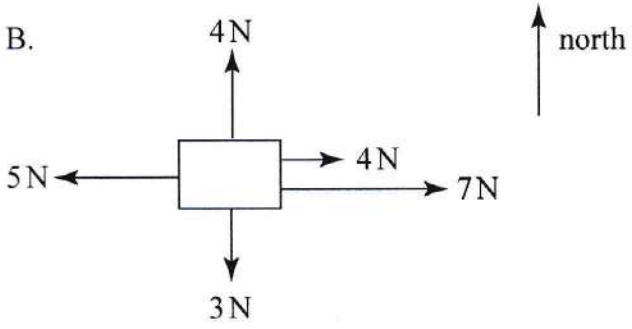
6. Force diagrams A, B, C and D (not drawn to scale) represent the forces acting on four objects.

What force diagram shows a net force of 1 N, in the direction of north, acting on the object?

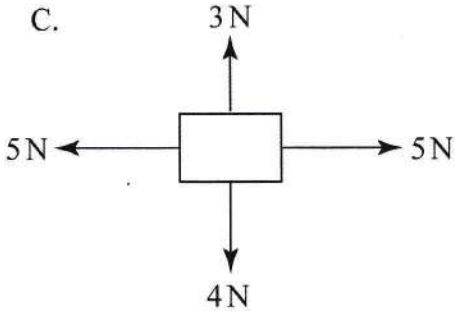
A.



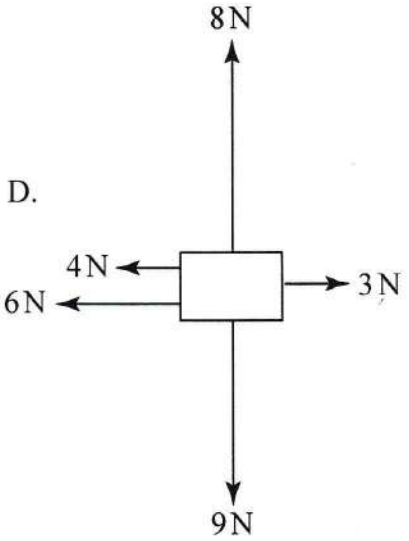

B.



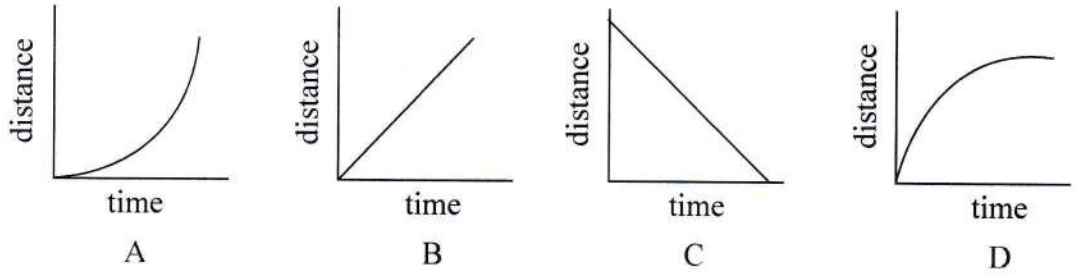

C.



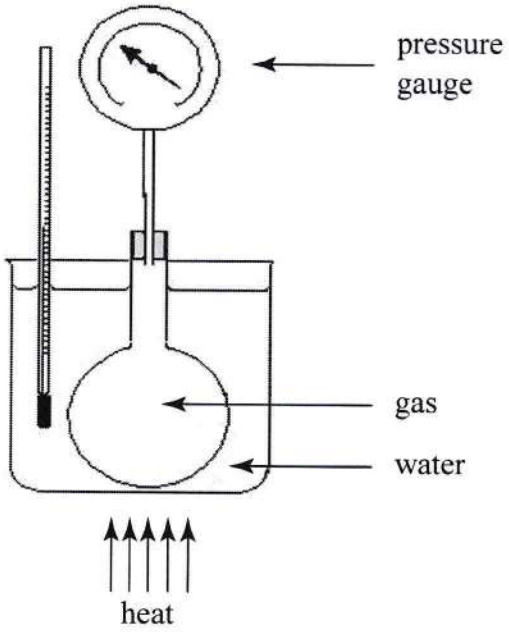

D.



7. Which graph best represents the motion of an object with decreasing speed?




8. The apparatus was used to investigate the behaviour of a fixed mass of gas, whose volume remained constant when heated.




Which row in the table correctly shows what happens as the gas is heated?

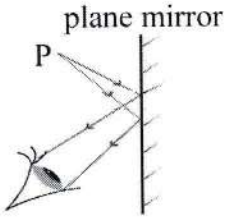
| | **kinetic energy of gas particles** | **pressure of gas** | **density of gas** |
|---|---|---|---|
| A. | remains the same | increases | increases |
| B. | increases | remains the same | increases |
| C. | increases | increases | remains the same |
| D. | remains the same | remains the same | remains the same |

9. An announcer's voice is heard by a spectator in a stadium bleacher 6 s after an announcement is made, then as an echo 4 s later. The speed of sound in air is 340 m/s.

What distance did the sound wave travel in producing the echo?

A. 680 m
B. 1 360 m
C. 2 040 m
D. 3 400 m

10. The letter P is placed a distance of 4 cm in front of a plane mirror.




Which row in the table gives the properties of the image formed?

| | **type of image** | **orientation of image** |
|---|---|---|
| A. | real | inverted |
| B. | virtual | laterally inverted |
| C. | real | laterally inverted |
| D. | virtual | inverted |

11. The pull of the engine of a jet ski is 3 000 N, when 1 200 N of drag acts against it. The jet ski has a mass 300 kg.

What is its rate of acceleration?

A. 4 m/s$^2$
B. 6 m/s$^2$
C. 10 m/s$^2$
D. 14 m/s$^2$

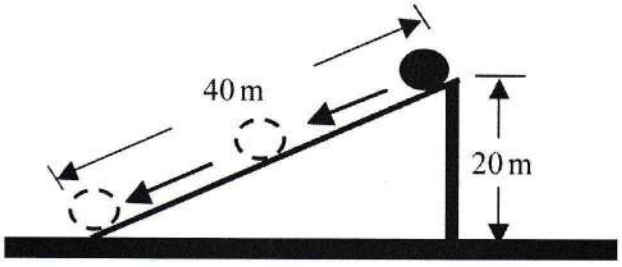
12. Which device converts electrical energy into kinetic energy?

A. battery
B. generator
C. motor
D. transformer

13. Which of the following is a scalar quantity?

A. acceleration
B. displacement
C. speed
D. velocity

14. A ball of mass 2 kg starts from rest and slides down a frictionless slope, under the influence of gravity (gravity = 10 N/kg or 10 m/s$^2$).

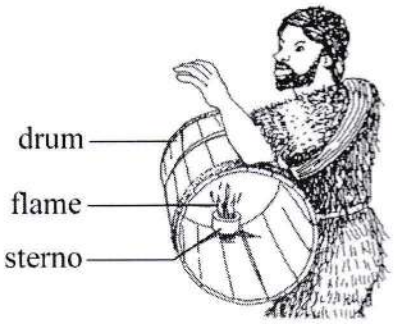



How much kinetic energy does the ball have at a height of 10 m, when it is midway down the slope?

A. 20 J
B. 40 J
C. 200 J
D. 400 J

15. A junkanoo drummer places a lit sterno in his drum.

What is the main method of heat transfer taking place within the drum?




A. conduction
B. convection
C. evaporation
D. radiation

16. Which process describes the random, haphazard movement of minute particles, suspended in a fluid, due to collisions with molecules of the surrounding fluid?

A. Brownian motion
B. diffusion
C. diffraction
D. wave motion

17. Which combination of colours might produce white light?

A. cyan and green
B. cyan and blue
C. magenta and blue
D. yellow and blue

18. A student investigates the behaviour of water when it changes state. She melts 20 g of ice at 0 °C and then gradually warms it to 3 °C.

Which row in the table describes the properties of water, as the ice melts and is warmed to 3 °C?

| | **mass** | **volume** | **density** |
|---|---|---|---|
| A. | decreases | remains same | decreases |
| B. | increases | decreases | same |
| C. | remains same | decreases | increases |
| D. | remains same | increases | decreases |

19. When cooking grits, salt is commonly added.

How does the addition of salt affect the boiling point of the water and the time taken for cooking grits?

| | **boiling point** | **cooking time** |
|---|---|---|
| A. | decreases | decreases |
| B. | decreases | increases |
| C. | increases | decreases |
| D. | increases | increases |

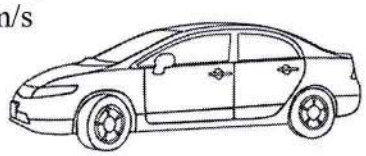
20. Which three members of the electromagnetic spectrum are commonly used for communications?

A. gamma rays; x-rays; radio-waves
B. infrared; x-rays; radio-waves
C. infrared; ultra-violet; radio-waves
D. microwaves; radio-waves; visible light

21. Which vehicle has the greatest momentum?

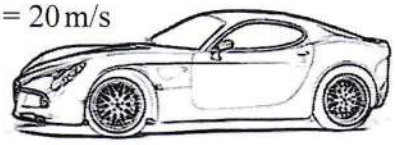
A

m = 500 kg
v = 30 m/s



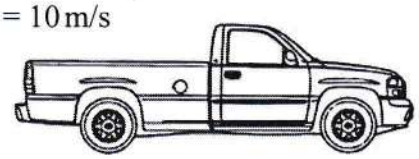
B

m = 600 kg
v = 20 m/s



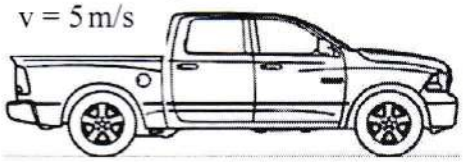
C

m = 2 000 kg
v = 10 m/s

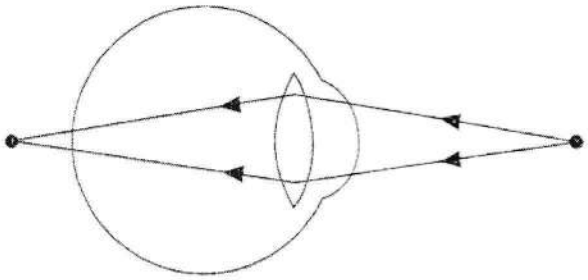


D

m = 5 000 kg
v = 5 m/s



22. A common eye defect is shown in the diagram.



Which row shows the eye defect and its corrective lens?

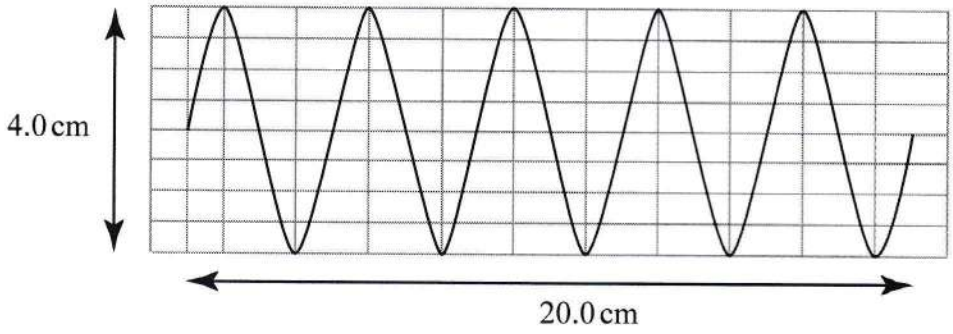
| | **eye defect** | **corrective lens** |
|---|---|---|
| A. | far-sightedness | concave |
| B. | far-sightedness | convex |
| C. | near-sightedness | concave |
| D. | near-sightedness | convex |

23. The Bahamas Telecommunications Corporation transmits telephone signals using fibre optic cables.

Which property of light is used in the technology?

A. diffraction
B. refraction
C. scattering
D. total internal reflection

24. A student draws the image of a wave as shown.




Which row shows the amplitude and wavelength?

| | **amplitude** | **wavelength** |
|---|---|---|
| A. | 2.0 cm | 2.0 cm |
| B. | 2.0 cm | 4.0 cm |
| C. | 4.0 cm | 2.0 cm |
| D. | 4.0 cm | 4.0 cm |

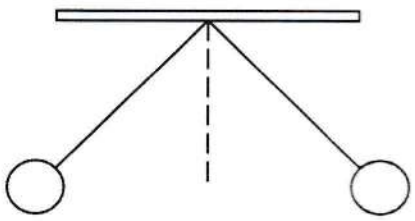
25. Which of the following combinations of magnetic materials, properties and application is correct?

| | **material** | **magnetically hard** | **application** |
|---|---|---|---|
| A. | steel | no | electromagnetic core |
| B. | iron | no | permanent magnet |
| C. | steel | yes | fuse |
| D. | iron | no | transformer |

26. Which line in the table identifies a sound wave?

| | type of wave | origin of wave |
|---|---|---|
| A. | longitudinal | electromagnetic |
| B. | longitudinal | vibrations |
| C. | transverse | electromagnetic |
| D. | transverse | vibrations |

27. Two identical conducting balls, suspended on nylon threads, come to rest with the threads making equal angles with the vertical (broken line), as shown in the diagram.



What does this indicate?

A. the balls both carry the same type of charge
B. the balls are uncharged
C. the balls are equally and oppositely charged
D. one ball is charged and the other is uncharged

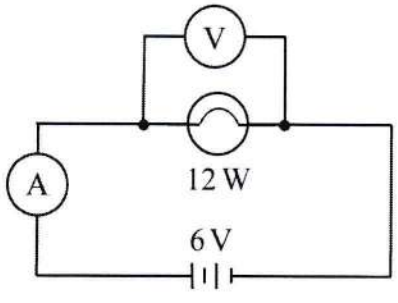
28. Which of the following substances is used for domestic electric conductors?

A. copper
B. plastic
C. PVC
D. rubber

29. Which one of the following methods can demagnetise a magnet?

A. freezing the magnet
B. heating the magnet strongly
C. immersing the magnet in cold water
D. stroking a steel bar with the magnet

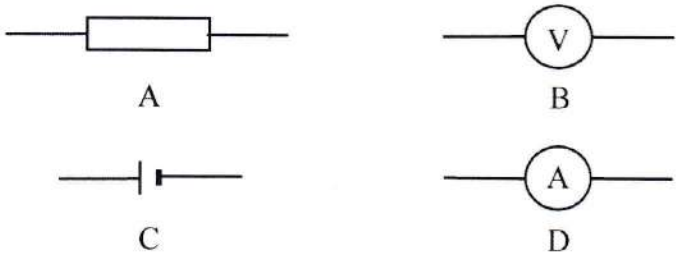
30. The diagram shows a 6 V, 12 W lamp connected to a 6 V battery, an ammeter and a voltmeter.



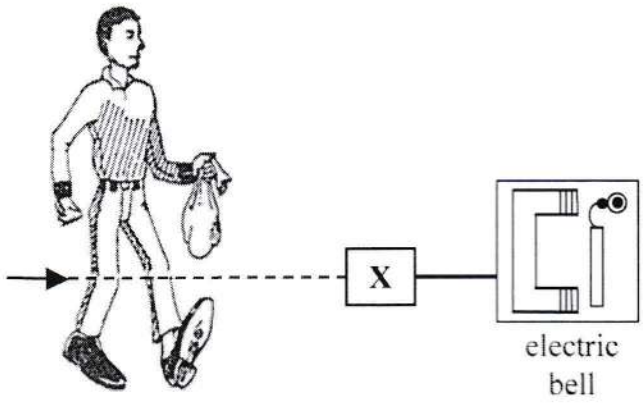

What is the reading on the ammeter?

A. 0.5 A
B. 2.0 A
C. 6.0 A
D. 72.0 A

31. Which symbol represents a source of energy for electrons?



32. The diagram shows a burglar alarm system consisting of component **X**, a light beam and an electric bell.

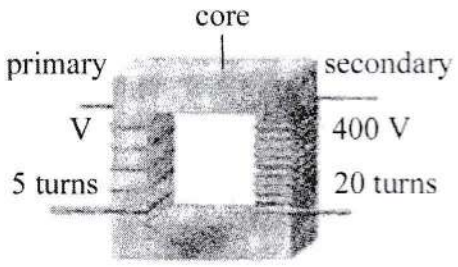



The alarm bell rings when a burglar cuts off the beam of light to component **X**.

What is component **X**?

A. a light emitting diode
B. a light-dependent resistor
C. a diode
D. a thermistor

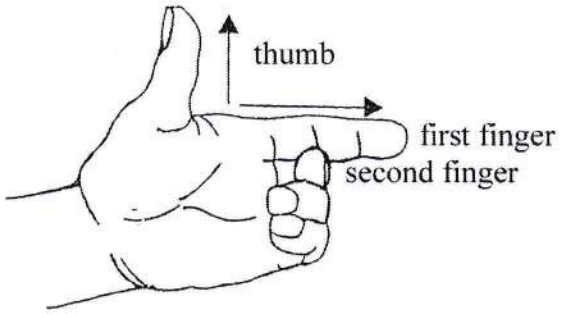
33. The diagram shows an ideal transformer with an output voltage of 400 V. The primary coil has 5 turns and the secondary coil has 20 turns.




What is the potential difference across the primary coil of the transformer?

A. 4 V
B. 80 V
C. 100 V
D. 1 600 V

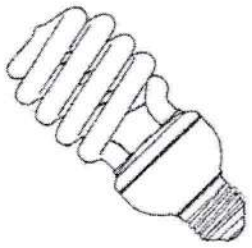
34. The diagram shows Fleming's Left Hand Rule.




Which is the correct statement for directions according to the rule?

| | **thumb** | **first finger** | **second finger** |
|---|---|---|---|
| A. | current | force/motion | magnetic field |
| B. | force/motion | magnetic field | current |
| C. | force/motion | current | magnetic field |
| D. | magnetic field | current | force/motion |

35. A 100 W lamp is replaced with a 15 W compact fluorescent lamp to save energy. The cost of 1 kWh of electricity is 20 cents.



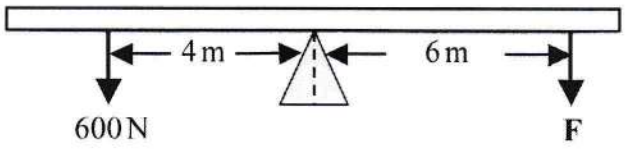
How much money is saved after 300 hours of use?

A. $ 0.90
B. $ 5.10
C. $ 6.00
D. $ 6.90

39. Which of the following requires an electromagnet to work?

A. air conditioner
B. burglar alarm
C. refrigerator
D. water heater

40. A uniform see-saw is balanced at its midpoint, with forces of 600 N and **F**, placed 4 m and 6 m respectively, from the midpoint, as shown in the diagram.



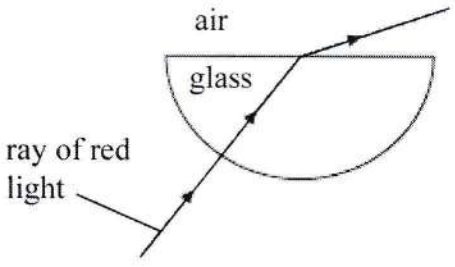

What is the value of **F**?

A. 240 N
B. 400 N
C. 2 400 N
D. 3 600 N

41. Which list of energy sources contains only renewable resources?

A. gas, geothermal, biomass
B. wave, solar, tidal
C. hydroelectric, wave, oil
D. wind, wave, nuclear

42. The diagram shows the path of a ray of red light, as it travels through a glass block.




Why is the ray of light refracted as it travels from glass into air?

A. its amplitude changes
B. its frequency changes
C. its speed changes
D. it changes to white light

43. Which device has a resistance that changes with light intensity?

A. LDR
B. LED
C. thermistor
D. solenoid

44. Which of the following devices utilises thermionic emission?

A. stereo
B. transistor radio
C. television picture tube
D. toaster

45. An astronaut on the Moon can see a spacecraft.
The astronaut sends a microwave signal, a light signal and a radio signal to the spacecraft. The signals all leave at the same time.

In which order will the signals arrive at the spacecraft?

A. radio first, then microwave, then light
B. light first, then microwave, then radio
C. light first, then radio, then microwave
D. they all arrive at the same time

46. Which variable is a scalar quantity?

A. energy
B. force
C. momentum
D. weight

47. The carbon in the body of an animal contains some radioactive carbon-14, which has a half-life of 6 000 years. At the time when any animal dies, each gram of carbon in its body emits about 16 β-particles per minute.

An animal remains are discovered and it is found that 4 β-particles are emitted per minute for each gram of carbon in the remains.

How old are the remains of the animal?

A. 1 500 years
B. 3 000 years
C. 6 000 years
D. 12 000 years

48. What does the nucleus of an atom contain?

A. electrons and neutrons
B. electrons and protons
C. neutrons and protons
D. neutrons only

49. Two nuclides have the symbols

$$^{19}_{9}\mathrm{F} \quad \text{and} \quad ^{39}_{19}\mathrm{K}$$

Which statement is true?

A. a nucleus of K has the same mass number as nucleus of F
B. a nucleus of K has twice as many protons as a nucleus of F
C. a nucleus of K has twice as many neutrons as a nucleus of F
D. a nucleus of K has twice as many electrons as a nucleus of F

50. A radioactive decay can be represented as shown.

$$^{233}_{91}\mathrm{Pa} \longrightarrow ^{233}_{92}\mathrm{U} + \mathrm{X}$$

What does **X** represent in this decay?

A. a neutron
B. a proton
C. an α-particle
D. a β-particle

3117/2 **BGCSE**

| School Number | Candidate Number |
|---|---|
| | |

Surname and Initials

# PHYSICS

**PAPER 2 3117/2**

**Thursday 26 MAY 2016 1:30 P.M.–3:00 P.M.**

**Additional Materials:**
**None**

## MINISTRY OF EDUCATION
## NATIONAL EXAMINATIONS

**BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**INSTRUCTIONS AND INFORMATION TO CANDIDATES**

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

Write your school number, candidate number, surname and initials in the spaces provided above.

Answer **ALL** the questions on this paper.

Read each question carefully and make sure you know what you have been asked to do before starting your answer.

Show **ALL** your working when answering numerical questions. Lines are provided on the question paper for your answers. You should write your answers on these lines only.

The mark for each part question is given in brackets [ ].

**BLANK PAGE**

2. A student investigates the effect of force on extension of a spiral spring.
Fig. 2.1 shows a simplified illustration of the apparatus used in the practical conducted.

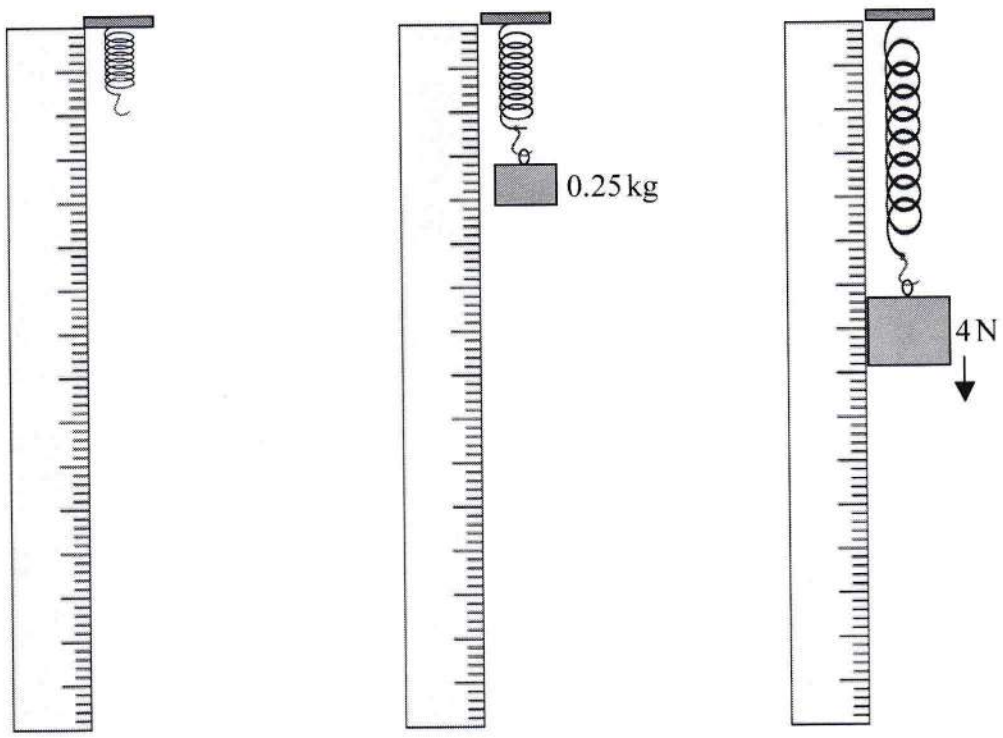



**Fig. 2.1**

(a) The original length of the spiral spring is 8.6 cm. When a 0.25 kg mass is added to the spring, the length of the spring length increases to 12.9 cm.

(i) Determine the weight of the 0.25 kg mass, if the gravitational force is approximately 10 N/kg on the surface of the earth.

[2]

(ii) Find the force constant of the spring used in Newtons per centimetre (N/cm).

[2]

(iii) The student then increases the mass on the spiral spring.

By how much would the spring extend when a force of 4 N acts on it?

[2]

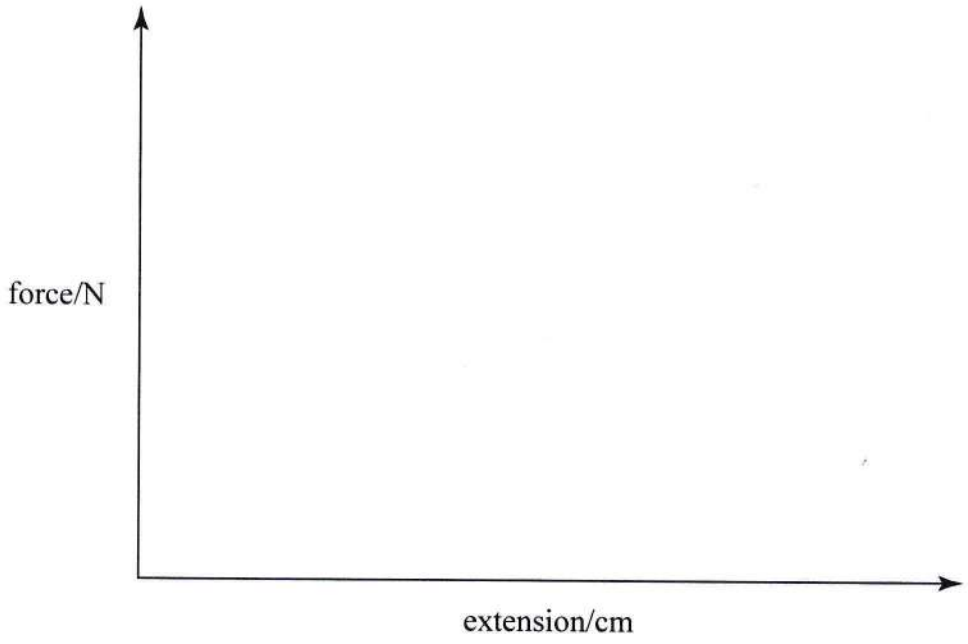
(iv) What is the total length of the spring when the 4 N weight is added to it?

[1]

(v) Find the force required to produce an extension of 18 cm.

[2]

(b) Sketch a force-extension graph for an elastic material that obeys Hooke's Law.




[1]

**TOTAL MARKS [10]**

3. A warehouse owner has to stack 40 identical metal sheets, each of weight 500 N, on a shelf in a storage room. The sheets are grouped together in a single block.
Fig. 3.1 shows the dimensions of the block.

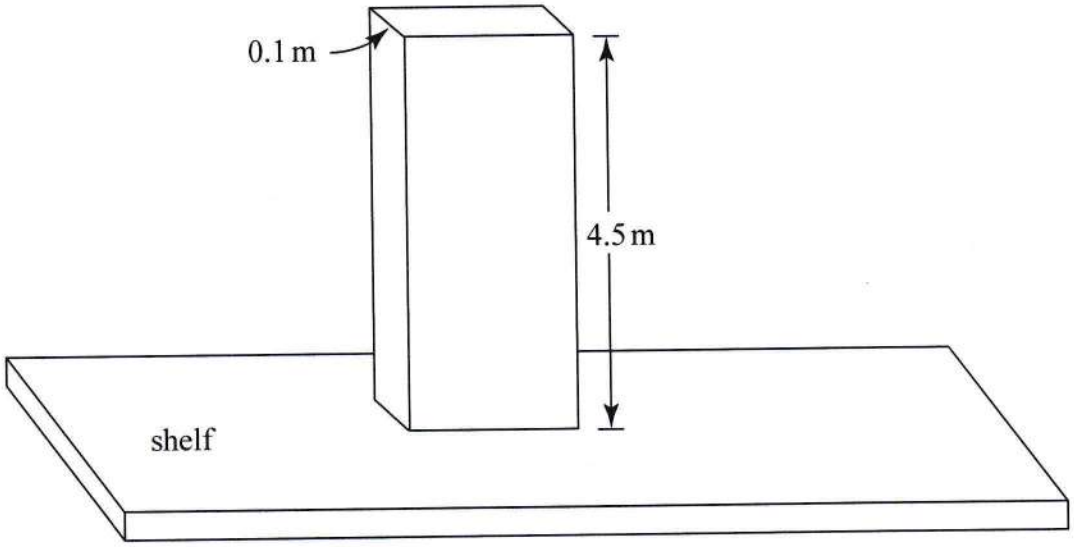



**Fig. 3.1**

(a) Calculate

(i) the area of the metal block in contact with the shelf as shown in Fig. 3.1.

[2]

(ii) the pressure exerted on the shelf by the 40 metal sheets.

[3]

(b) (i) The block is now placed so that the largest area is in contact with the shelf.

Calculate the area which is in contact with the shelf.

[2]

(ii) Without further calculation, predict the magnitude of the pressure exerted on the shelf by the 40 metal sheets.

_____

_____ [1]

(iii) Give a reason for your response to (b)(ii).

_____

_____ [2]

**TOTAL MARKS [10]**

4. This question is about gas laws.
Fig. 4.1 shows a typical hot air balloon. Before its ascent, the balloon is filled with hot air.

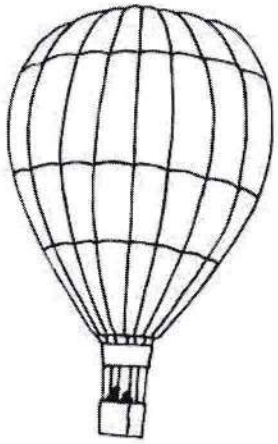


**Fig. 4.1**

(a) When the air is heated, state what happens to the

(i) kinetic energy of the gas particles;

_____ [1]

(ii) volume of gas contained in the balloon;

_____ [1]

(iii) density of gas inside the balloon.

_____ [1]

(b) As altitude increases, atmospheric pressure decreases.

State what effect, if any, the decrease in atmospheric pressure would have on the volume of gas in the balloon.

_____ [1]

(c) Fig. 4.2 shows a pressure-volume graph of a fixed mass of gas.

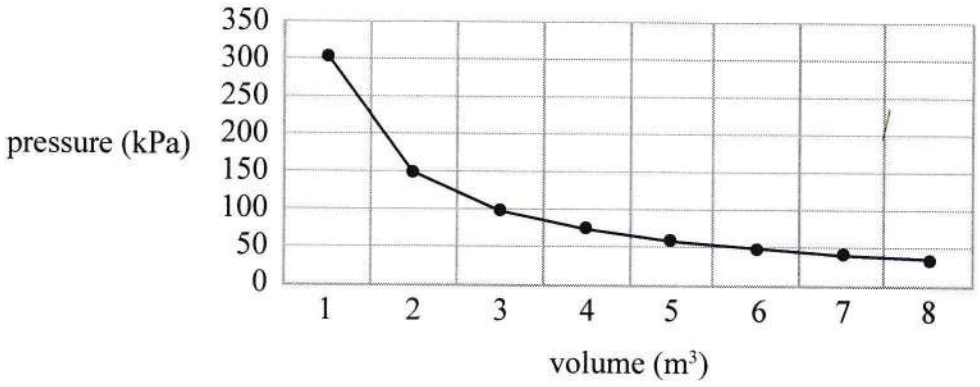



**Fig. 4.2**

(i) Under what condition must this experiment have been carried out?

_____ [1]

Using Fig. 4.2, state what would be the

(ii) volume of the gas when the pressure is 200 kPa

_____ [1]

(iii) pressure when the volume is 3.5 $m^3$.

_____ [1]

(iv) Describe the relationship between pressure and volume.

_____ [1]

(v) On Fig. 4.2, sketch the curve that would be obtained if the experiment was repeated at a higher temperature. [1]

(vi) A bubble of gas rises from 80 m deep in a body of water to the surface.

State what happens to the volume of the bubble as it rises.

_____ [1]

**TOTAL MARKS [10]**

(ii) Spheres **A** and **B** are then separated by holding the insulating stands, and keeping the positively charged rod close to sphere **B**, as shown in Fig. 5.2.

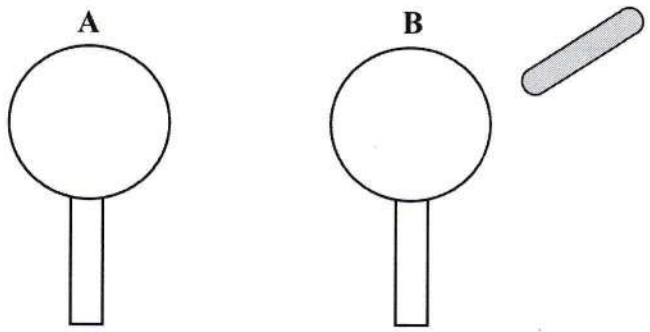



**Fig. 5.2**

State the charges left on spheres **A** and **B** when the spheres are separated.

sphere **A** _____

sphere **B** _____ [2]

(c) In inkjet printers, tiny drops of ink are given an electrostatic charge and forced out of a fine nozzle and then passed between two oppositely charged plates. Fig. 5.3 shows a part of a typical inkjet printer.

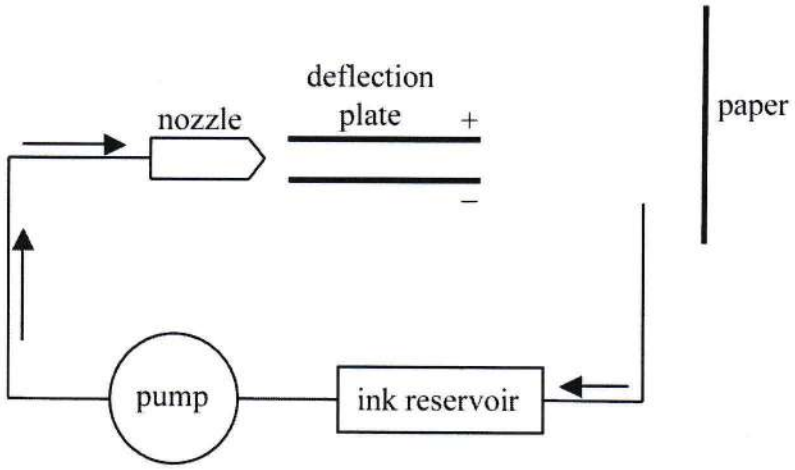



**Fig. 5.3**

(i) On Fig 5.3, draw the path of a negatively charged ink droplet. [1]

(ii) State why the droplets follow the path shown.

_____

_____ [1]

**TOTAL MARKS [10]**

(c) Fig. 6.2 shows the cooling curve for the wax.

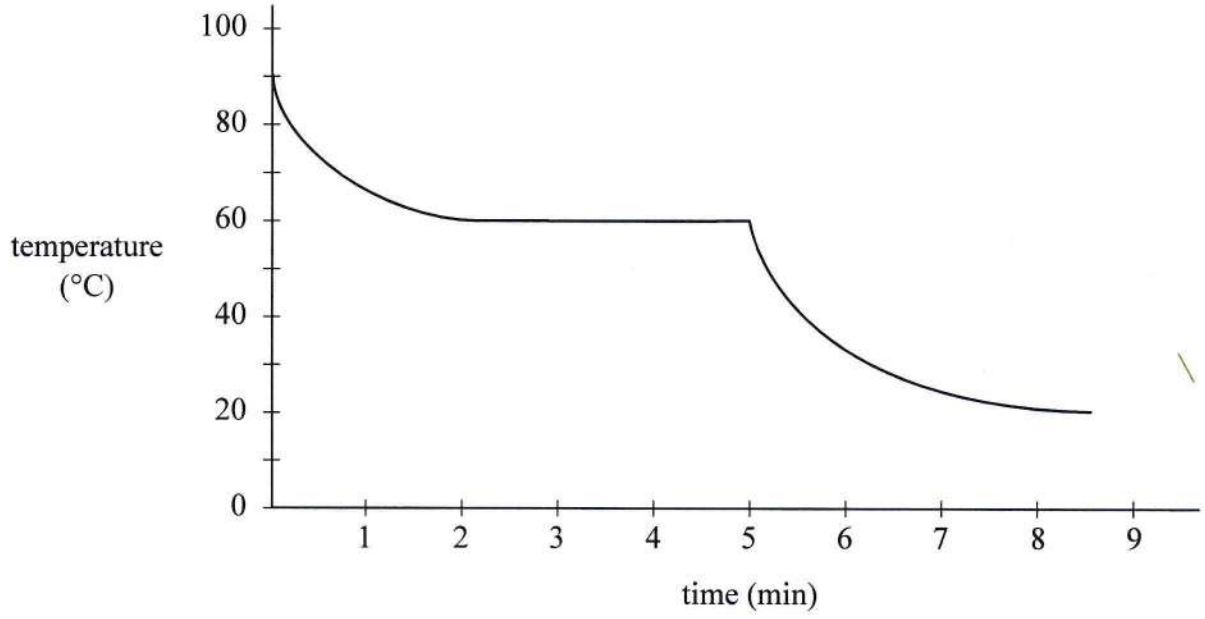



**Fig. 6.2**

(i) Briefly explain how cooling affects the kinetic energy of the wax molecules.

_____ [1]

(ii) Name the state of matter of the wax when the temperature is 58 °C.

_____ [1]

(iii) State what would happen to the freezing point of the wax if impurities were added.

_____ [1]

(iv) State the freezing point of the wax.

_____ [1]

**TOTAL MARKS [10]**

7. This question is about waves and the electromagnetic spectrum.
Table 7.1 shows four properties of waves.

(a) Complete the table by placing a tick (✓) in the column to match the property with the wave.

**Table. 7.1**

| wave property | light | sound |
|---|---|---|
| travels in a vacuum | | |
| transverse wave | | |
| can be diffracted | | |
| transfers energy | | |

[4]

(b) Tamina sets up a ripple tank to produce 2 waves each second. A wave travels 100 cm in 2 s. She measures the distance between the waves as 25 cm.

Find the frequency and the speed of the wave.

[3]

(c) Name the type of wave in the electromagnetic spectrum which

(i) is used in medical imaging equipment;

_____ [1]

(ii) transmits television signals to satellites in orbit;

_____ [1]

(d) Name the wave in the electromagnetic spectrum with the shortest wavelength and the highest frequency.

_____ [1]

**TOTAL MARKS [10]**

8. This question is about current electricity and Ohm's Law.

(a) The circuit, in Fig. 8.1, is used to measure the current flowing in a lamp.

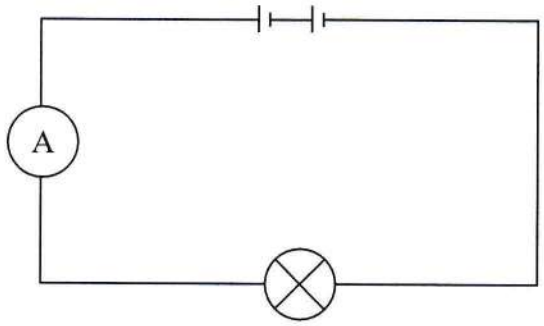



**Fig. 8.1**

(i) The current in the circuit is 0.40 A and the resistance of the lamp is 7.5 Ω. Stating the equation, calculate the voltage across the lamp.

[2]

(ii) In the circuit in Fig. 8.2 the lamps and the cells are the same as those used in part (a)(i).

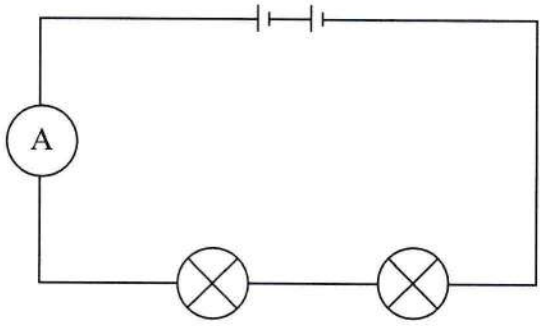



**Fig. 8.2**

Calculate the current in this circuit.

[3]

(iii) A device, called a diode, is added to the circuit in Fig. 8.1 to give the circuit shown in Fig. 8.3.

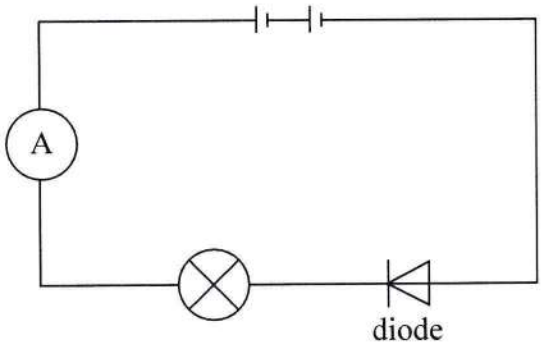


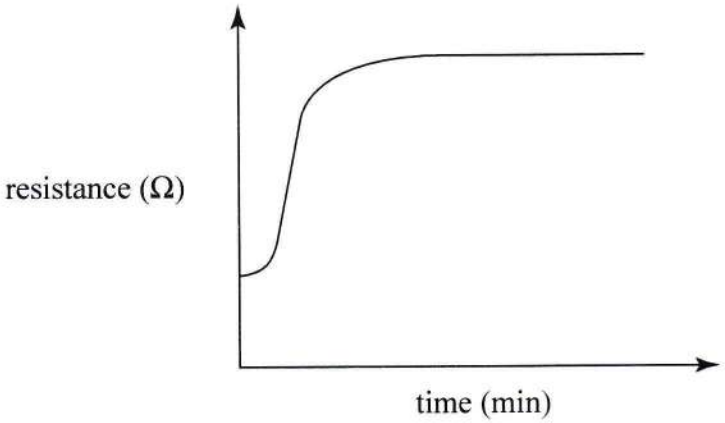

**Fig. 8.3**

The new circuit looks like the one, in Fig. 8.3. Will a current flow in this circuit? Explain your answer.

_____

_____ [2]

(b) The graph below shows how the resistance of the lamp, in part (a)(i), changes with time from the moment it is first switched on.




(i) Describe how the resistance changes with time

_____ [1]

(ii) Suggest why the resistance changes in this way.

_____ [1]

(iii) Describe how the current in this lamp, changes with time, from the moment it is first switched on.

_____

_____ [1]

**TOTAL MARKS [10]**

3117/3 **BGCSE**

| School Number | Candidate Number |
|---|---|
| | |
| Surname and Initials | |

# PHYSICS

**PAPER 3 3117/3**

**Thursday 2 JUNE 2016 12:30 P.M.–2:00 P.M.**

**Additional materials:**
**Graph paper**

## MINISTRY OF EDUCATION
## NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

**INSTRUCTIONS AND INFORMATION TO CANDIDATES**

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

Write your school number, candidate number, surname and initials at the top of this page as well as at the top of all lined paper submitted.

Answer **ALL** the questions in **Section A** in the spaces provided on this question booklet.

Answer **TWO** questions from **Section B** on the lined paper provided at the back of this question booklet.

Show **ALL** working when answering numerical questions.

Answers to numerical problems should be given to a suitable number of significant figures.

The intended marks for each question or part question are given in brackets [ ].

## LIST OF FORMULAE

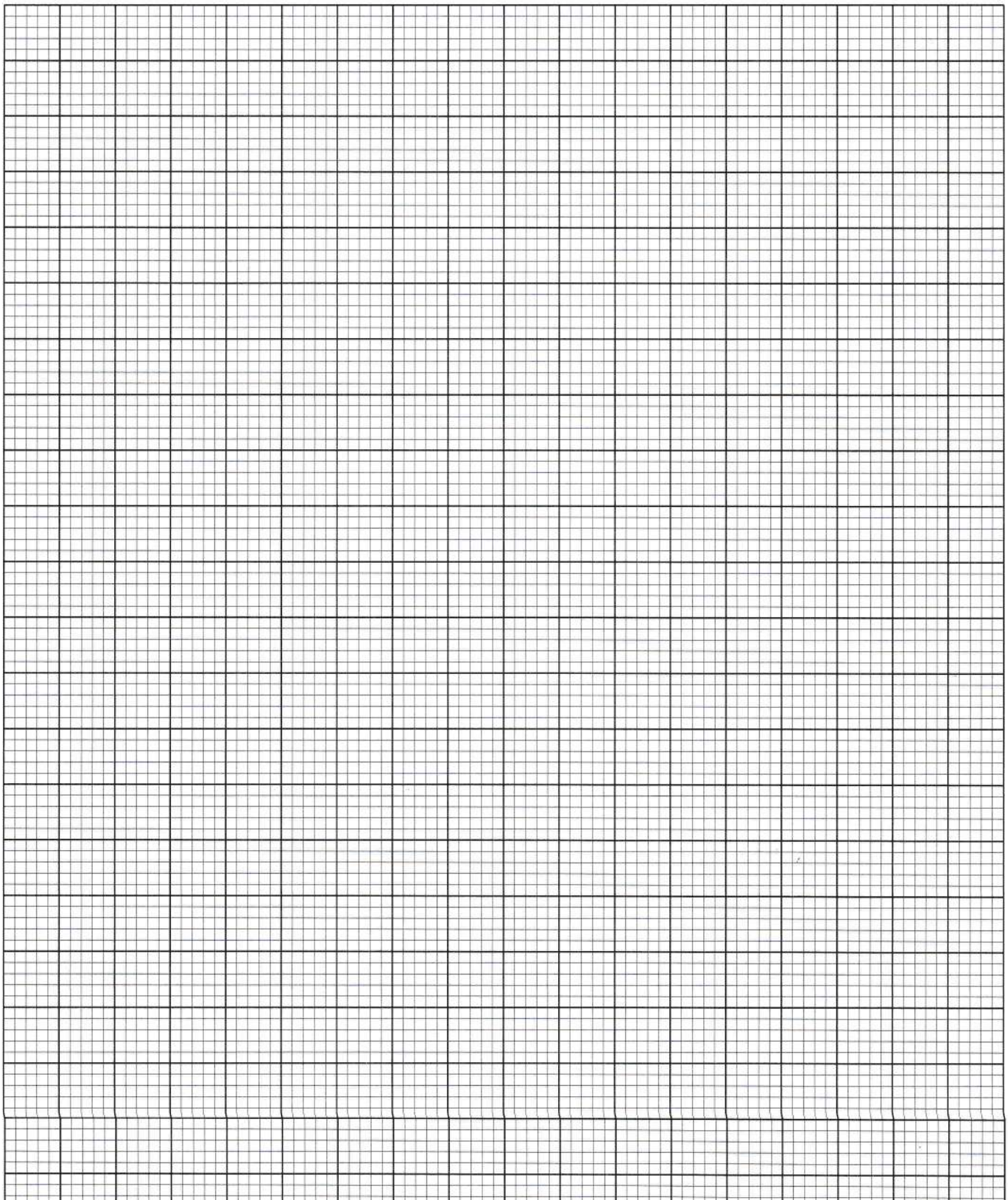
| | |
|---|---|
| weight = mass × gravitational field strength | $\text{weight} = mg$ |
| force = mass × acceleration | $F = ma$ |
| $\text{pressure} = \frac{\text{normal force}}{\text{area}}$ | $p = \frac{F}{A}$ |
| pressure due to a liquid = depth × density × g | $p = hDg$ |
| $\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$ | $v = \frac{s}{t}$ |
| $\text{average velocity} = \frac{\text{distance travelled in a given direction}}{\text{time taken}}$ | $v = \frac{s}{t}$ |
| $\text{acceleration} = \frac{\text{increase in velocity}}{\text{time}}$ | $a = \frac{v - u}{t}$ |
| $\text{density} = \frac{\text{mass}}{\text{volume}}$ | $\text{D} = \frac{m}{V}$ |
| ideal gas equation | $\frac{p_1 V_1}{T_1} = \frac{p_2 \text{V}_2}{T_2}$ |
| Charles' law equation | $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ |
| kinetic energy = $\frac{1}{2}$ mass × speed$^2$ | kinetic energy = $\frac{1}{2}$ mv$^2$ |
| change in gravitational potential energy = weight × change in height | |
| $\text{power} = \frac{\text{energy}}{\text{time}}$ | |
| $\text{efficiency} = \frac{\text{work output}}{\text{work input}}$ | |
| $\text{efficiency} = \frac{\text{power output}}{\text{power input}}$ | |
| wave speed = frequency × wavelength | $v = f\lambda$ |
| energy = mass × specific heat capacity × temperature change | $W = mc\Delta\theta$ |
| charge = current × time | $Q = It$ |
| $\text{potential difference} = \frac{\text{work done}}{\text{charge moved}}$ | $V = \frac{W}{\text{Q}}$ |
| $\text{resistance} = \frac{\text{potential difference}}{\text{current}}$ | $\frac{\text{V}_\text{p}}{\text{n}_\text{p}} = \frac{\text{V}_\text{s}}{\text{n}_\text{s}}$ |
| effective resistance of resistors in series | $R = R_1 + R_2$ |
| effective resistance of resistors in parallel | $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ |
| power = potential difference × current | $P = VI$ |
| refractive index of a medium | $\text{n} = \frac{\sin \text{i}}{\sin \text{r}} = \frac{\text{real depth}}{\text{apparent depth}}$ |
| $\text{magnification} = \frac{\text{image distance (v)}}{\text{object distance (u)}}$ | $\text{m} = \frac{\text{v}}{\text{u}}$ |

**SCIENCE GRAPH PAPER**

**MINISTRY OF EDUCATION** **AB7**

**BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

| School No. | Candidate No. | Level: | For Examiner's Use |
|---|---|---|---|
| Subject Number & Title: | | Paper: | |
| Surname & Initials: | | Section: | |
| Signature: | Date: | Qu. No. | |



## Section A

Answer **ALL** questions

1. This question is about simple machines.
Fig. 1.1 shows a multiple pulley used to lift a load 2.5 m high, when an input force (effort) of 220 N is applied to it. The pulley system has a mechanical advantage of 4.2.

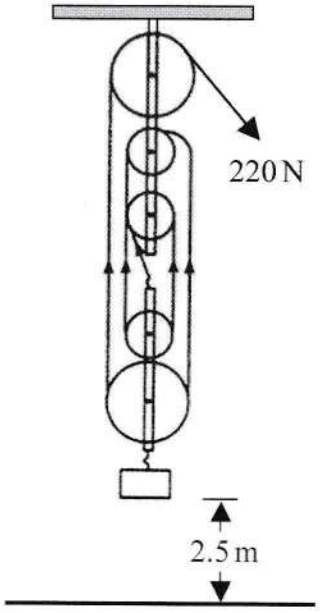



**Fig. 1.1**

(a) What is the load lifted?

[2]

(b) (i) What is the velocity ratio of the pulley shown in Fig. 1.1?

[1]

(ii) Over what distance is the input force (effort) applied?

[2]

(c) Determine the efficiency of the pulley system used.

[2]

(d) Calculate the efficiency of another pulley, used to raise a load of 500 N, a height of 2 m when an effort of 210 N is applied to it for a distance of 6 m.

[3]

**TOTAL MARKS [10]**

2. This question is about the refraction of light.
Fig. 2.1 shows a rectangular glass block, 15 cm long with an air bubble inside.

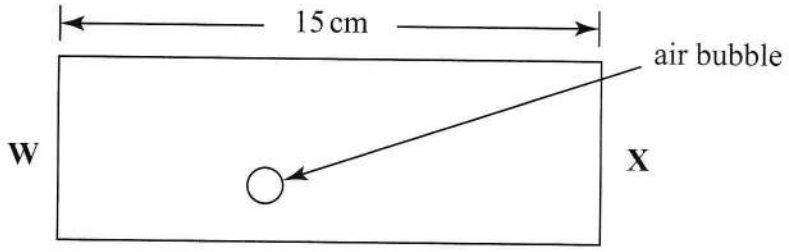



**Fig. 2.1**

(a) When viewed from side **X**, the air bubble appears to be 6.0 cm away from **X**.

Calculate where the air bubble would appear to be when viewed from side **W**. The refractive index of the glass is 1.5.

[4]

(b) Fig. 2.2 shows a flashlight held under water in such a way that a ray of light is produced which strikes the surface of the water at angle ***i***.

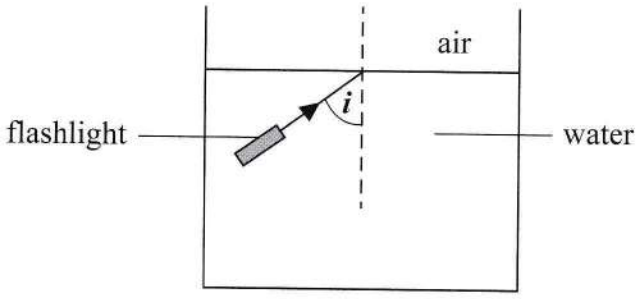



**Fig. 2.2**

(i) The critical angle for water is 49°.

Draw **two** sketches to show what happens to the ray of light from the flashlight when angle ***i*** is 20° and when angle ***i*** is 60°.

[4]

(ii) Name the phenomenon taking place when angle ***i*** is 60°.

_____ [1]

(iii) Name the type of technology which uses this phenomenon with applications in telecommunications and medicine.

_____

_____ [1]

**TOTAL MARKS [10]**

3. This question is about transformers.

(a) Fig. 3.1 shows a transformer that is used to change 120 V mains voltage to light a 12 V lamp.

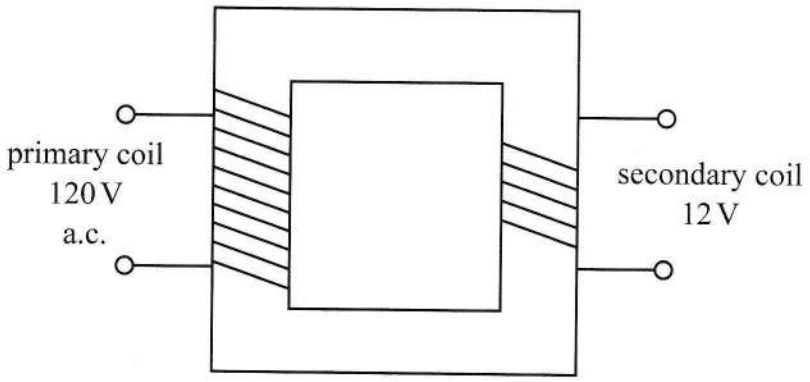



**Fig. 3.1**

(i) Explain the term alternating current (a.c.).

_____

_____ [2]

(ii) Calculate the ratio of turns for the transformer.

[1]

(b) (i) Describe in detail, how a transformer works.

_____

_____

_____

_____ [3]

(ii) State two factors that would make a transformer not 100% efficient.

_____

_____

_____ [2]

(iii) State ways in which these deficiencies are overcome when manufacturing transformers.

_____

_____

_____ [2]

**TOTAL MARKS [10]**

(c) (i) The small puck hits the large puck with a force of 20 N.

State the size ***and*** direction of the reaction force.

_____ [1]

(ii) Calculate the acceleration of the large puck on impact.

[2]

(d) The acceleration in (c)(ii) is less than that of the small puck.
Explain why.

[1]

**TOTAL MARKS [10]**

## Section B
Answer any **two** questions

5. This question is about acceleration and gravity.

(a) Explain what happens to a falling body acted on only by gravity. [2]

(b) A student performed a simple experiment to determine the acceleration due to gravity, by measuring the time taken for a steel ball bearing to fall through air.

Give **ONE** reason why a steel ball bearing is used for short distances. [1]

(c) The table 5.1 shows the experimental results obtained by the student.

**Table 5.1**

| distance fallen, $d$ (m) | 0.96 | 1.09 | 1.17 | 1.28 | 1.37 | 1.55 | 1.71 |
|---|---|---|---|---|---|---|---|
| time taken, $t$ (s) | 0.44 | 0.47 | 0.49 | 0.51 | 0.53 | 0.56 | 0.59 |

(i) Calculate the values of $t^2$ for the values shown in the Table and construct a table of values $d$ (m) and $t^2$ ($s^2$). [2]

(ii) Plot a graph of $d$ ($y$-axis) against $t^2$ ($x$–axis), starting axes at (0,0). Draw the best fit line through the points. [6]

(iii) Determine the slope/gradient of the graph. [3]

(iv) The equation for the graph is $d = \frac{1}{2} gt^2$. Use the equation of the slope/gradient of the graph to (iii) to determine the value for $g$. [2]

(d) In another experiment, the steel ball is dropped vertically downwards from the top of the laboratory stairs.

(i) What is its velocity after 2.5 s? [2]

(ii) Through what distance does the ball fall during this time? [2]

**TOTAL MARKS [20]**

## Section B
Answer any **two** questions

5. This question is about acceleration and gravity.

(a) Explain what happens to a falling body acted on only by gravity. [2]

(b) A student performed a simple experiment to determine the acceleration due to gravity, by measuring the time taken for a steel ball bearing to fall through air.

Give **ONE** reason why a steel ball bearing is used for short distances. [1]

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(d) In another experiment, the steel ball is dropped vertically downwards from the top of the laboratory stairs.

(i) What is its velocity after 2.5 s? [2]

(ii) Through what distance does the ball fall during this time? [2]

**TOTAL MARKS [20]**

(d) In a further experiment, the immersion heater is placed in some crushed ice in a filter funnel as shown in Fig. 6.2.

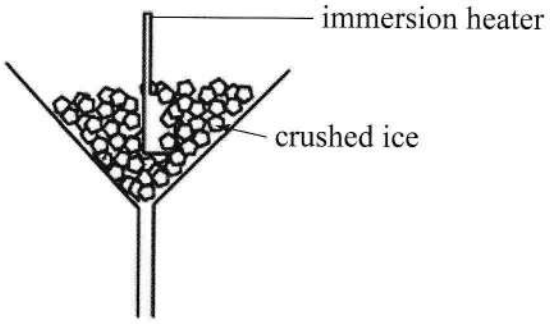


**Fig. 6.2**

(i) Calculate the specific latent heat of fusion of ice, if after 250 seconds, 40 g of ice was found to have melted. [3]

(ii) Explain how you expect the calculated value to differ from the actual value of the latent heat of fusion of ice. Give a reason for your response. [2]

**TOTAL MARKS [20]**

7. Fig. 7.1 shows a power supply, ammeter and a thermistor connected in series. A voltmeter is connected in parallel to the thermistor. A thermometer is in contact with the thermistor.

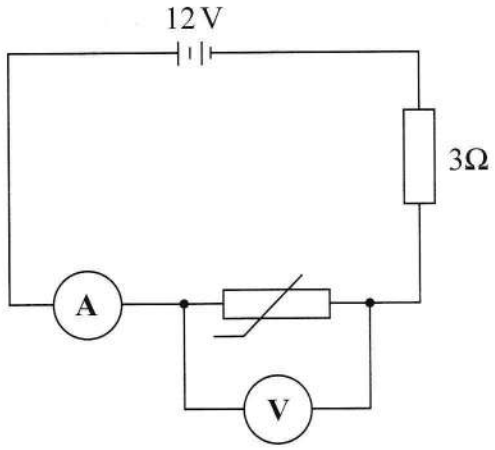


**Fig. 7.1**

(a) Describe, with the aid of a labelled diagram, how you would vary the temperature of the thermistor. [5]

(b) A student performs the experiment and records observations shown in the Table 7.1.

**Table 7.1**

| temperature (°C) | 12 | 23 | 32 | 52 | 82 |
|---|---|---|---|---|---|
| ammeter reading (A) | 0.30 | 0.40 | 0.50 | 0.80 | 1.50 |
| voltmeter reading (V) | 11.1 | 10.8 | 10.5 | 9.6 | 7.5 |

(i) Calculate the resistance of the thermistor at each of the values given in the table above and record them in your own table of temperature, t (°C) and resistance, R (Ω). [5]

(ii) Plot a graph of resistance ($y$-axis) against temperature ($x$-axis). [6]

(iii) From the graph, determine the resistance of the thermistor at 25°C [1]

(iv) Calculate the current through the thermistor at 25°C. [3]

**TOTAL MARKS [20]**

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