

## Location Entry Codes

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As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

<b>Question Paper</b>	<b>Mark Scheme</b>	<b>Principal Examiner's Report</b>
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

### **Who can I contact for further information on these changes?**

Please direct any questions about this to CIE's Customer Services team at:

[international@cie.org.uk](mailto:international@cie.org.uk)

The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

- First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

- Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

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NUMBER

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CANDIDATE  
NUMBER

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**PHYSICS**

Paper 3 Extended

**0625/31**

**May/June 2009**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

You may lose marks if you do not show your working or if you do not use appropriate units.

Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall = 10 m/s<sup>2</sup>).

At the end of the examination, fasten all your work securely together.

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

This document consists of **20** printed pages.



- 1 An engineering machine has a piston which is going up and down approximately 75 times per minute.

Describe carefully how a stopwatch may be used to find accurately the time for one up-and-down cycle of the piston.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

- 2 (a) A certain volume of water at room temperature and the same volume of ice in a freezer are each heated through the same temperature rise.

Which of them will have the greater expansion, and why?

Which? .....

Why? ..... [1]

- (b) For strength, concrete pillars are usually reinforced with metal rods, which are embedded in the concrete before it sets.

The list below shows how much a length of 1 m of each material expands when the temperature rises by 1 °C.

aluminium	0.03 mm
concrete	0.01 mm
steel	0.01 mm

Use this information to decide which metal should be used to reinforce concrete, why it is suitable, and why the other metal is not suitable.

Which metal should be used? .....

Why is it suitable? .....

Why is the other metal unsuitable? .....

..... [3]

[Total: 4]

- 3 (a) Fig. 3.1 shows a skier descending a hillside. Fig. 3.2 shows the speed/time graph of his motion.

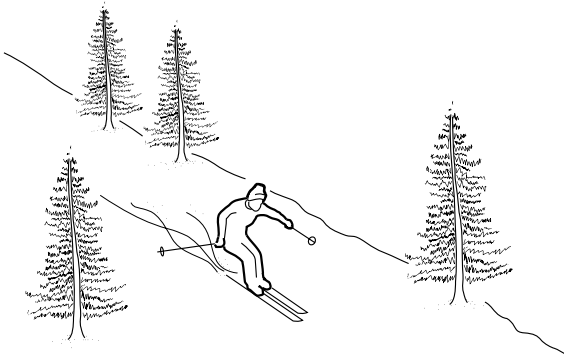


Fig. 3.1

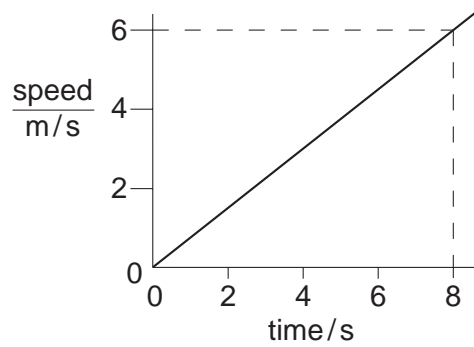


Fig. 3.2

- (i) How can you tell that the acceleration of the skier is constant during the 8 s shown on the graph?

..... [1]

- (ii) Calculate the acceleration of the skier.

acceleration = ..... [2]

- (b) Another skier starts from rest at the top of the slope. As his speed increases the friction force on the skier increases.

- (i) State the effect of this increasing friction force on the acceleration.

..... [1]

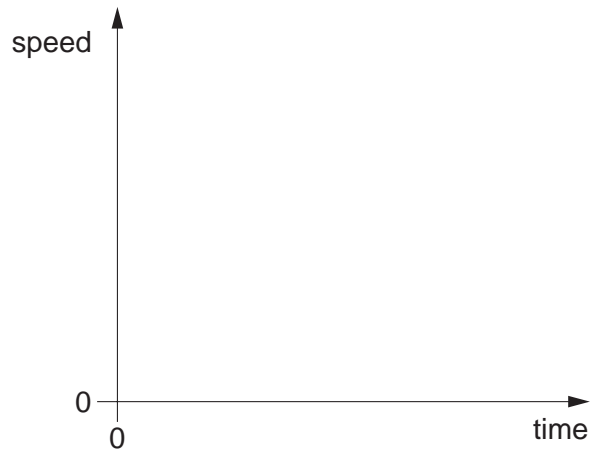
- (ii) Eventually the speed of the skier becomes constant.

What can be said about the friction force when the speed is constant?

..... [2]

- (iii) 1. On the axes of Fig. 3.3, sketch a possible speed/time graph for the motion of the second skier.

*For  
Examiner's  
Use*



**Fig. 3.3**

2. On your graph, mark with the letter A a region where the acceleration is not constant. Mark with the letter B the region where the speed is constant. [4]

[Total: 10]

- 4 (a) In an accident, a truck goes off the road and into a ditch. Two breakdown vehicles A and B are used to pull the truck out of the ditch, as shown in Fig. 4.1.

For  
Examiner's  
Use

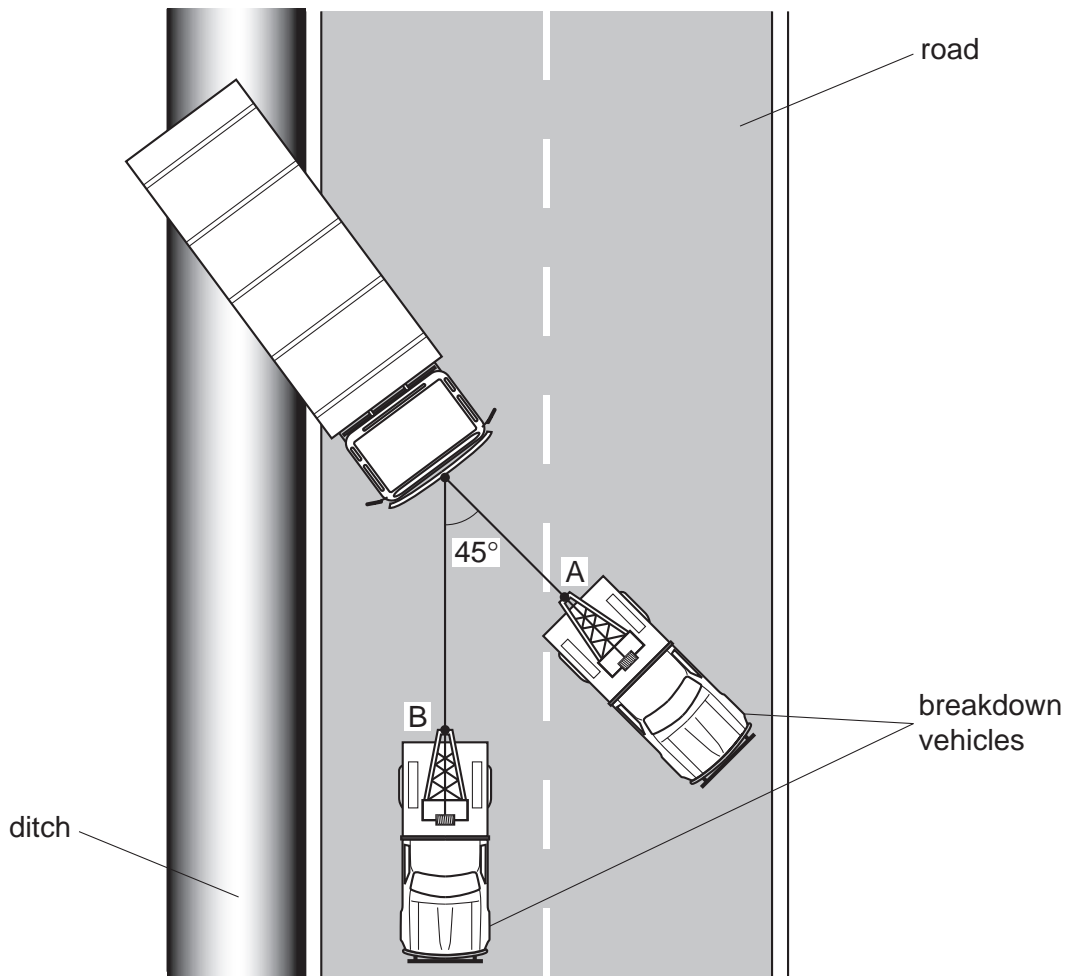


Fig. 4.1

At one point in the rescue operation, breakdown vehicle A is exerting a force of 4000 N and breakdown vehicle B is exerting a force of 2000 N.

For  
Examiner's  
Use

- (i) Using a scale of 1 cm = 500 N, make a scale drawing to show the resultant force on the truck.

[4]

- (ii) Use your diagram to find the magnitude and direction of the resultant force on the truck.

magnitude of resultant force = .....

direction of resultant force = ..... to direction of road [2]

- (b) (i) State why the resultant force is an example of a vector quantity.

..... [1]

- (ii) Give an example of a vector quantity that is not a force.

..... [1]

[Total: 8]



- 5 A wind turbine has blades, which sweep out an area of diameter 25 m.

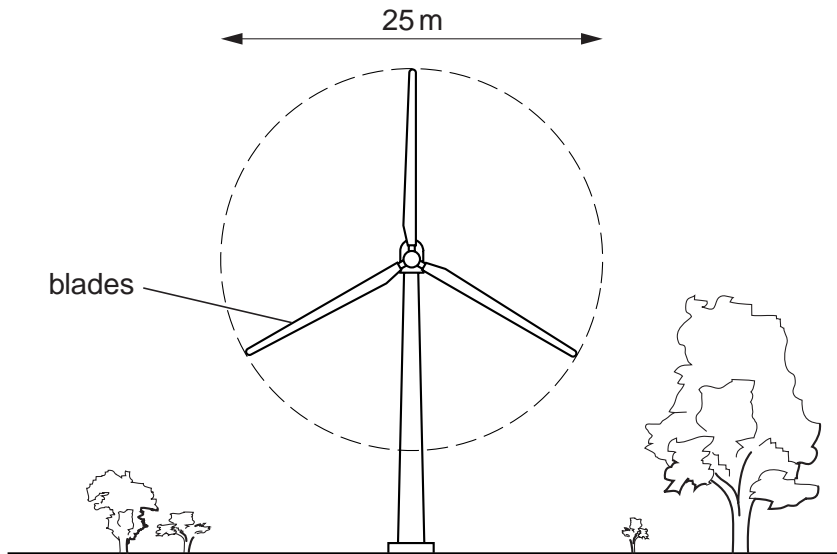


Fig. 5.1

- (a) The wind is blowing directly towards the wind turbine at a speed of 12 m/s. At this wind speed, 7500 kg of air passes every second through the circular area swept out by the blades.
- (i) Calculate the kinetic energy of the air travelling at 12 m/s, which passes through the circular area in 1 second.

kinetic energy = ..... [3]

- (ii) The turbine converts 10% of the kinetic energy of the wind to electrical energy.

Calculate the electrical power output of the turbine. State any equation that you use.

power = ..... [3]

(b) On another day, the wind speed is half that in (a).

(i) Calculate the mass of air passing through the circular area per second on this day.

mass = ..... [1]

(ii) Calculate the power output of the wind turbine on the second day as a fraction of that on the first day.

fraction = ..... [3]

[Total: 10]

For  
Examiner's  
Use

6 (a) A man squeezes a pin between his thumb and finger, as shown in Fig. 6.1.

For  
Examiner's  
Use

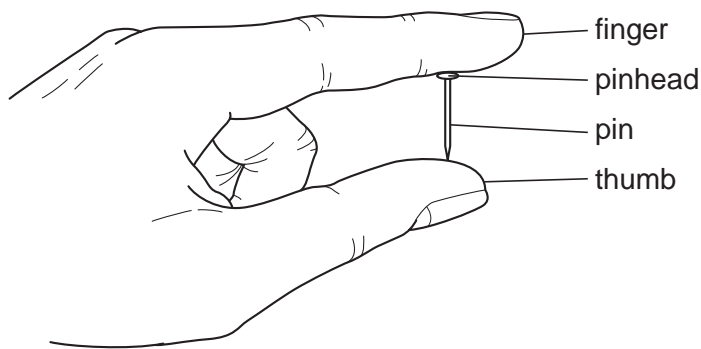


Fig. 6.1

The finger exerts a force of 84 N on the pinhead.

The pinhead has an area of  $6.0 \times 10^{-5} \text{ m}^2$ .

(i) Calculate the pressure exerted by the finger on the pinhead.

pressure = ..... [2]

(ii) State the value of the force exerted by the pin on the thumb.

..... [1]

(iii) Explain why the pin causes more pain in the man's thumb than in his finger.

.....  
 ..... [2]

(b) The density of the water in a swimming pool is  $1000 \text{ kg/m}^3$ . The pool is 3 m deep.

(i) Calculate the pressure of the water at the bottom of the pool.

pressure = ..... [2]

(ii) Another pool has the same depth of water, but has twice the area.

State the pressure of the water at the bottom of this pool.

pressure = ..... [1]

[Total: 8]

For  
Examiner's  
Use

- 7 (a) Some water is poured onto a plastic table-top, forming a puddle. The same volume of water is poured into a plastic dish, which is placed alongside the puddle. This is illustrated in Fig. 7.1.

For  
Examiner's  
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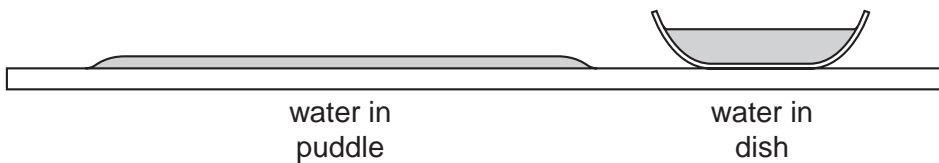


Fig. 7.1

Both lots of water begin to evaporate.

- (i) In terms of the behaviour of molecules, describe what happens during the process of evaporation.

.....  
 .....  
 .....  
 ..... [2]

- (ii) Explain why the puddle dries out more rapidly than the water in the dish.

.....  
 .....  
 .....  
 ..... [2]

- (iii) State two changes that would make both lots of water evaporate more rapidly.

1. ....  
 2. .... [2]

(b) In a place where refrigeration is not possible, a person attempts to keep a bottle of milk cool by using the procedure illustrated in Fig. 7.2.

For  
Examiner's  
Use

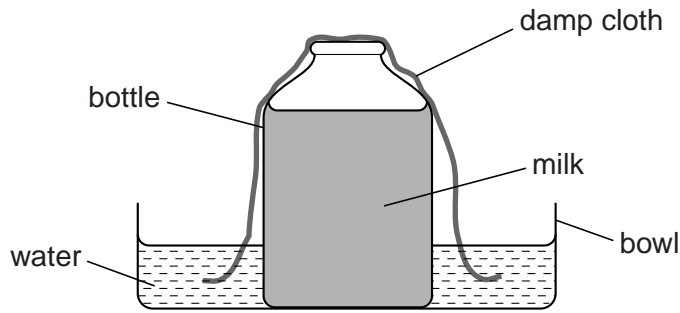


Fig. 7.2

Explain in terms of molecules why this procedure would be successful.

.....

.....

..... [3]

[Total: 9]

- 8 In an optics lesson, a Physics student traces the paths of three rays of light near the boundary between medium A and air. The student uses a protractor to measure the various angles.

For  
Examiner's  
Use

Fig. 8.1 illustrates the three measurements.

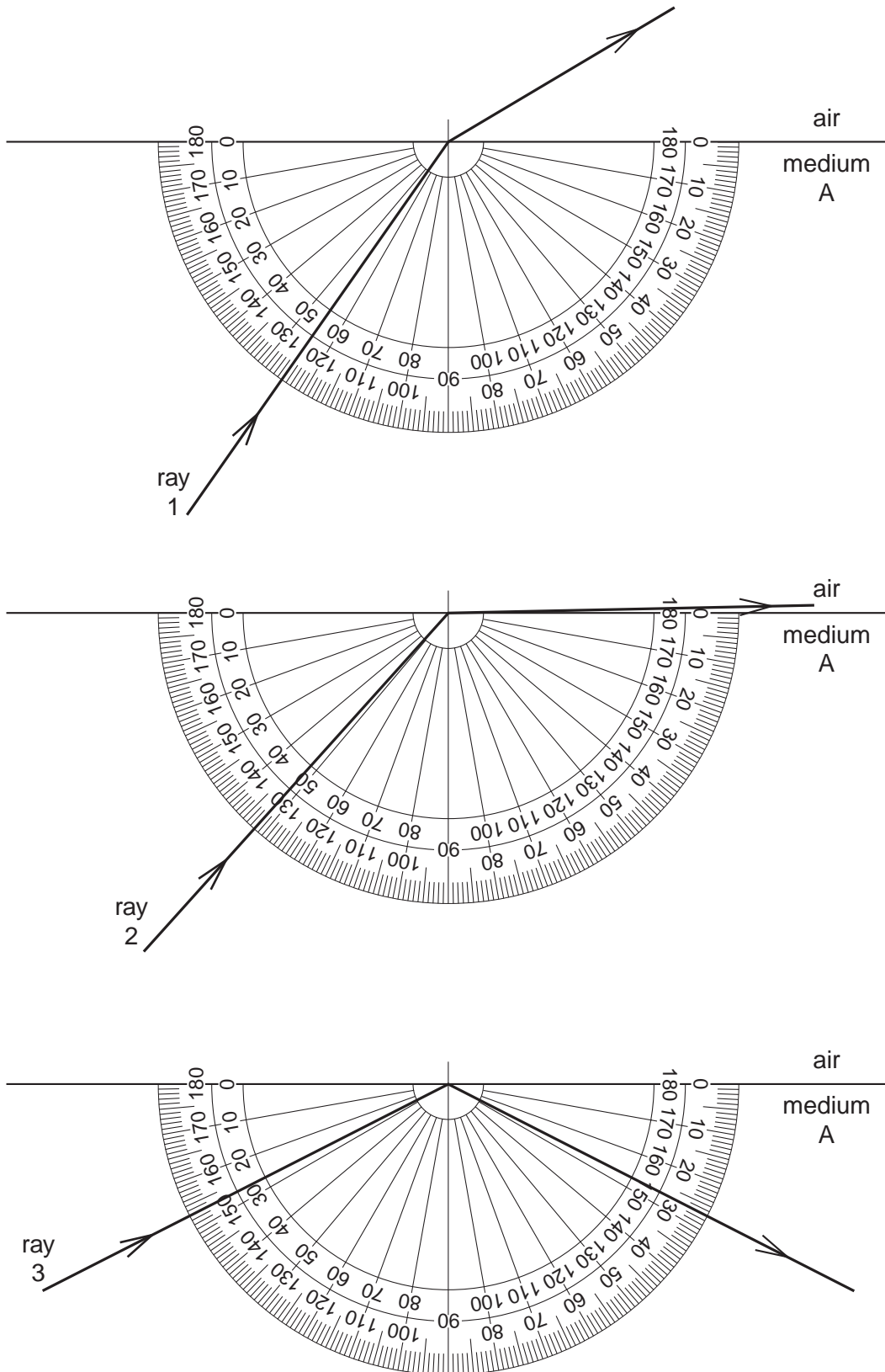


Fig. 8.1

(a) State which is the optically denser medium, A or air, and how you can tell this.

.....  
..... [1]

(b) State in which medium the light travels the faster, and how you know this.

.....  
..... [1]

(c) State the critical angle of medium A.

..... [1]

(d) State the full name for what is happening to ray 3.

..... [1]

(e) The refractive index of medium A is 1.49.

**Calculate** the value of the angle of refraction of ray 1, showing all your working.

angle of refraction = ..... [2]

(f) The speed of light in air is  $3.0 \times 10^8$  m/s.

Calculate the speed of light in medium A, showing all your working.

speed of light = ..... [2]

[Total: 8]



- 9 (a) Fig. 9.1 shows an a.c. supply connected in series to a diode and a resistor.

For  
Examiner's  
Use

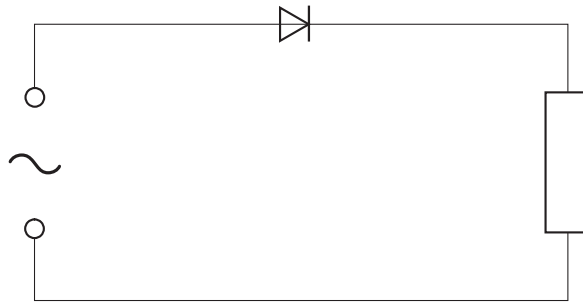


Fig. 9.1

On the axes of Fig. 9.2, draw a graph showing the variation of the current in the resistor. [1]

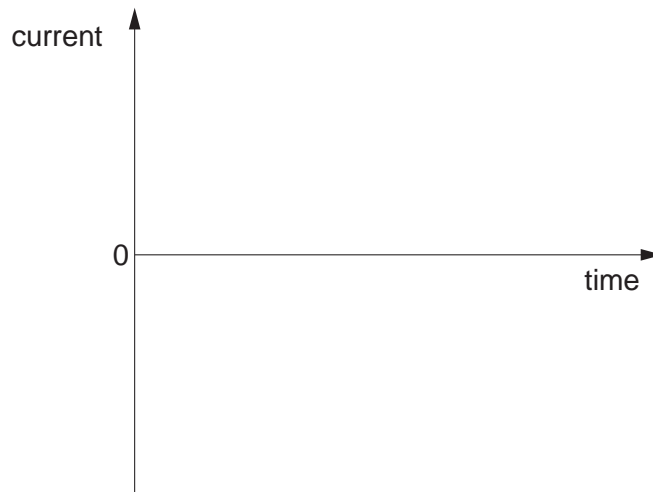
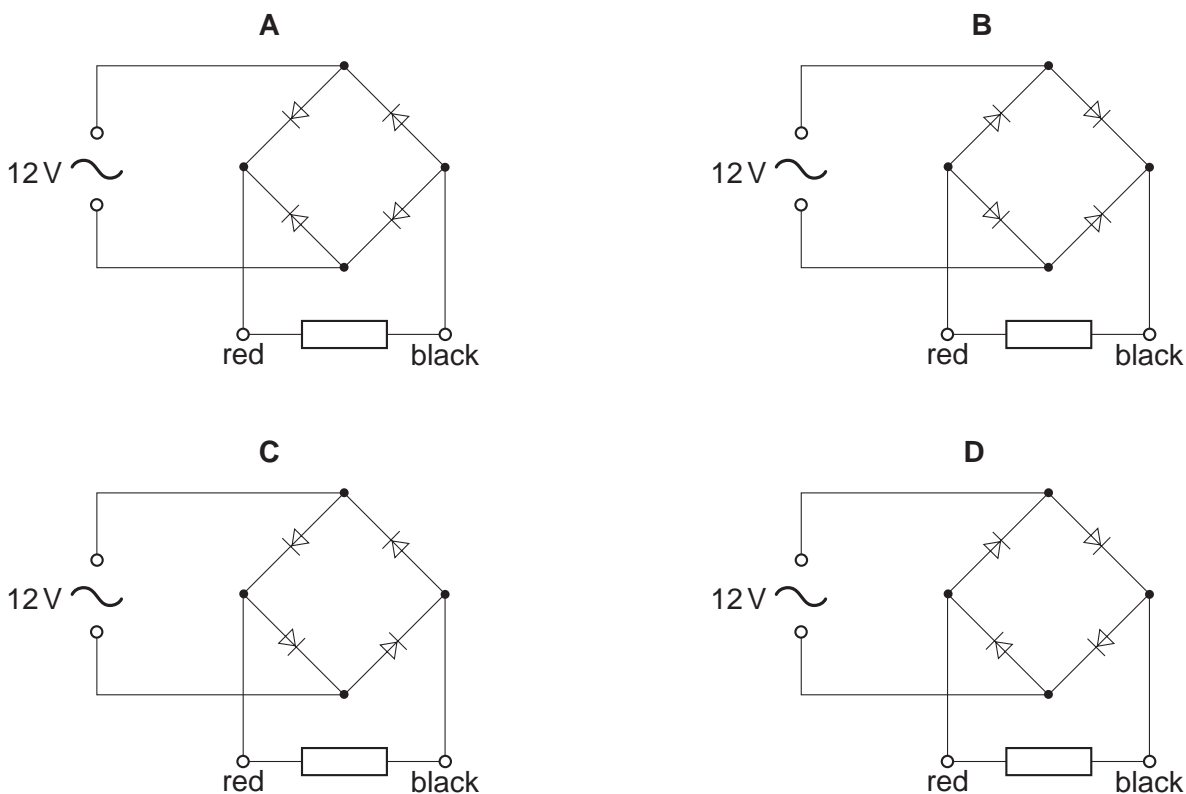


Fig. 9.2

(b) Fig. 9.3 shows four attempts, **A**, **B**, **C** and **D**, to connect a circuit known as a bridge rectifier.

The circuit is connected to a 12V a.c. supply.



**Fig. 9.3**

(i) In which circuit will the direction of the conventional current in the resistor always be from red to black?

..... [1]

(ii) On the circuit you chose in (b)(i), clearly indicate with arrows the path of the conventional current in the circuit when the upper terminal of the a.c. supply is positive with respect to the lower terminal. [2]

[Total: 4]

10 The circuit shown in Fig. 10.1 uses a 12V battery.

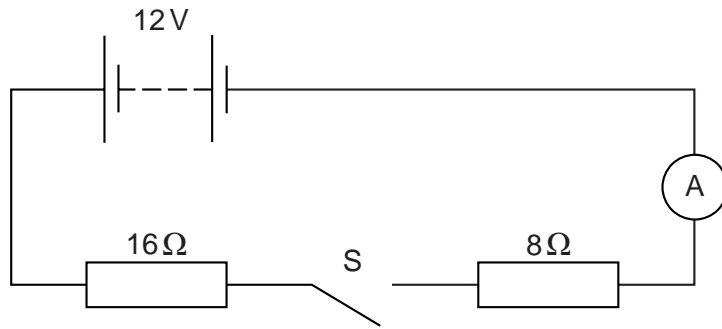


Fig. 10.1

(a) Switch S is open, as shown in Fig. 10.1.

State the value of

(i) the reading on the ammeter,

reading = ..... [1]

(ii) the potential difference (p.d.) across S.

p.d. = ..... [1]

(b) Switch S is now closed.

(i) Calculate the current in the ammeter.

current = ..... [2]

(ii) Calculate the p.d. across the  $8\Omega$  resistor.

p.d. = ..... [2]

- (c) The two resistors are now connected in parallel.

Calculate the new reading on the ammeter when S is closed, stating clearly any equations that you use.

For  
Examiner's  
Use

reading = ..... [4]

[Total: 10]

**Question 11 is on the next page.**

11 A beam of ionising radiation, containing  $\alpha$ -particles,  $\beta$ -particles and  $\gamma$ -rays, is travelling left to right across the page. A magnetic field acts perpendicularly into the page.

- (a) In the table below, tick the boxes that describe the deflection of each of the types of radiation as it passes through the magnetic field. One line has been completed, to help you.

	not deflected	deflected towards top of page	deflected towards bottom of page	large deflection	small deflection
$\alpha$ -particles		✓			✓
$\beta$ -particles					
$\gamma$ -rays					

[3]

- (b) An electric field is now applied, in the same region as the magnetic field and at the same time as the magnetic field.

What is the direction of the electric field in order to cancel out the deflection of the  $\alpha$ -particles?

..... [2]

[Total: 5]

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NUMBER

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**PHYSICS**

Paper 3 Extended

**0625/32**

**May/June 2009**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

You may lose marks if you do not show your working or if you do not use appropriate units.

Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall =  $10 \text{ m/s}^2$ ).

At the end of the examination, fasten all your work securely together.

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

This document consists of **20** printed pages.





- 2 (a) A certain volume of water at room temperature and the same volume of ice in a freezer are each heated through the same temperature rise.

Which of them will have the greater expansion, and why?

Which? .....

Why? ..... [1]

- (b) For strength, concrete pillars are usually reinforced with metal rods, which are embedded in the concrete before it sets.

The list below shows how much a length of 1 m of each material expands when the temperature rises by 1 °C.

aluminium	0.03 mm
concrete	0.01 mm
steel	0.01 mm

Use this information to decide which metal should be used to reinforce concrete, why it is suitable, and why the other metal is not suitable.

Which metal should be used? .....

Why is it suitable? .....

Why is the other metal unsuitable? .....

..... [3]

[Total: 4]



- 3 A free-fall parachutist jumps out of an aeroplane, but doesn't open his parachute until after some time has elapsed.

Fig. 3.1 shows the graph of his speed during the fall.

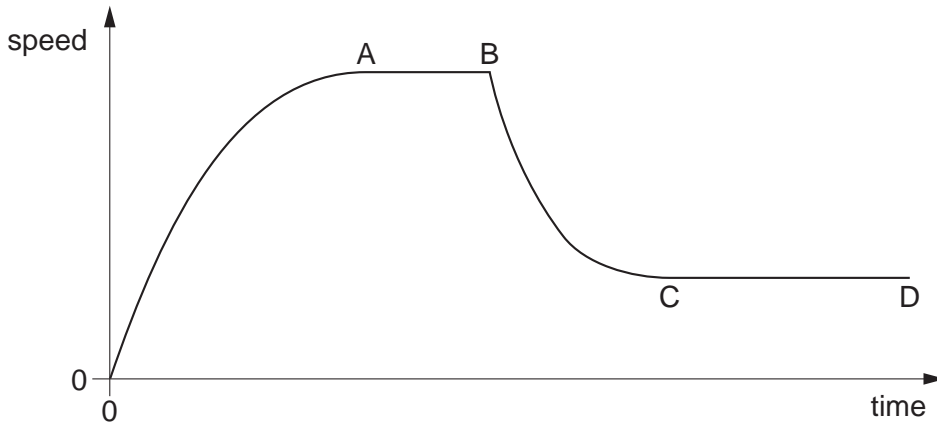


Fig. 3.1

- (a) What is the value of the acceleration of the parachutist immediately after he has jumped from the aeroplane?

..... [1]

- (b) How can you tell that the acceleration decreases until point A on the graph is reached?

.....  
..... [1]

- (c) State why the acceleration of the parachutist decreases until point A on the graph.

.....  
.....  
.....  
..... [2]

- (d) Consider section AB of the graph.

- (i) State what is happening to the parachutist's speed in this section.

..... [1]

- (ii) What can be said about the forces on the parachutist during this section?

.....  
..... [1]

(e) At which point did the parachutist open his parachute?

..... [1]

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(f) Explain why the speed decreases from B to C.

.....  
.....  
..... [2]

[Total: 9]

- 4 (a) In an accident, a truck goes off the road and into a ditch. Two breakdown vehicles A and B are used to pull the truck out of the ditch, as shown in Fig. 4.1.

For  
Examiner's  
Use

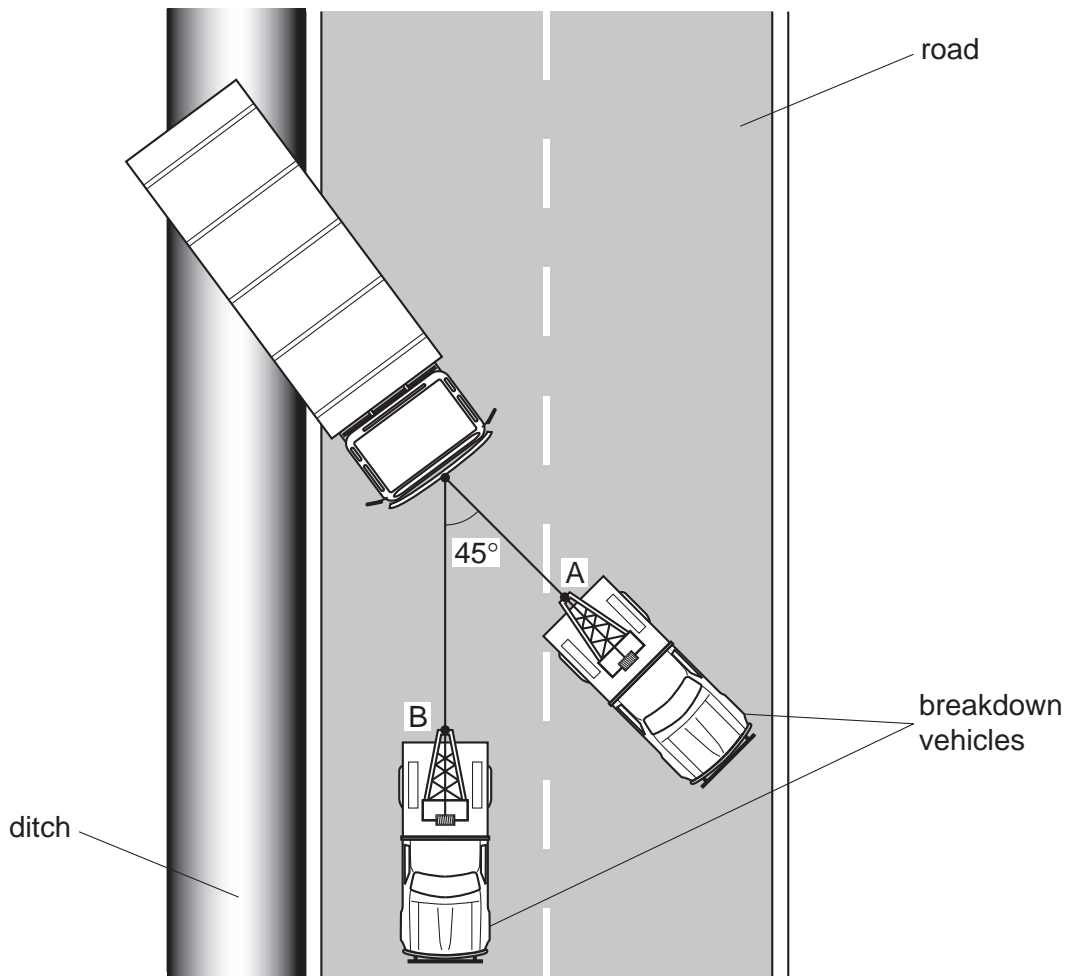


Fig. 4.1

At one point in the rescue operation, breakdown vehicle A is exerting a force of 4000 N and breakdown vehicle B is exerting a force of 2000 N.

For  
Examiner's  
Use

- (i) Using a scale of 1 cm = 500 N, make a scale drawing to show the resultant force on the truck.

[4]

- (ii) Use your diagram to find the magnitude and direction of the resultant force on the truck.

magnitude of resultant force = .....

direction of resultant force = ..... to direction of road [2]

- (b) (i) State why the resultant force is an example of a vector quantity.

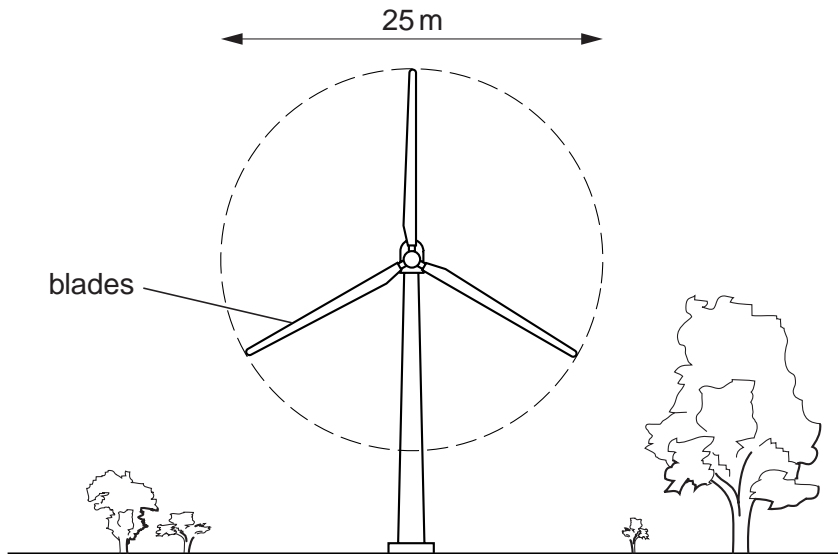
..... [1]

- (ii) Give an example of a vector quantity that is not a force.

..... [1]

[Total: 8]

- 5 A wind turbine has blades, which sweep out an area of diameter 25 m.



**Fig. 5.1**

- (a) The wind is blowing directly towards the wind turbine at a speed of 12 m/s. At this wind speed, 7500 kg of air passes every second through the circular area swept out by the blades.
- (i) Calculate the kinetic energy of the air travelling at 12 m/s, which passes through the circular area in 1 second.

kinetic energy = ..... [3]

- (ii) The turbine converts 10% of the kinetic energy of the wind to electrical energy.

Calculate the electrical power output of the turbine. State any equation that you use.

power = ..... [3]

(b) On another day, the wind speed is half that in (a).

- (i) Calculate the mass of air passing through the circular area per second on this day.

mass = ..... [1]

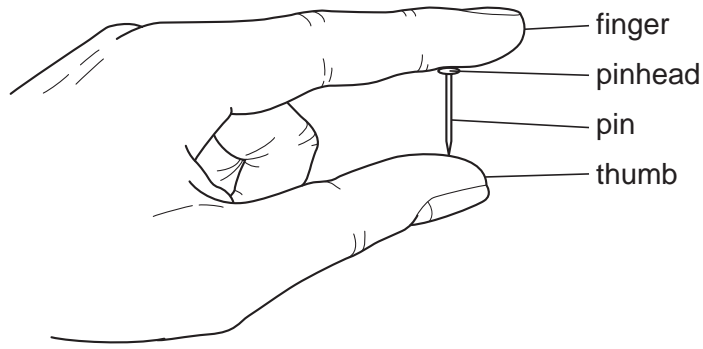
- (ii) Calculate the power output of the wind turbine on the second day as a fraction of that on the first day.

fraction = ..... [3]

[Total: 10]

For  
Examiner's  
Use

- 6 (a) A man squeezes a pin between his thumb and finger, as shown in Fig. 6.1.



**Fig. 6.1**

The finger exerts a force of 84 N on the pinhead.

The pinhead has an area of  $6.0 \times 10^{-5} \text{ m}^2$ .

- (i) Calculate the pressure exerted by the finger on the pinhead.

pressure = ..... [2]

- (ii) State the value of the force exerted by the pin on the thumb.

..... [1]

- (iii) Explain why the pin causes more pain in the man's thumb than in his finger.

.....  
 ..... [2]

(b) The density of the water in a swimming pool is  $1000 \text{ kg/m}^3$ . The pool is 3 m deep.

(i) Calculate the pressure of the water at the bottom of the pool.

pressure = ..... [2]

(ii) Another pool has the same depth of water but has twice the area.

State the pressure of the water at the bottom of this pool.

pressure = ..... [1]

[Total: 8]

For  
Examiner's  
Use



- 7 (a) Some water is poured onto a plastic table-top, forming a puddle. The same volume of water is poured into a plastic dish, which is placed alongside the puddle. This is illustrated in Fig. 7.1.

For  
Examiner's  
Use

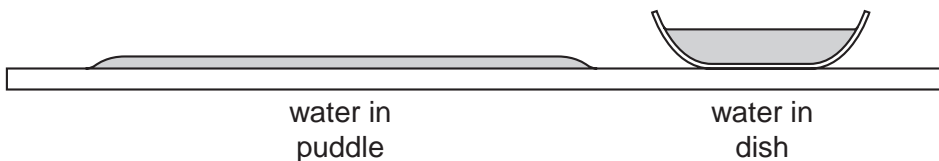


Fig. 7.1

Both lots of water begin to evaporate.

- (i) In terms of the behaviour of molecules, describe what happens during the process of evaporation.

.....  
 .....  
 .....  
 ..... [2]

- (ii) Explain why the puddle dries out more rapidly than the water in the dish.

.....  
 .....  
 .....  
 ..... [2]

- (iii) State two changes that would make both lots of water evaporate more rapidly.

1. ....  
 2. .... [2]

(b) In a place where refrigeration is not possible, a person attempts to keep a bottle of milk cool by using the procedure illustrated in Fig. 7.2.

For  
Examiner's  
Use

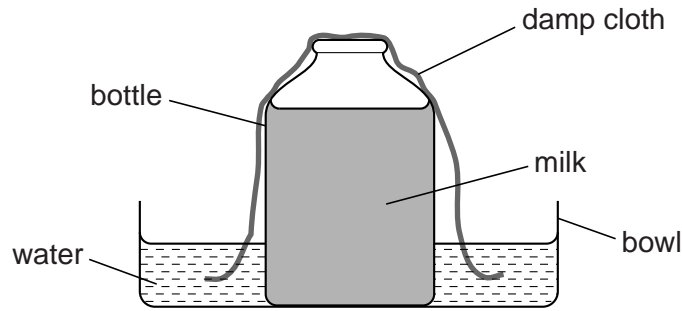


Fig. 7.2

Explain in terms of molecules why this procedure would be successful.

.....  
.....  
..... [3]

[Total: 9]

- 8 In an optics lesson, a Physics student traces the paths of three rays of light near the boundary between medium A and air. The student uses a protractor to measure the various angles.

For  
Examiner's  
Use

Fig. 8.1 illustrates the three measurements.

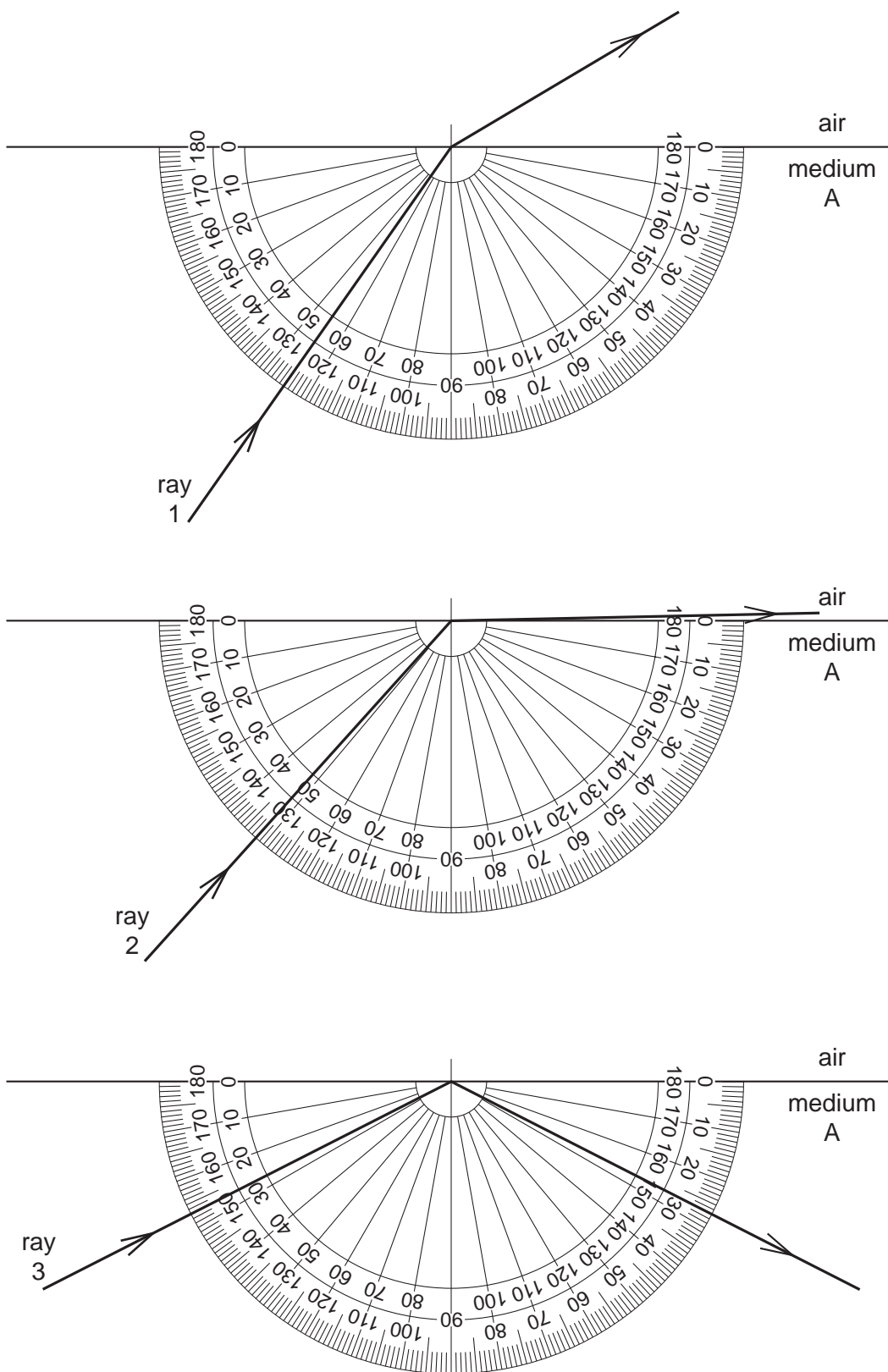


Fig. 8.1

(a) State which is the optically denser medium, A or air, and how you can tell this.

.....  
..... [1]

(b) State in which medium the light travels the faster, and how you know this.

.....  
..... [1]

(c) State the critical angle of medium A.

.....[1]

(d) State the full name for what is happening to ray 3.

.....[1]

(e) The refractive index of medium A is 1.49.

**Calculate** the value of the angle of refraction of ray 1, showing all your working.

angle of refraction = ..... [2]

(f) The speed of light in air is  $3.0 \times 10^8$  m/s.

Calculate the speed of light in medium A, showing all your working.

speed of light = ..... [2]

[Total: 8]

- 9 (a) Fig. 9.1 shows an a.c. supply connected in series to a diode and a resistor.

For  
Examiner's  
Use

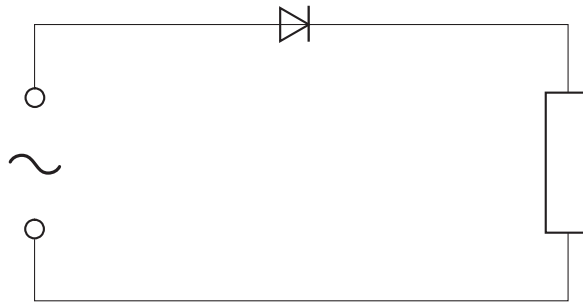


Fig. 9.1

On the axes of Fig. 9.2, draw a graph showing the variation of the current in the resistor. [1]

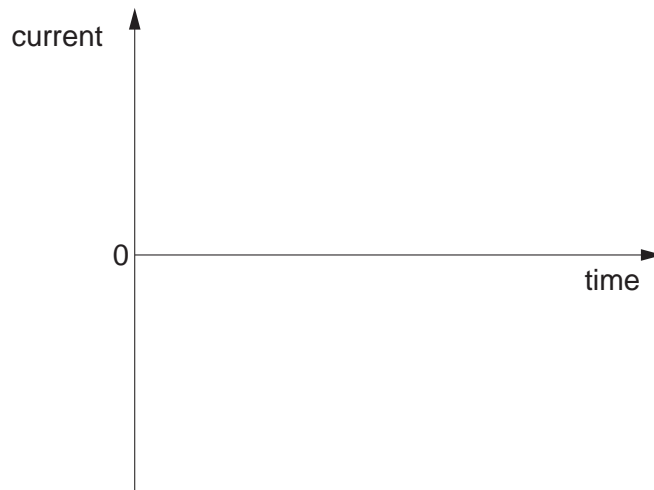
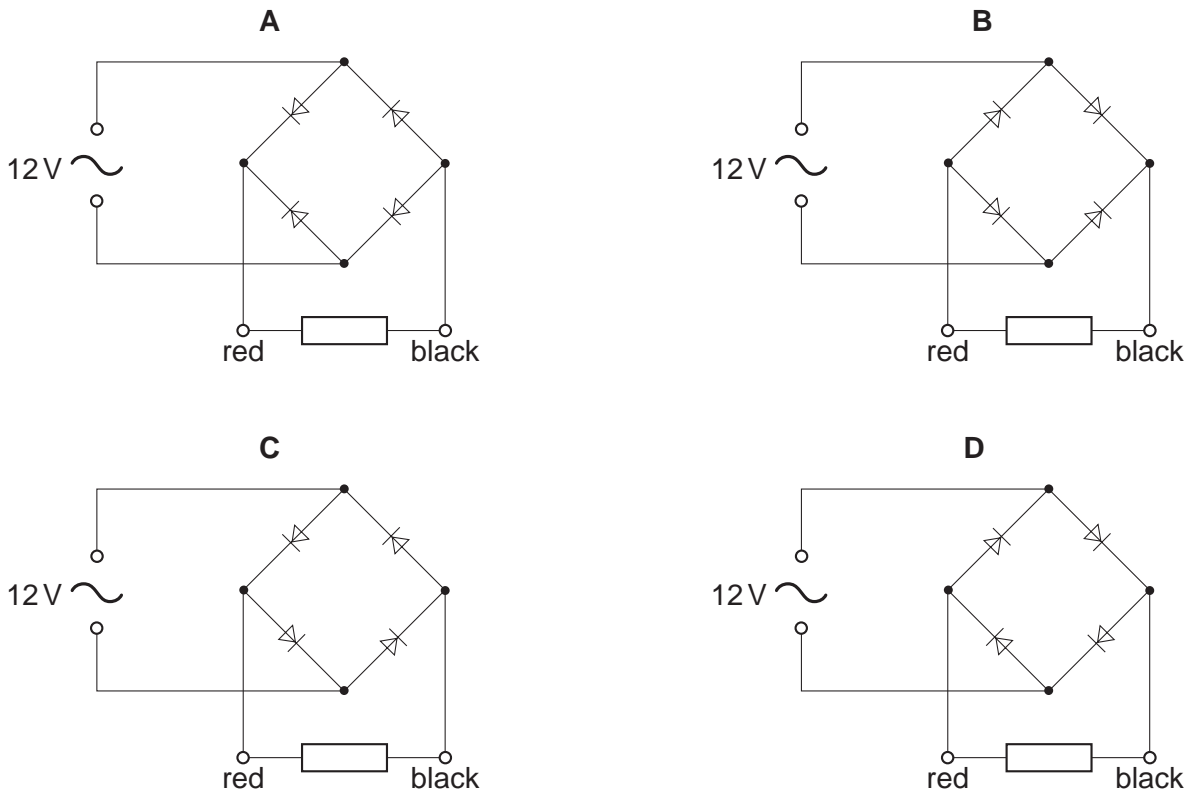


Fig. 9.2

(b) Fig. 9.3 shows four attempts, **A**, **B**, **C** and **D**, to connect a circuit known as a bridge rectifier.

The circuit is connected to a 12V a.c. supply.



**Fig. 9.3**

- (i) In which circuit will the direction of the conventional current in the resistor always be from red to black?  
 ..... [1]
- (ii) On the circuit you chose in (b)(i), clearly indicate with arrows the path of the conventional current through the circuit when the upper terminal of the a.c. supply is positive with respect to the lower terminal. [2]

[Total: 4]

- 10 The circuit shown in Fig. 10.1 uses a 12V battery. A and B are identical lamps, each designed to work from a 6V supply.

For  
Examiner's  
Use

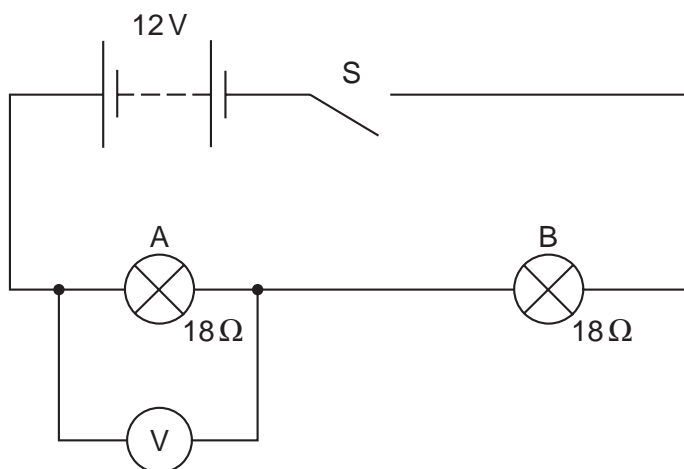


Fig. 10.1

- (a) Switch S is open, as shown in Fig. 10.1.

(i) State the value of

1. the potential difference (p.d.) across S,

p.d. = ..... [1]

2. the reading on the voltmeter.

reading = ..... [1]

(ii) Comment on the brightness of the two lamps.

..... [1]

- (b) Switch S is now closed.

(i) State the new reading on the voltmeter.

new reading = ..... [1]

(ii) Comment on the brightness of the two lamps.

..... [1]

(iii) Under these conditions, each lamp has a resistance of  $18\Omega$ .

Calculate the current in each lamp.

current = ..... [3]

(c) With switch S open, lamp B is connected in parallel with lamp A. With no current, each lamp has a resistance of  $1.8\ \Omega$ .

For  
Examiner's  
Use

(i) Calculate the value of the combined resistance of A and B.

combined resistance = ..... [2]

(ii) State why it would not be wise to close S when A and B are connected in parallel.

.....

..... [1]

[Total: 11]

**Question 11 is on the next page.**



11 A beam of ionising radiation, containing  $\alpha$ -particles,  $\beta$ -particles and  $\gamma$ -rays, is travelling left to right across the page. A magnetic field acts perpendicularly into the page.

- (a) In the table below, tick the boxes which describe the deflection of each of the types of radiation as it passes through the magnetic field. One line has been completed, to help you.

	not deflected	deflected towards top of page	deflected towards bottom of page	large deflection	small deflection
$\alpha$ -particles		✓			✓
$\beta$ -particles					
$\gamma$ -rays					

[3]

- (b) An electric field is now applied, in the same region as the magnetic field, and at the same time as the magnetic field.

What is the direction of the electric field, in order to cancel out the deflection of the  $\alpha$ -particles?

..... [2]

[Total: 5]

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