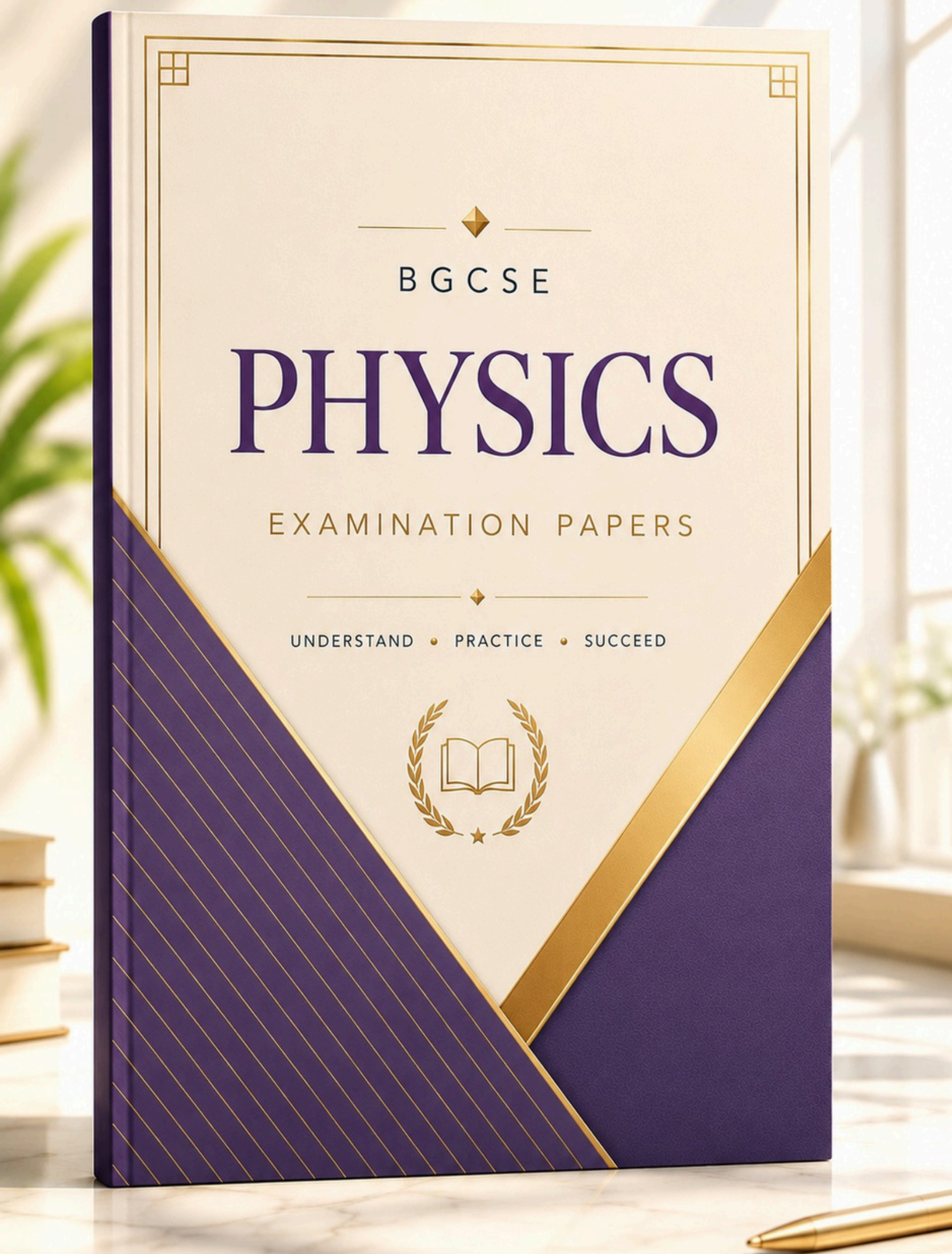
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PHYSICS

PAPER 1 3117/1

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NATIONAL EXAMINATIONS

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INSTRUCTIONS AND INFORMATION TO CANDIDATES

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.

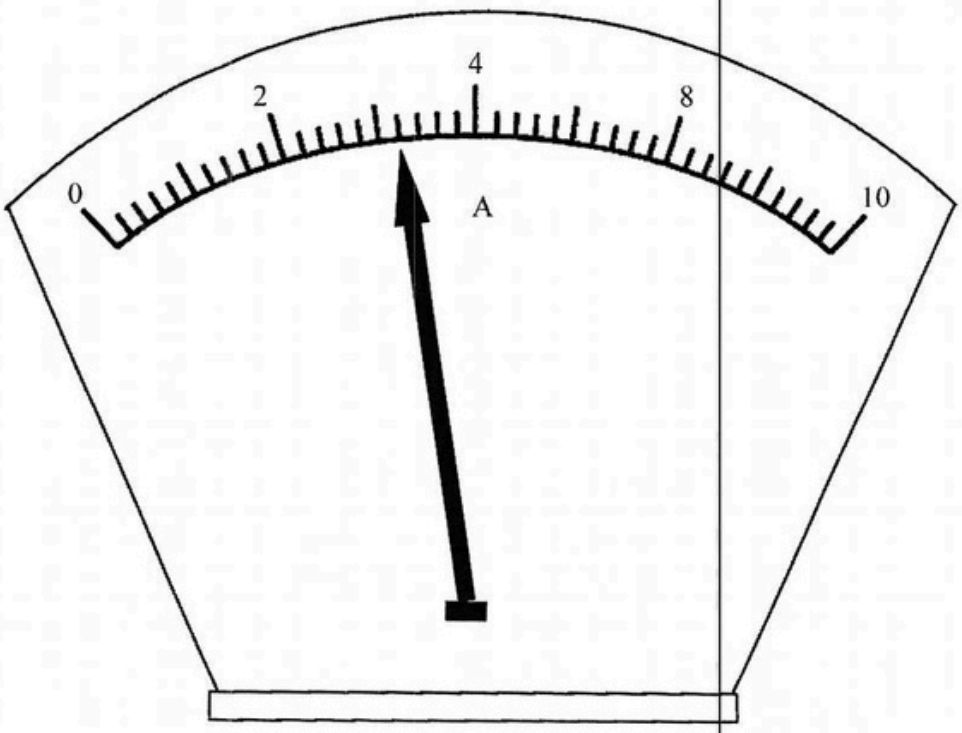
Answer as many questions as you can. For each question, four possible answers, A, B, C, and D are given.

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

Rough work paper should not be handed in.

This question paper consists of _21_ printed pages and _3_ blank pages.

1. The reading of an ammeter used to measure current in an electrical circuit is shown.



What is the reading on the ammeter's scale?

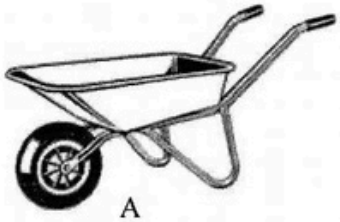
A. 0.26 A
B. 0.32 A
C. 2.6 A
D. 3.2 A

2. Physical quantities can sometimes have more than one unit. Each line of the table shows two possible units for a physical quantity.

	unit 1	**unit 2**
A	J	kWh
B	J	Nm
C	J/s	N
D	J/s	W

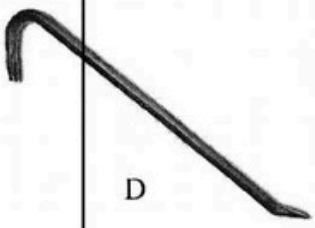
Which row in the table gives units for rate of doing work?

3. Which of the following represents a second class lever?


A

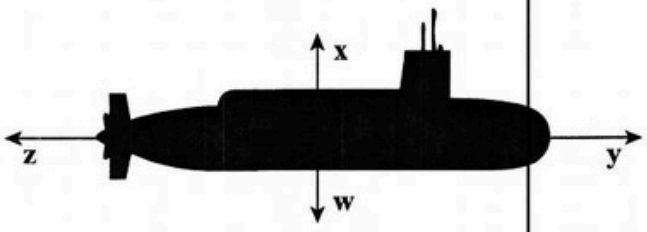

B


C


D

4. The diagram shows a picture of a submerged submarine.

Which pair of forces must balance to keep the submarine submerged at a constant depth?

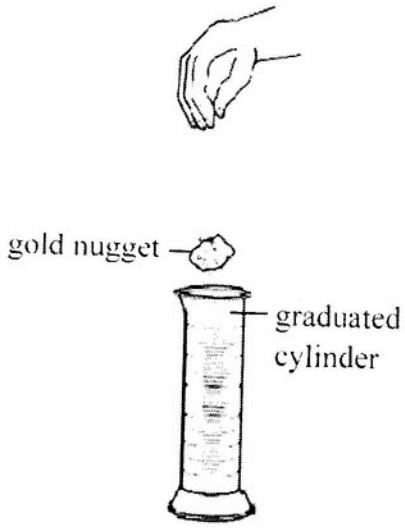


A. **w** and **x**
B. **w** and **y**
C. **y** and **z**
D. **x** and **z**

5. A trolley is used to carry a box of weight 800 N. The weight of the trolley and the box is 1 550 N. If the gravitational force per unit mass is 10 N/kg, what is the mass of the trolley on its own?

A. 75 kg
B. 155 kg
C. 800 kg
D. 15 500 kg

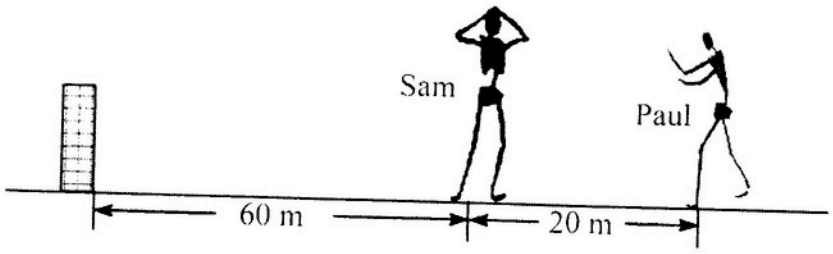
6. A measuring cylinder contains 75 cm^3 of water. A gold nugget is gently lowered and fully immersed in the water.



The new volume of the water and the nugget is found to be 90 cm^3. If the mass of the gold is 45 g, what is the density of the gold nugget?

A. 0.33 g/cm^3
B. 0.50 g/cm^3
C. 0.60 g/cm^3
D. 3.0 g/cm^3

7. Two students, Sam and Paul conduct simple investigations on the reflection of sound waves. Sam and Paul stand 60 m and 80 m away from a wall, respeetively as shown.



If the speed of sound in air is 340 m/s, how long after seeing Paul clap his hand, will Sam hear the echo of thc clap?

A. 0.35 s
B. 0.24 s
C. 0.41 s
D. 0.47 s

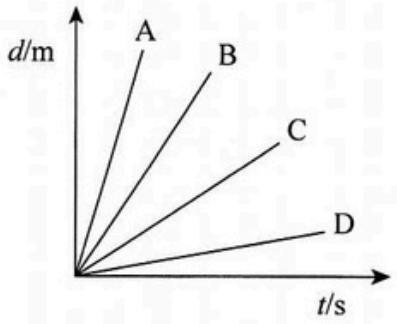
8. Which is **NOT** true of the image formed in a plane mirror?

A. laterally inverted
B. real
C. same size as object
D. same distance behind mirror as object is in front of mirror

9. Which of these equations illustrates Newton's second law of motion?

A. force = mass × acceleration
B. $\text{pressure} = \frac{\text{force}}{\text{area}}$
C. $\text{speed} = \frac{\text{distance}}{\text{time}}$
D. weight = mass × gravitational constant

10. The distance-time graph shows the movement for four cars **A**, **B**, **C** and **D**. Which car is moving the fastest?



11. What is the energy change as an object falls through the air (assuming there is no air resistance)?

A. gravitational potential to kinetic
B. gravitational potential to sound
C. kinetic to gravitational potential
D. kinetic to sound

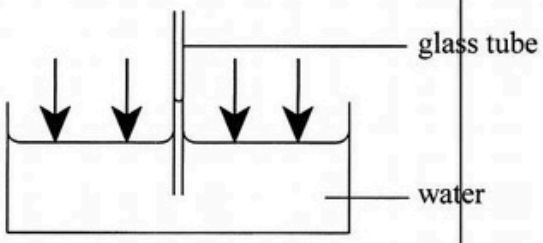
12. Which physical quantity has both **magnitude** and **direction**?

A. time
B. weight
C. mass
D. speed

13. Why do computer monitors have holes or slots in the back of their cabinets?

A. to allow for conduction of heat
B. to allow for convection of heat
C. to allow for radiation of heat
D. to allow for reflection of heat

14. The diagram shows water rising in a glass tube



What causes this effect?

A. atmospheric pressure
B. increased air pressure in the glass tube
C. decreased atmospheric pressure
D. water pressure

15. Smoke particles in air are examined under a microscope. They move about and make frequent, haphazard changes in direction. Why is this seen?

A. they repel each other
B. they attract each other
C. they are able to move themselves
D. they collide with invisible air molecules

16. Marcus cycles at a steady speed of 6 m/s for 2 minutes. What is the average distance covered by Marcus?

A. 12 m
B. 20 m
C. 360 m
D. 720 m

17. Performers at a play are dressed in red shirts and white pants. When blue stage light falls on them, what colours would their shirts and pants appear, respectively?

A. black and blue
B. black and white
C. magenta and white
D. blue and magenta

18. A block of glass has a critical angle of 42°. Which angle of incidence must a light ray enter, in order for total internal reflection to occur?

A. 30°
B. 42°
C. 60°
D. 90°

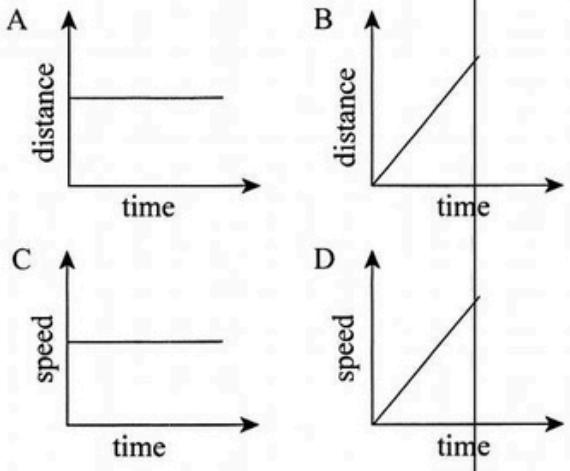
19. Which member of the electromagnetic spectrum listed below is not used for communication?

A. gamma rays
B. microwaves
C. radiowaves
D. visible light

20. Which line in the table identifies the mode of action and origin of a sound wave?

	mode of action	origin of wave
A	longitudinal	electromagnetic
B	longitudinal	vibrations
C	transverse	electromagnetic
D	transverse	vibrations

21. Which motion time graphs shows constant acceleration?



22. The table shows the results of four students climbing to the top of a wall.

Which student demonstrates the greatest power?

	work done/J	time/s
A	1000	4
B	1000	8
C	2000	5
D	2000	10

23. A soccer player of mass 100 kg runs with a speed of 4m/s to kick a stationary ball of mass 0.4 kg.

What is the initial momentum of the soccer player and ball?

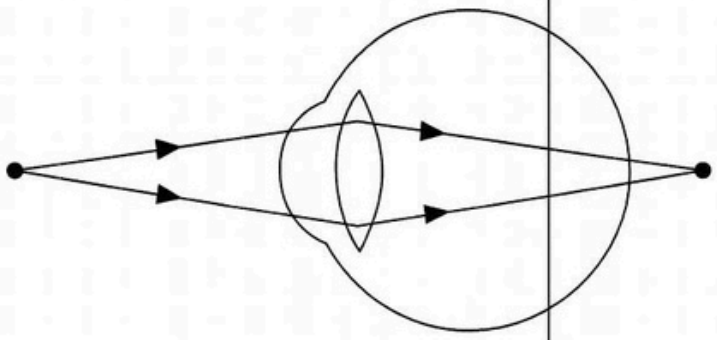
	initial momentum (kg m/s)	
	soccer player	**ball**
A	25	0
B	400	0
C	25	0.4
D	400	0.4

24. Convex mirrors are commonly used in everyday life.

Which row describes a convex mirror?

	effect on parallel light rays	**characteristics**
A	diverges light	produces upright enlarged images of close–up objects
B	converges light	produces upright enlarged images of close–up objects
C	diverges light	produces a wide field view
D	converges light	produces a wide field view

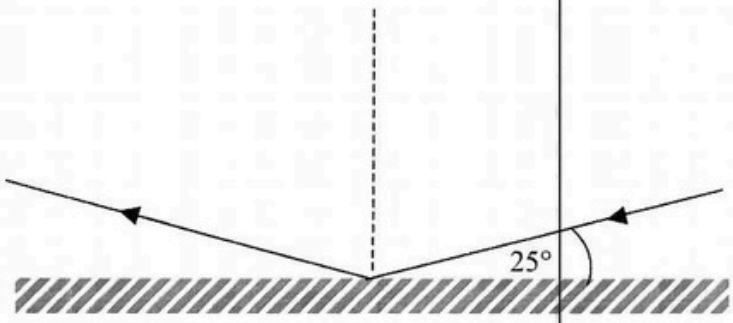
25. A common eye defect is shown in the diagram.



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

26. Candace directs a ray of light at a plane mirror as shown in the diagram and observes its reflection.



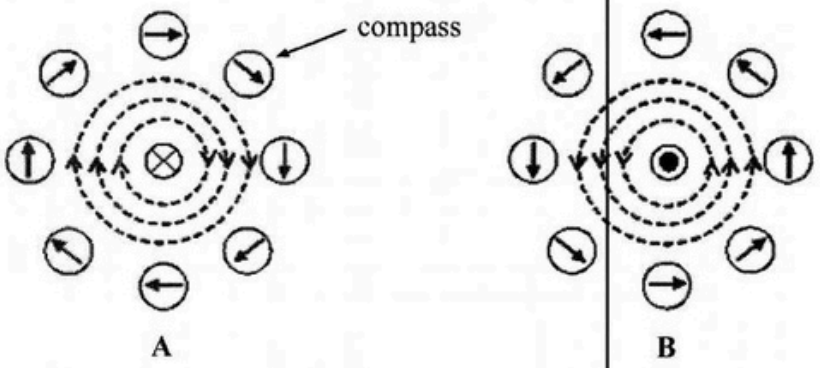
What is the angle of reflection?

A. 25°
B. 65°
C. 90°
D. 130°

27. Which is a magnetically **hard** metal?

A. aluminium
B. iron
C. steel
D. zinc

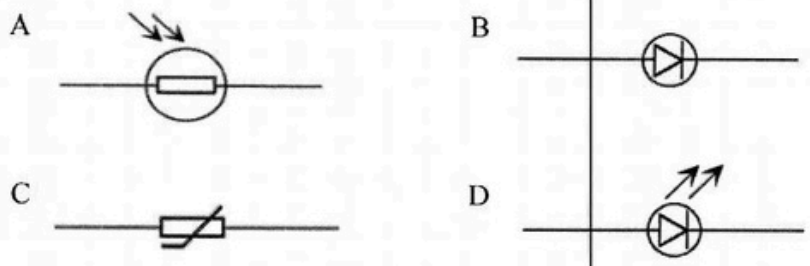
28. A student investigates the magnetic fields around wires carrying current using iron filings and plotting compasses. Two of the magnetic fields obtained are shown.



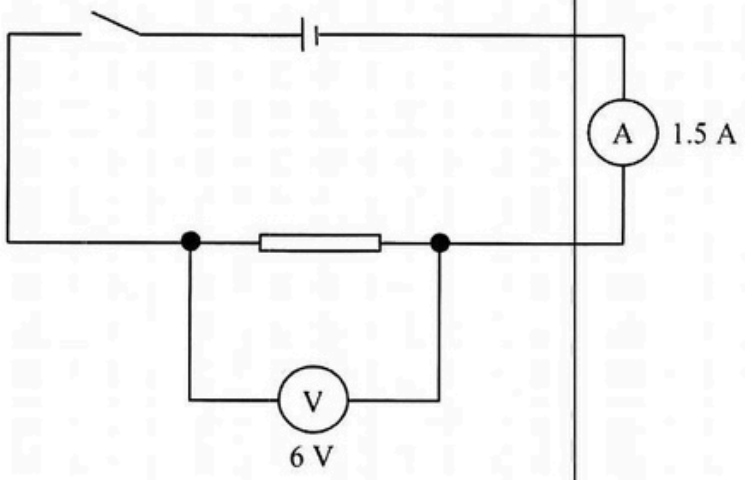
Which row correctly classifies magnetic fields **A** and **B**?

	magnetic field A	**magnetic field B**
A	circular coil carrying current out of plane of paper	circular coil carrying current into plane of paper
B	circular coil carrying current out of plane of paper	straight wire carrying current into plane of paper
C	straight wire carrying current out of plane of paper	circular coil carrying current into plane of paper
D	straight wire carrying current into plane of paper	straight wire carrying current out of plane of paper

29. The diagrams show some common circuit symbols. Which symbol represents a light emitting diode?



30. When the voltage across a resistor is 6 V, the current through it is 1.5 A.



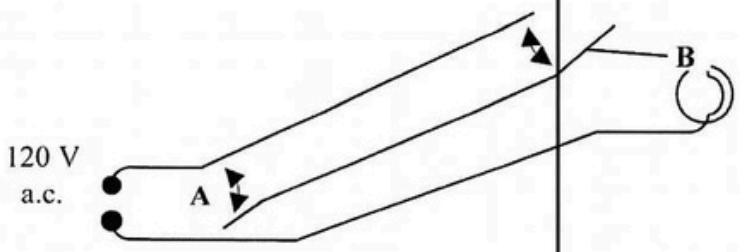
What is the resistance of the resistor used?

A. 4.0 Ω
B. 4.5 Ω
C. 7.5 Ω
D. 9.0 Ω

31. Which component is best suited for use in a temperature sensor?

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

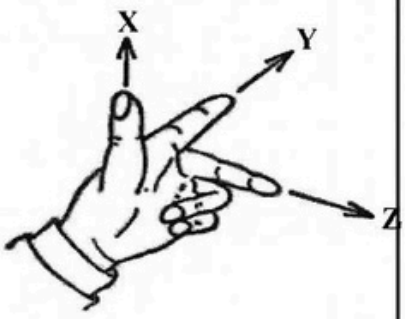
32. Two way switches are commonly used to control lights from two locations, such as from the top and bottom of the stairs.



Which positions of switches **A** and **B** match with the lighting of the lamp?

	switch A	**switch B**	**lamp**
A	down	up	on
B	up	down	on
C	down	down	on
D	up	up	off

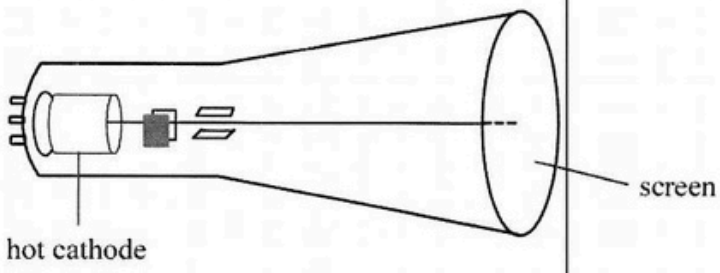
33. Peter uses the Fleming's Left hand rule to determine the motion of a straight wire carrying current suspended at right angles inside a magnetic field.



What directions are represented by letters **X**, **Y** and **Z**?

	X	**Y**	**Z**
A	conventional current	magnetic field	motion of wire
B	motion of wire	magnetic field	conventional current
C	magnetic field	conventional current	motion of wire
D	conventional current	motion of wire	magnetic field

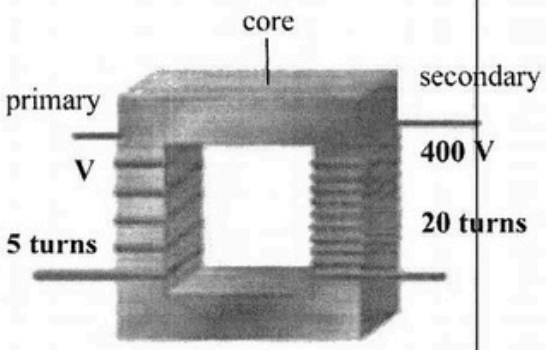
34. The diagram shows a cathode ray tube which contains an electron gun.



What is the name given to electrons produced from the hot cathode?

A. heat
B. light
C. positive ions
D. thermionic emission

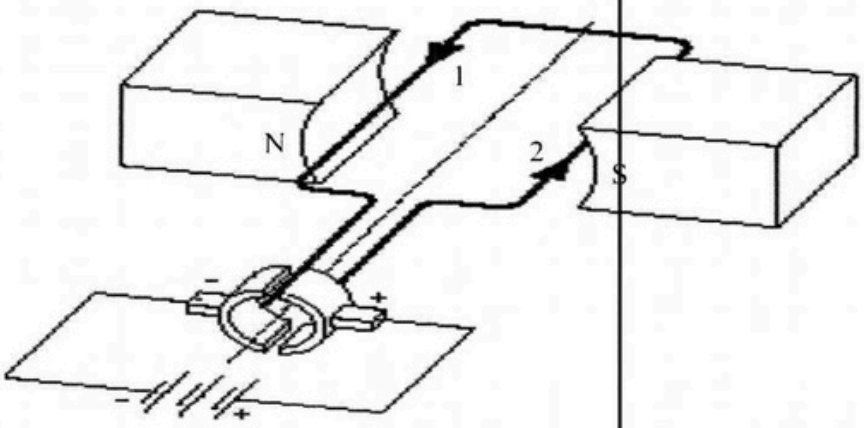
35. The diagram shows an ideal transformer with an output voltage of 400 V. The primary coil has 5 turns and the secondary coil has 20 turns.



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

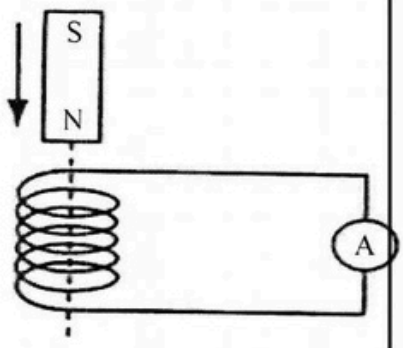
36. A simplified diagram of a d.c. electric motor is shown.



How would **wires 1** and **2** move and in what direction would the coil rotate?

	wire 1	**wire 2**	**rotation of coil**
A	down	up	anticlockwise
B	up	down	clockwise
C	down	up	clockwise
D	up	down	anticlockwise

37. When a magnet is moved through a solenoid as shown, voltage is induced. If the circuit is complete, current is also induced.



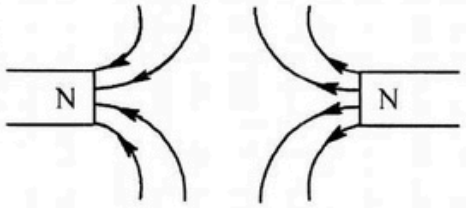
What change would **not** increase the size of the induced current?

A. holding the magnet stationary in the solenoid
B. increasing the number of coils in the solenoid
C. moving the magnet faster
D. using a stronger magnet

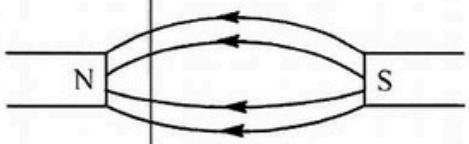
38. The diagrams represent the magnetic fields between the poles of two bar magnets.

Which diagram correctly represents the magnetic field?

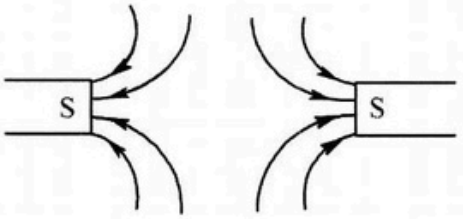
A



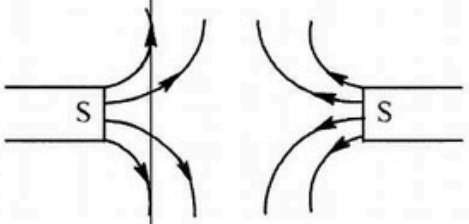
B



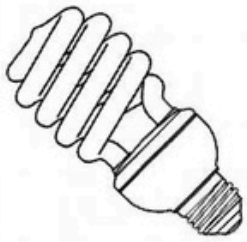
C



D



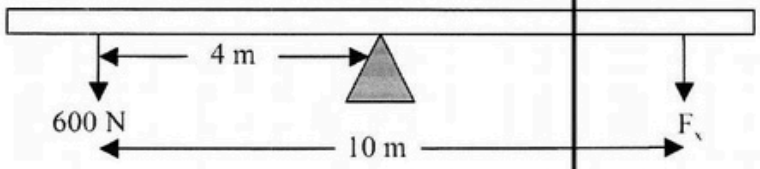
39. Compact fluorescent lamps (CFLs) are replacing filament lamps in homes in an effort to save energy.



A 15 W CFL produces the same amount of light as a 100 W filament lamp. The cost of 1 kWh of electricity is 20 cents. How much money could be saved by replacing the 100 W lamp with a 15 W lamp if it is used for 300 hours?

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

40. A uniform see-saw is balanced at its midpoint, with forces of 600 N and F_x, placed 4 m and 6 m respectively, from the midpoint.



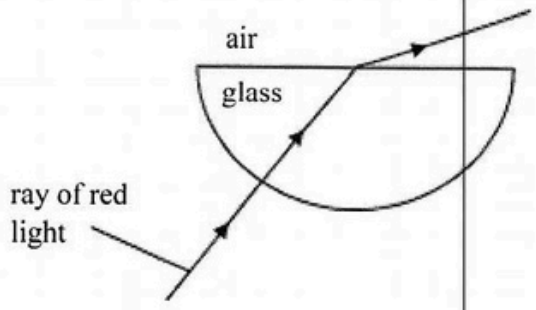
What is the value of F_x?

A. 240 N
B. 400 N
C. 2400 N
D. 3600 N

41. A household electrical plug contains a fuse. Which line in the table indicates the name and colour of the wire to which the fuse is connected?

	name	**colour**
A	live	blue
B	live	brown
C	neutral	blue
D	neutral	brown

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

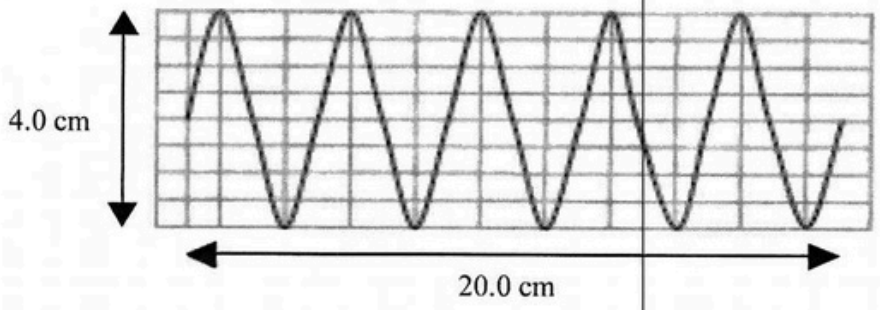


Why is the ray of light refracted as it travels from glass into air?

A. its amplitude changes
B. its frequency change
C. its speed changes
D. it is not white light

Use this information to answer questions 43 and 44.

A student draws the image of the waves as shown.



43. What is the amplitude of the wave?

A. 2.0 cm
B. 4.0 cm
C. 5.0 cm
D. 20.0 cm

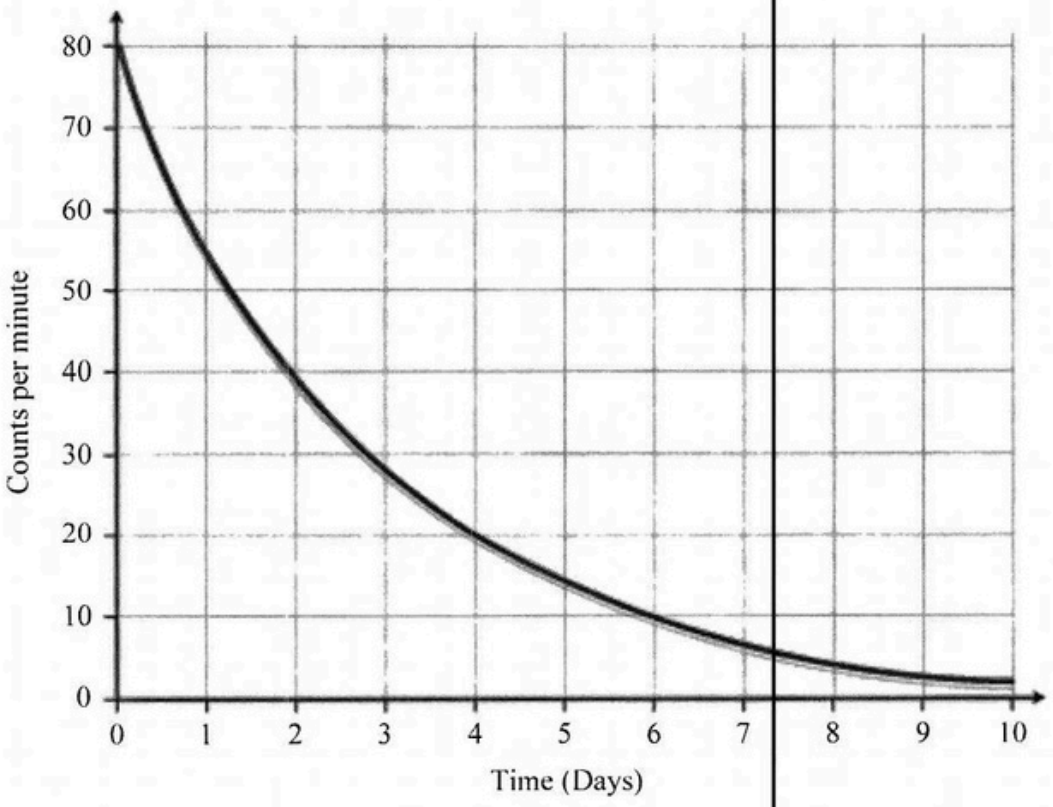
44. What is the wavelength of the wave?

A. 2.0 cm
B. 4.0 cm
C. 5.0 cm
D. 20.0 cm

45. An astronaut on the Moon sees a spacecraft and 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. The graph shows how the count rate of a certain radioactive isotope changes with time.



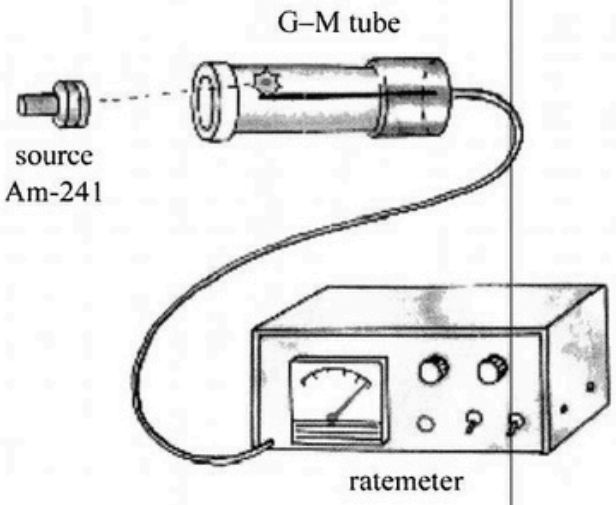
What is the half-life of the radioisotope?

A. 2 days
B. 4 days
C. 10 days
D. 20 days

47. Which one of the following makes use of a nuclear fusion?

A. a battery
B. a coal fired power plant
C. a nuclear power plant
D. the Sun

48. The diagram shows a radioactive source and a radiation detector. The radiation detected decreases significantly when the distance between the source and the detector is greater than 5 cm.



Which type of radiation is the source emitting?

A. alpha radiation only
B. beta radiation only
C. gamma radiation only
D. alpha and beta radiation only

49. How many protons and neutrons are there in the nucleus of the isotope of cobalt represented by the symbol $^{60}_{27}Co$?

	protons	**neutrons**
A	27	33
B	33	27
C	27	60
D	60	27

50. To prevent fruit from rotting which of the following nuclear radiations are used?

A. alpha
B. beta
C. gamma
D. alpha and beta

3117/2

BGCSE

School Number	Candidate Number

Surname and Initials

PHYSICS

PAPER 2 3117/2

Thursday 30 MAY 2013 1:30 P.M.–3:00 P.M.

No additional materials required.

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 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 [ ].

This question paper consists of _17_ printed pages and _3_ blank pages.

1. This question is about quantities and units used in Physics.

Match the units listed in **column P** with the correct quantity listed in **column Q**, by writing the letter corresponding to the correct unit from column P in the space provided.

Each of the units in column P should be used once only.

	Column P – Units	**Column Q** – Quantities	
A	joule (J)	rate of energy production	_____
B	newton (N)	potential energy	_____
C	newton–metre (Nm)	momentum	_____
D	kilogram metre per second (kgm/s)	electrical energy	_____
E	kilowatt hour (kWh)	speed	_____
F	watt (W)	work done	_____
G	metre per second (m/s)	pressure	_____
H	metre per second squared (m/s^2)	density	_____
I	newton per metre squared (N/m^2)	gravitational force	_____
J	kilogram per metre cubed (kg/m^3)	acceleration	_____

TOTAL MARKS [10]

2. This question is about electrostatics.

A student rubs a polythene rod with a soft insulating glove as shown in Fig. 2.1.

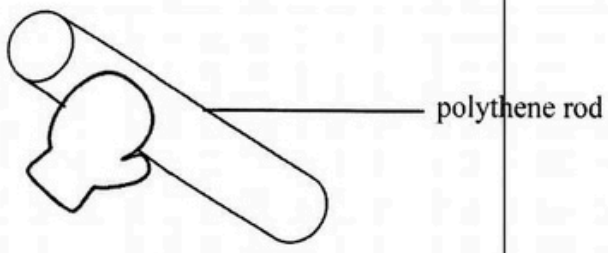


Fig. 2.1

(a) (i) State the nature of the charge on the polythene rod after having been rubbed.

_____ [1]

(ii) Explain, in terms of movement of particles, how the polythene rod becomes charged.

_____

_____ [1]

(b) The charged polythene rod is held a short distance from a narrow stream of water as shown in Fig. 2.2.

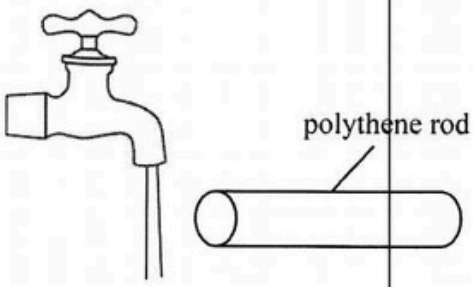


Fig. 2.2

(i) State what is observed when the charged polythene rod is held close to the narrow stream of water.

_____

_____ [1]

(ii) Explain how this occurs.

_____

_____

_____

_____ [2]

(c) Fig. 2.3 shows a tall building protected by a lightning conductor which consists of spikes connected by a thick strip to a plate in the ground.

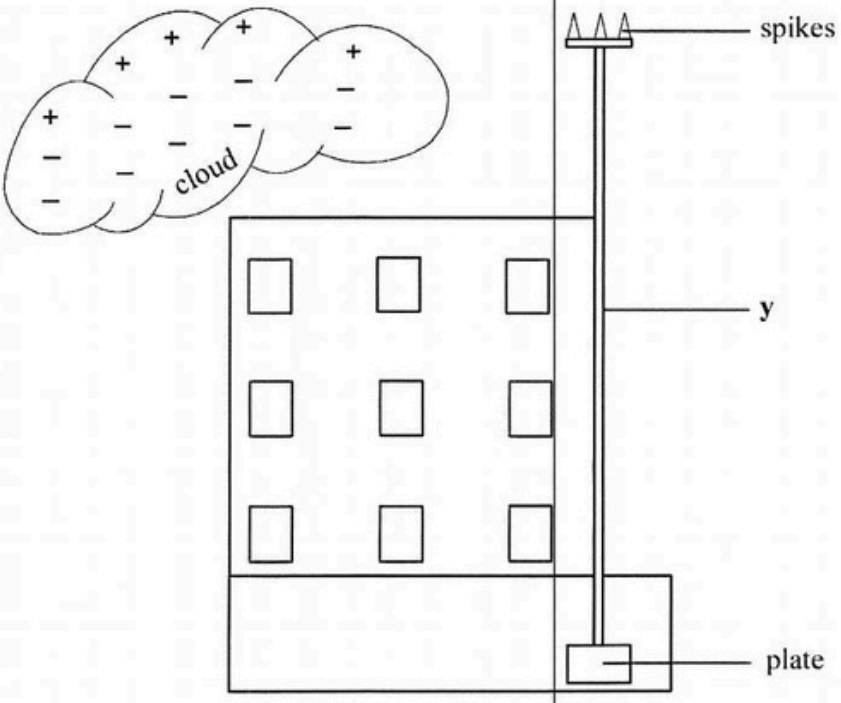


Fig. 2.3

(i) Name a suitable material which should be used to make the thick strip **y**.

_____ [1]

(ii) State what happens in the lightning conductor as the negatively charged cloud passes over the building.

_____

_____ [1]

(iii) Identify the type of charge left on the spikes after the cloud passes over the building.

_____ [1]

(iv) State how this charge on the spikes affect the nearby air molecules.

_____ [1]

TOTAL MARKS [10]

3. This question is about electrical circuits.

Fig. 3.1 shows two identical lamps connected to a dry cell and four ammeters.

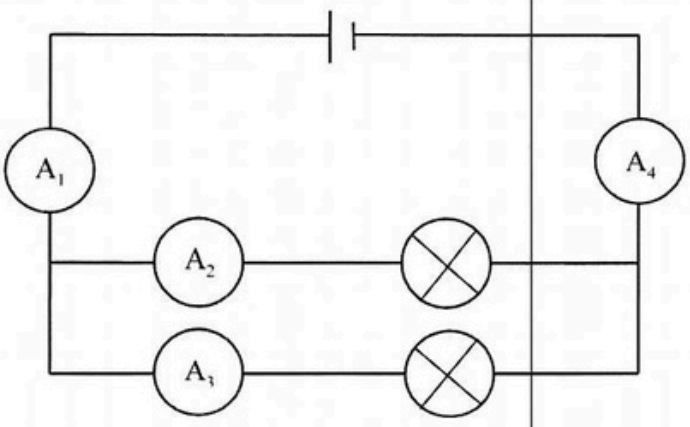


Fig. 3.1

(a) (i) Draw an arrow on the diagram to show clearly the conventional direction of the current from the dry cell. [1]

(ii) State how the lamps are connected in the circuit.

_____ [1]

(iii) The ammeter reading on A_1 is 1.5A and on A_2 it is 0.75A. Find the readings on

ammeter A_3 _____

ammeter A_4 _____ [2]

(iv) If a second identical dry cell is connected in series to the first one, what will be the reading on ammeter A_1?

_____ [2]

(b) Fig. 3.2 shows a simple circuit.

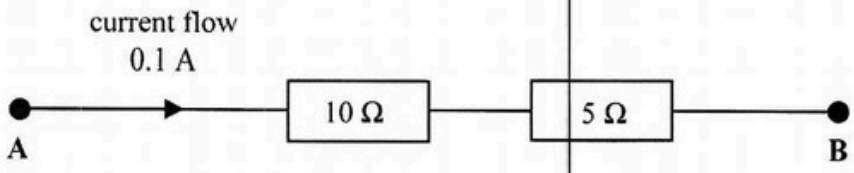


Fig. 3.2

Calculate the

(i) resistance between **A** and **B**;

[2]

(ii) potential difference between A and B.

[2]

TOTAL MARKS [10]

4. This question is about the kinetic theory of matter, changes of state and density.
Fig. 4.1 shows the apparatus used for cooling 16 g of warmed liquefied wax.

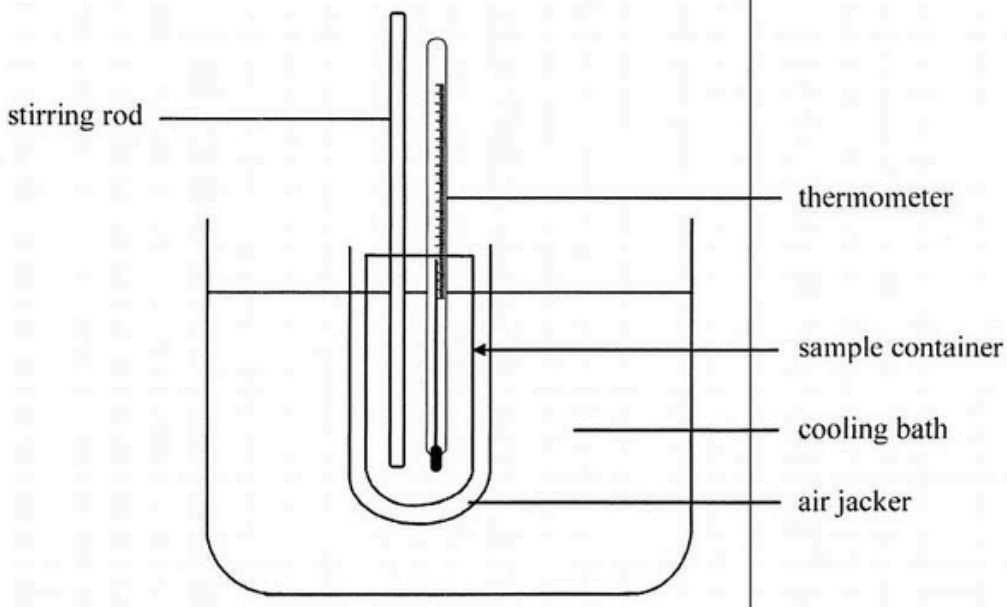


Fig. 4.1

(a) The liquefied wax has a density of 0.8 g/cm^3. Calculate the volume of the liquefied wax.

[3]

(b) (i) The liquefied wax is allowed to cool. State the effect that cooling would have on the volume occupied by the wax.

_____ [1]

(ii) A piece of solid wax has a density of 0.4 g/cm^3. State whether or not this wax will float or sink in water. Give a reason for your answer.
(Density of water = 1 g/cm^3)

_____

_____

_____ [2]

(c) Fig. 4.2 shows the cooling curve of the wax.

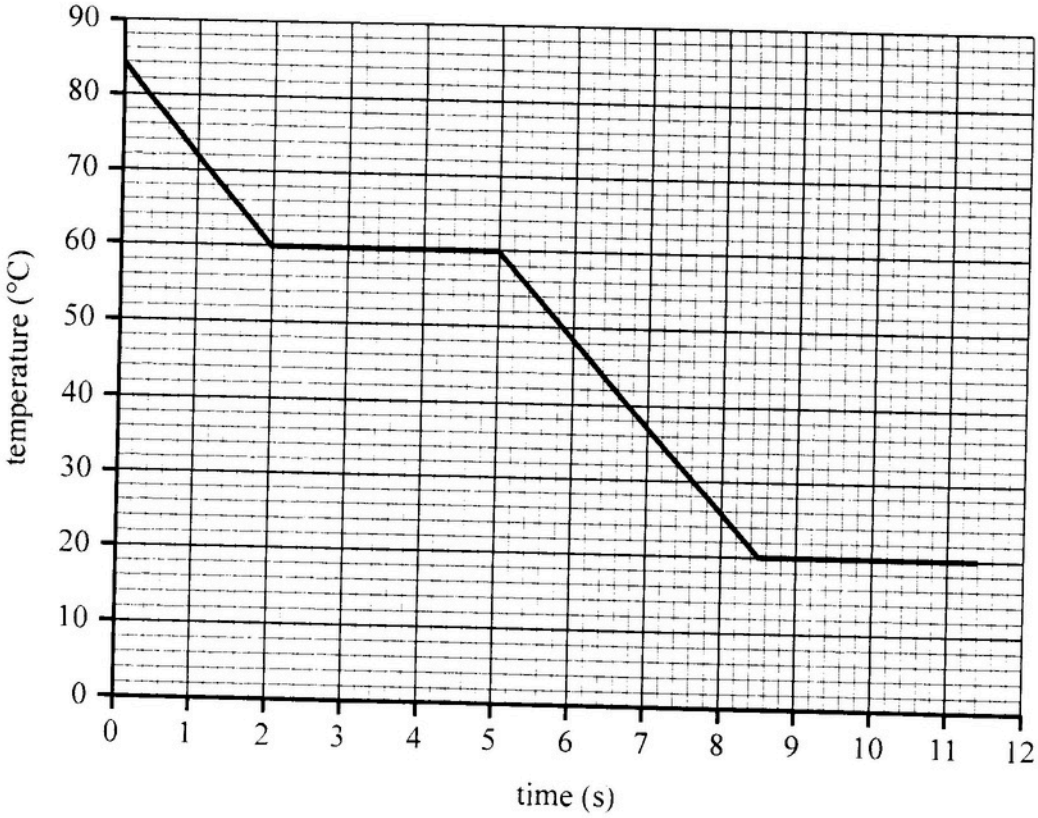


Fig. 4.2

(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 the freezing point of the wax.

_____ [1]

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

_____ [1]

TOTAL MARKS [10]

5. This question is about Newton's Laws of Motion.

Fig. 5.1 shows a simplified diagram of forces acting on a man swimming forward in a pool.

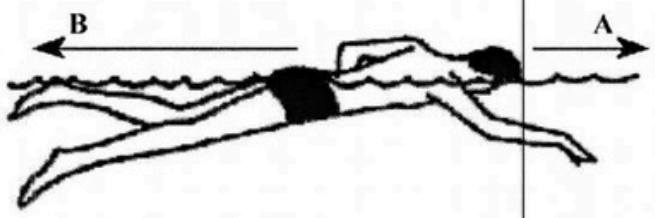


Fig. 5.1

(a) (i) Name the **TWO** horizontal forces **A** and **B**.

A _____

B _____ [2]

(ii) Describe how the forward motion of the swimmer will change if the size of

A is greater than **B**; _____

A is equal to **B**. _____ [2]

(iii) Describe **ONE** way the swimmer can reduce the magnitude of **A**.

_____ [1]

(iv) The swimmer's acceleration can be calculated using the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

If the swimmer's change in velocity over 3 s is 1.2 m/s, what is his acceleration?

[2]

(b) State which of Newton's Laws is applicable in each of the following cases.

(i) A swimmer moving forward at constant speed.

_____ [1]

(ii) A swimmer who produces greater thrust will accelerate more.

_____ [1]

(c) State the equation that links acceleration, force and mass.

_____ [1]

TOTAL MARKS [10]

6. This question is about mass and weight.

(a) An astronaut has a weight of 900 N on earth, where the gravitational field strength is approximately 10 N/kg.

Fig. 6.1

Find the astronaut's mass on the earth.

[2]

(b) The astronaut then travels to the moon where the gravitational field strength is one-sixth of that on earth.

On the surface of the moon, find the astronaut's

(i) mass;

[1]

(ii) weight.

[3]

(c) State **TWO** factors that affect the weight of an object?

_____

_____ [2]

(d) State **TWO** ways in which mass differs from weight.

1. _____

_____

2. _____

_____ [2]

TOTAL MARKS [10]

7. Fig. 7.1 and Fig. 7.2 show two views of a vertical wire carrying a current up through a horizontal card. Points P and Q are marked on the card.

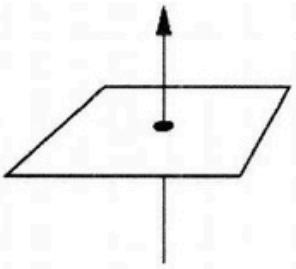
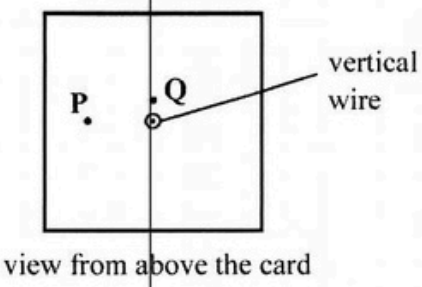


Fig. 7.1



view from above the card

Fig. 7.2

(a) (i) On the horizontal card on Fig. 7.1 draw a complete magnetic field line (line of force) and indicate its direction with an arrow. [2]

(ii) Two compasses are placed at points **P** and **Q** on Fig. 7.2. On Fig. 7.2, indicate using arrows the direction that each compass needle would point. [2]

(iii) Name a suitable material that could be used to make the compass needle.

_____ [1]

(b) State the effect, on the direction in which compasses **P** and **Q** point, of

(i) increasing the current in the wire,

_____ [1]

(ii) reversing the direction of the current in the wire.

_____ [1]

(c) Fig. 7.3 shows the view from above of another vertical wire carrying a current up through a horizontal card. A centimetre (cm) grid is marked on the card. Point **W** is 1 cm vertically above the top surface of the card.

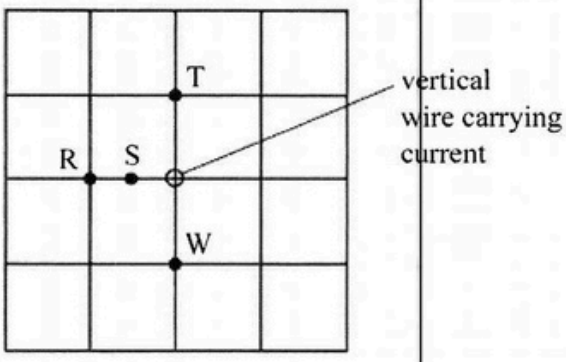


Fig. 7.3

State the magnetic field strength at **S**, **T** and **W** in terms of the magnetic field strength at **R**.

Use **weaker**, **same strength** or **stronger** for each answer.

S _____

T _____

W _____ [3]

TOTAL MARKS [10]

8. This question is about transformers.

Figure 8.1 shows a diagram of a transformer circuit used to charge car batteries.

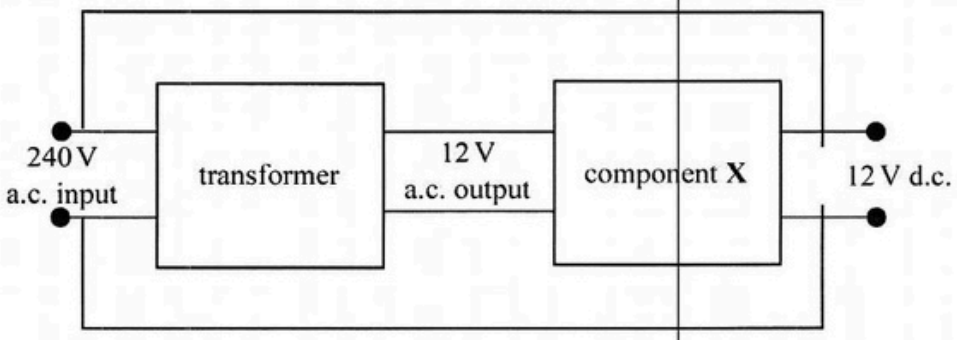


Fig. 8.1

(a) Name the type of transformer represented in Fig. 8.1

_____ [1]

(b) Component **X** converts a.c. to d.c.

(i) Name a suitable device for component **X**.

_____ [1]

(ii) Give the name of this process, of converting a.c. to d.c.

_____ [1]

(iii) A transformer has a primary coil of 50 turns and a secondary coil of 1 250 turns. What primary voltage is needed for the secondary voltage of 500 V to be obtained? (Show clearly all steps in your calculations).

[3]

(c) (i) State whether the transformer would work on a direct current input.

_____ [1]

(ii) Explain your answer to (c)(i).

_____

_____ [3]

TOTAL MARKS [10]

End]

3117/3

BGCSE

School Number	Candidate Number

Surname and Initials

PHYSICS

PAPER 3 3117/3

Thursday 6 JUNE 2013 12:30 P.M.–2:30 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 [ ].

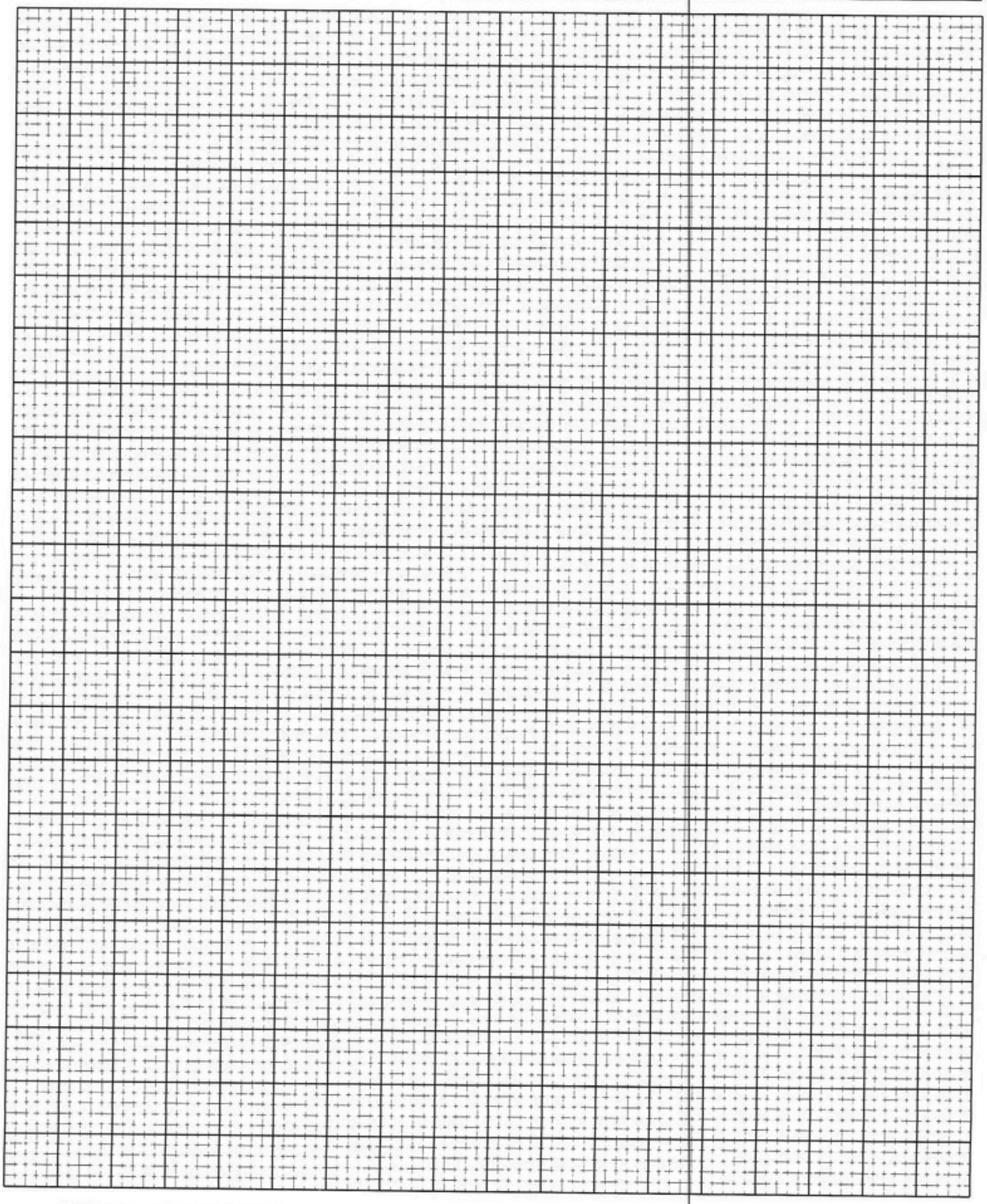
This question paper consists of 15 printed pages, 4 lined pages and 1 blank page.

SCIENCE GRAPH PAPER

MINISTRY OF EDUCATION
BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

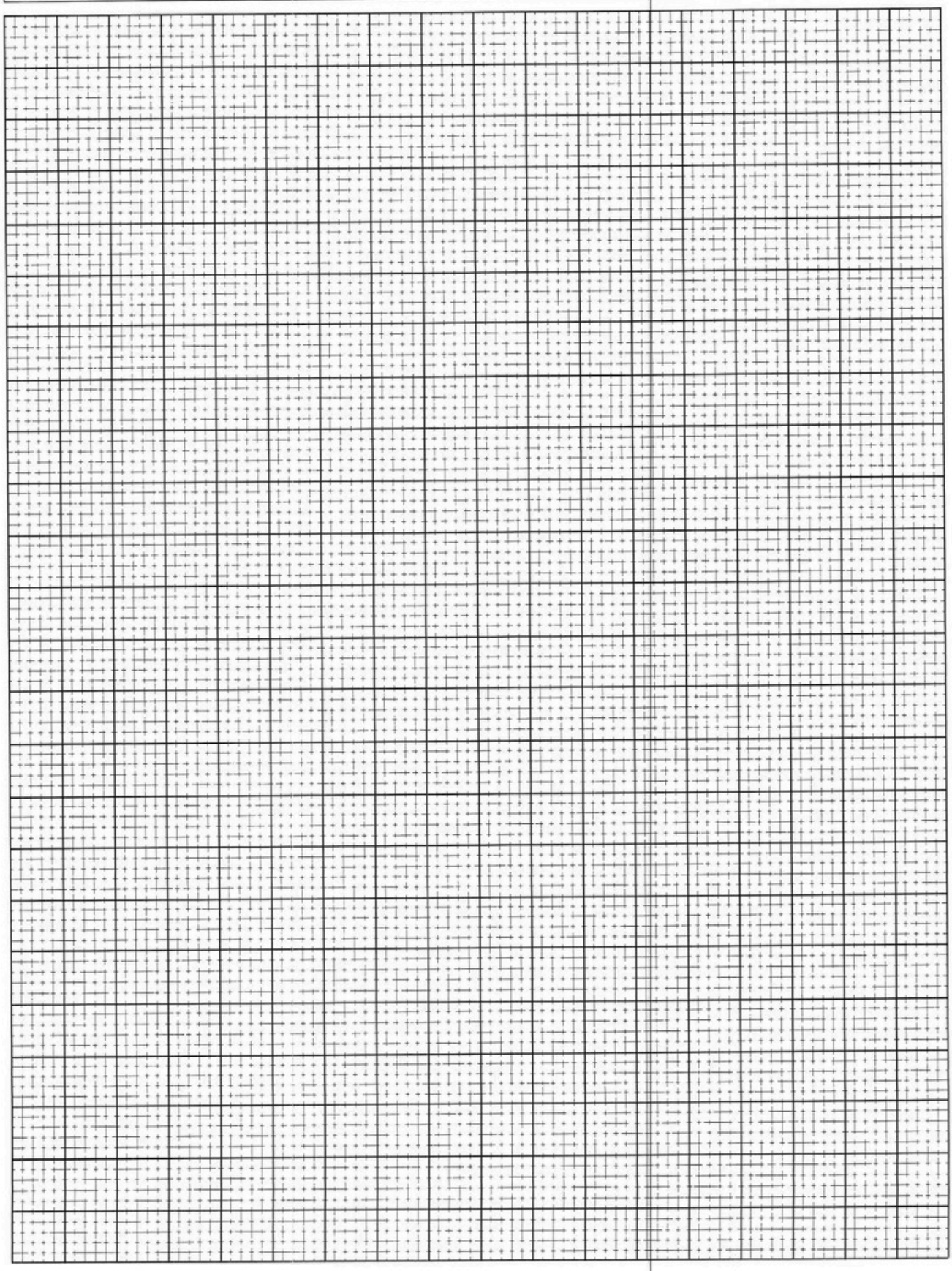
AB7

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



EXAMINATION

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



Section A

1. This question is about linear motion.

Fig. 1.1 shows the motion of two students, Susan and Kelly, as they begin their walk home from school. Kelly's motion is incomplete.

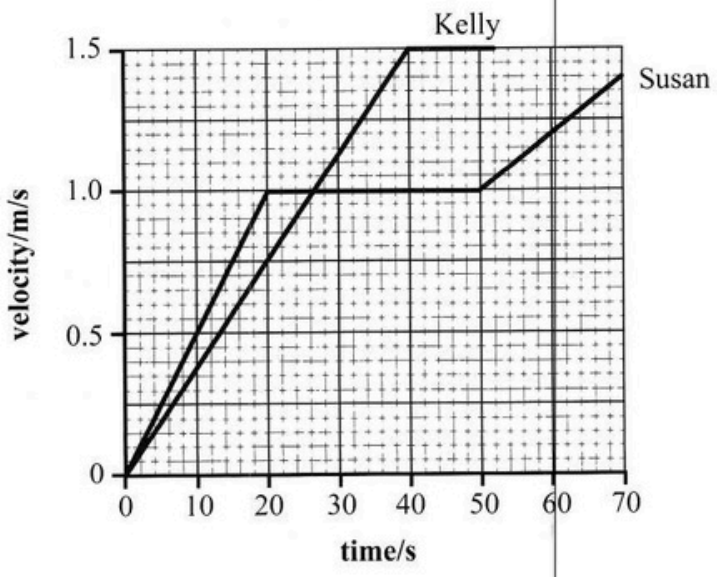


Fig. 1.1

(a) (i) Compare and contrast Kelly and Susan's motion for the first 20 seconds of the journey.

_____

_____

_____ [2]

(ii) State the time at which both girls had the same velocity.

_____ [1]

(b) (i) Calculate the total distance travelled by Susan during the first 70 s of her journey.

[4]

(ii) Calculate Susan's average velocity for the whole journey.

[1]

(c) How much longer must Kelly, travelling at 1.5 m/s, take to complete her journey, if she covered the same distance as Susan?

[2]

TOTAL MARKS [10]

2. This question is about electrical circuits.

(a) A student is given a bag of 2 Ω resistors and asked to connect them in circuits to give a range of total resistances. Using the smallest number of 2 Ω resistors, draw the resistor combinations to obtain the following resistances:

(i) 4 Ω

(ii) 1 Ω

(iii) 3 Ω

(iv) 2/3 Ω (0.67 Ω)

[7]

(b) The resistor combination with the total resistance of 5 Ω is connected to a dry cell, with a potential difference of 1.5 V. Calculate the current in the circuit.

[3]

TOTAL MARKS [10]

3. This question is about refraction.

Fig. 3.1 shows a ray of light passing through a semi-circular glass block.

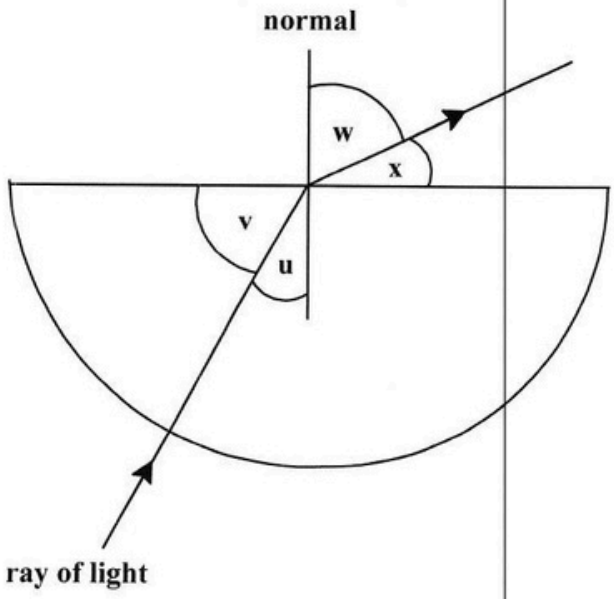


Fig. 3.1

(a) (i) Explain why the ray is not deviated when it enters the glass block.

_____

_____

_____ [2]

(ii) Explain why the ray of light deviates when it leaves the glass block.

_____

_____

_____ [2]

(iii) Write down an expression for the refractive index, of glass to air, using two of the lettered angles.

_____

_____ [1]

(b) Angle **u** is increased until the out-going ray just skims the surface of the block.

(i) What name is given to angle **u** when this takes place?

_____ [1]

(ii) If the refractive index of the glass is 1.5, calculate the value of angle **u**.

[2]

(iii) On Fig. 3.1, draw a ray of light travelling into the glass block with an angle **u** of about 85°. Show the passage of the ray of light as it passes through the glass block. [1]

State the name given to this effect.

_____ [1]

TOTAL MARKS [10]

4. This question is about Hooke's Law.

Fig. 4.1 shows an experiment to investigate the relationship between force and extension using a spiral spring.

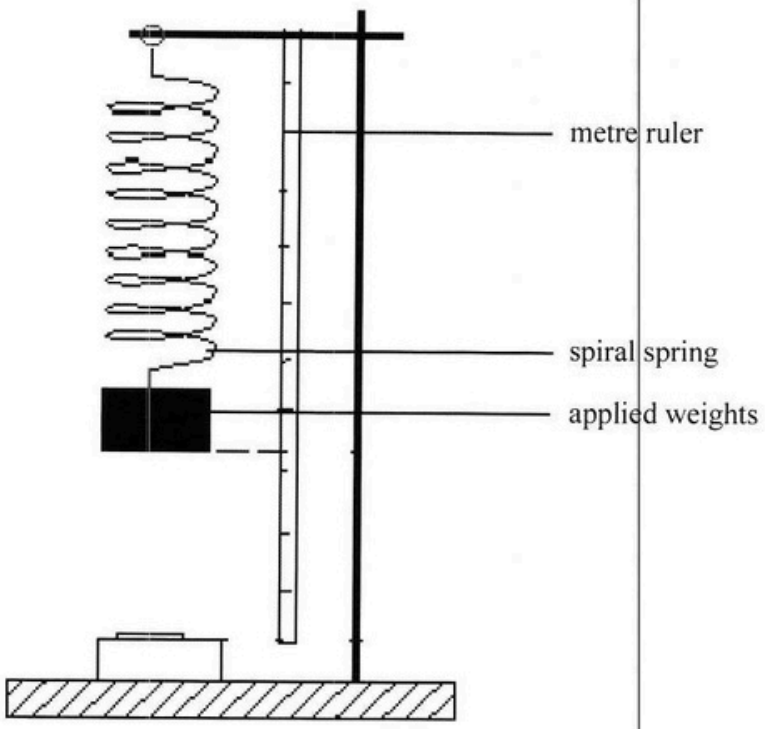


Fig. 4.1

(a) An applied weight of 3 N is added to the spring. The spring extends to length of 12 cm, the original length of the spring with no applied weight was 8 cm.

(i) The spiral spring obeys Hooke's Law. Calculate the weight on the spring when the **extension** is 10 cm.

[2]

(ii) If the elastic limit is not exceeded, what weight must be added to the spring for its **total length** to be 32 cm?

[3]

(iii) If two identical springs were joined one below the other, describe how the extension would change if the weight in (a)(ii) was added to the bottom spring.

_____ [1]

(b) The student conducted another investigation by adding similar weights to spiral springs made of three different materials.

A force/extension graph of the three materials is shown in Fig. 4.2.

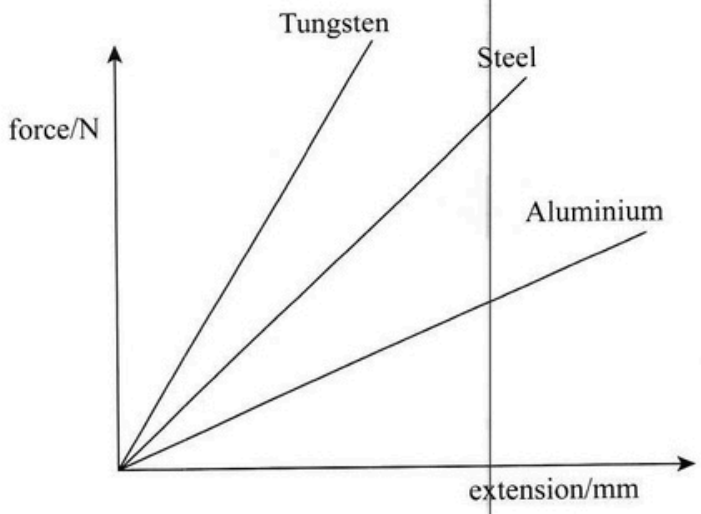


Fig. 4.2

(i) Give the name the material tested which produces the greatest extension for unit force applied.

_____ [1]

(ii) The force/extension graph in Fig. 4.3 show the results obtained for the steel spring used.

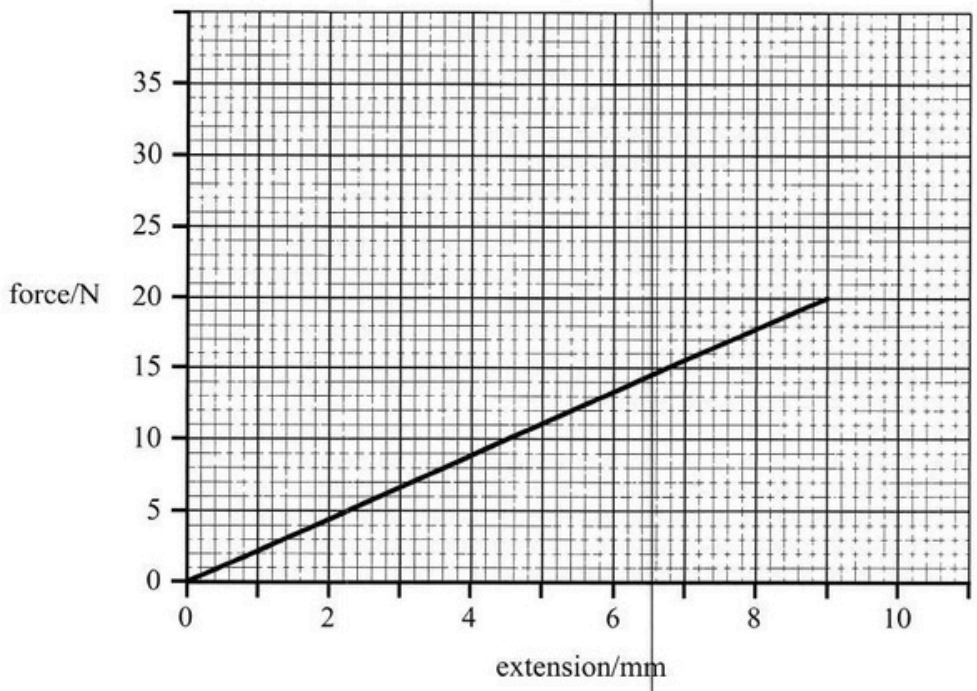


Fig. 4.3

When manufacturing a spring, an engineer will make use of a property known as the **spring constant**. The spring constant can be found by calculating the gradient of the line from a force against extension graph.

Calculate the spring constant of the steel spring used for this investigation.

[3]

TOTAL MARKS [10]

Section B

5. This question is about isotopes and radioactive decay.

Fig. 5.1 shows a radioactive decay series. Nucleus **A** decays to nucleus **B** and in successive stages to nucleus **E**, whose proton number (number of protons) is 90 and nucleon number (number of neutrons and protons) is 230.

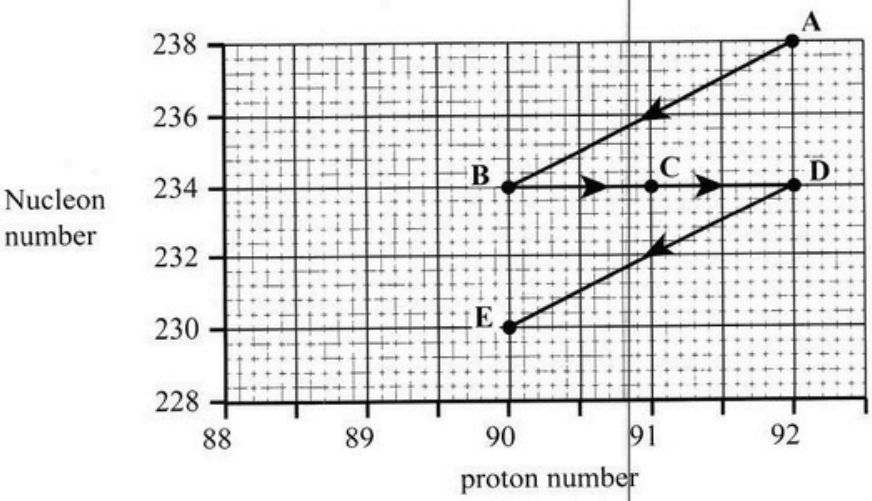


Fig. 5.1

(a) How many neutrons are contained in nucleus **A**? [2]

(b) What is the nucleon number of nucleus **E**? [2]

(c) Name the radiation emitted in the changes

(i) **B** to **C**

(ii) **D** to **E** [2]

(d) Nucleus **D** and another nucleus form atoms which are isotopes.
Name the other nucleus. [1]

(e) The count from a radioactive isotope is measured at the same time each day. The results are shown in the table.

time/days	0	1	2	3	4	5	6
count/min	12000	7650	5000	3300	2150	1400	900

On the graph paper, plot a graph of the data recorded in the table, count (y-axis) against time (x-axis). [8]

From the graph:

(f) (i) Write the time when the count rate is 4000. [1]

(ii) Write the time when the count rate is 2000. [1]

(iii) Find the value of the half-life. [2]

(iv) Find the count rate after 2.5 days. [1]

TOTAL MARKS [20]

6. This question is about work, energy and power.

Fig. 6.1 shows a winch and a motor attached to a power supply which is used to lift small loads to a height of 5 m. An inextensible rope is passed over a frictionless pulley as shown in the diagram.

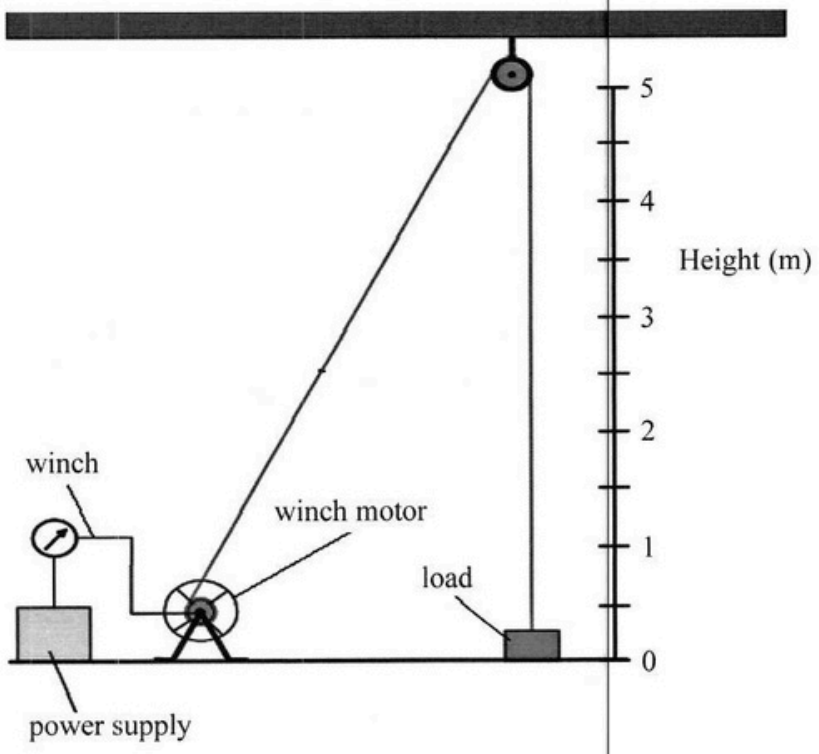


Fig. 6.1

(a) Define the following terms:

(i) Power,

(ii) efficiency. [2]

(b) State how the useful work output of the motor could be determined. [1]

(c) Table 6.1 shows the data recorded as different loads were lifted.

load (N)	distance (m)	time (s)	current (A)	voltage (V)	electrical energy supplied (J)	potential energy gained (J)	efficiency
2	5	9.8	0.5	6			
4	5	10.4	0.6	6			
6	5	10.5	0.7	6			
8	5	10.8	0.8	6			
10	5	10.9	0.9	6			
12	5	11.0	0.9	6			
14	5	12.0	1.0	6			
16	5	15.5	1.1	6			
18	5	11.4	2.2	6			

Table 6.1

(i) Copy and complete Table 6.1, by calculating the energy supplied by the motor in joules;

(ii) the potential energy gained by the load and

(iii) the efficiency of the motor (to two decimal places) for each load lifted. [6]

(d) (i) Plot a graph of efficiency (y axis) against load (x axis). [5]

(ii) At what load is the efficiency at its maximum? [1]

(iii) State what effect, decreasing the electrical energy, would have on the efficiency of the motor, for loads less than 14 N. [1]

(iv) Suggest one way in which the electrical energy supplied to the motor is wasted. [1]

(e) A 6 kW motor is used to lift a mass of 1400 kg a height of 13 m. Given that the operation takes 40 seconds, calculate the efficiency of the motor used for lifting this mass. [3]

TOTAL MARKS [20]

7. This question is about machines and moments.

A construction worker uses the block and tackle pulley system as shown in Fig. 7.1. to lift cement of weight 5 000 N, to a height of 15 m using an effort of 900 N.

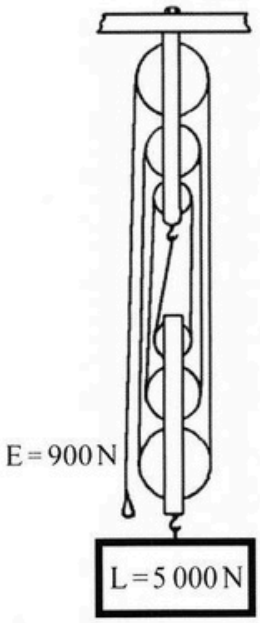


Fig. 7.1

(a) (i) Define the term **velocity ratio**. [1]

(ii) State the velocity ratio of the block and tackle pulley system shown in Fig. 7.1. [1]

(b) Calculate the:

(i) distance moved by the effort, in lifting the 5 000 N load to the height of 15 m, [2]

(ii) work done by construction worker, in using the block and tackle pulley system to lift the 5 000 N load. (assume the lower block has zero mass), [2]

(iii) state the potential energy gained by the load, [2]

(iv) mechanical advantage of the block and tackle pulley system, [2]

(v) % efficiency of the block and tackle pulley system. [2]

(c) A student uses a simplified model of a single moveable pulley as shown in Fig. 7.2 to lift various loads, while using a spring balance to record the effort used in each case.

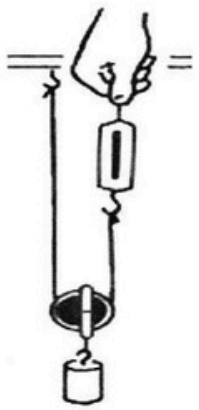


Fig. 7.2

Table 7.1 shows the results of this investigation.

load/N	1.50	3.00	4.50	6.00	9.00
effort/N	0.75	1.50	2.25	3.00	4.50

Table 7.1

(i) Plot a graph of load on the *y*-axis against effort on the *x*-axis. [5]

(ii) Find the gradient of the graph and hence state the mechanical advantage of the pulley used. [3]

TOTAL MARKS [20]

End]