FOR OFFICIAL USE					

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3220/401

NATIONAL WEDNESDAY, 17 MAY QUALIFICATIONS 9.00 AM - 10.30 AM 2006

PHYSICS STANDARD GRADE General Level

Fill in these boxes and read what is printed below.	
Full name of centre	Town
Forename(s)	Surname
Date of birth Day Month Year Scottish candidate number	Number of seat
Reference may be made to the Physics Data Booklet. 1 All questions should be answered.	
The questions may be answered in any order but a legibly in this book.	all answers must be written clearly and
3 For questions 1–7, write down, in the space pro answer you think is correct. There is only one corre	The state of the s
4 For questions 8–19, write your answer where indi provided after the question.	cated by the question or in the space
5 If you change your mind about your answer you space provided at the end of the answer book.	may score it out and replace it in the
6 Before leaving the examination room you must give not, you may lose all the marks for this paper.	e this book to the invigilator. If you do





WRITE IN MARGIN K&U PS Marks Which part of a television receiver picks up all signals? Tuner A Modulator В \mathbf{C} Decoder Amplifier D Ε Aerial Answer 1 The nucleus of a uranium atom contains A electrons only В neutrons only \mathbf{C} electrons and protons only D protons and neutrons only \mathbf{E} electrons, protons and neutrons. Answer 1 What is the unit of equivalent dose? becquerel A \mathbf{B} joule kilogram \mathbf{C} D sievert E watt 1 [3220/401] Page two

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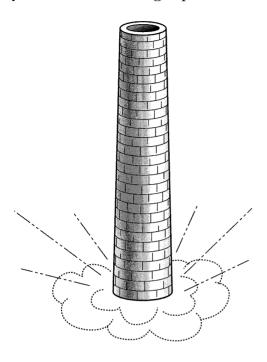
N. An uncharged capacitor C is connected to a resistor R, a 9 volt battery and a switch S as shown. 9 volts When switch S is closed the voltage across the capacitor Α remains at 0 volt gradually rises from 0 volt to 9 volts immediately drops from 9 volts to 0 volt C \mathbf{D} gradually drops from 9 volts to 0 volt Ε remains at 9 volts. Answer Which of the following is a unit of heat? 5. degree celsius joule В \mathbf{C} joule per kilogram joule per kilogram per degree celsius D Е watt Answer 6. Which of the following is the shortest distance? The distance from the Earth to the nearest star in our galaxy В edge of our galaxy \mathbf{C} Moon D Sun E nearest planet. Answer

DO NOT WRITE IN THIS MARGIN K&U PS Marks 7. Radio waves from space can be detected by a Geiger-Müller tube photographic plate В C scintillation counter telescope D E tuner. Answer 1

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8. A factory chimney is demolished using explosives.



A crowd of people watches from a safe distance. A person in the crowd hears the sound 2.5 seconds after seeing the explosion.

(a)	Explain why the	re is a delay	between	seeing t	the explosion	and	hearing	the
	sound.							

(b) Calculate the distance between the chimney and the person in the crowd.

(The speed of sound in air is 340 metres per second.)

Space for working and answer

(c) Why should the demolition worker who sets off the explosives wear ear protectors to reduce the noise level to below 80 decibels?

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9. The flex of a mains appliance has a 3-pin plug fitted as shown.

neutral earth live cord grip

The flex contains three wires—live, neutral and earth.

- (a) Circle the correct answer for each of the questions about the wires.
 - (i) The colour of the insulation around the live wire is $\begin{cases} blue \\ brown \\ green/yellow \end{cases}.$

(ii) The colour of the insulation around the neutral wire is $\begin{cases} blue \\ brown \\ green/yellow \end{cases}$.

(iii) The $\begin{cases} earth \\ live \\ neutral \end{cases}$ wire is a safety device.

(b) **Explain** why the flex must be held in place by the cord grip.

(c) Another appliance has only two wires in its flex. This appliance carries the following symbol.



(i) Name this symbol.

.....

(ii) Which wire is not needed in this flex?

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10. Read the following passage.

> The temperature of the human body is maintained at about 37 degrees celsius. An increase or a decrease in body temperature of as little as 5 degrees celsius can be very serious.

> Doctors often use ear thermometers to measure body temperature. thermometers measure the infrared radiation emitted from the eardrum and surrounding tissue.

> One type of ear thermometer has a scale that ranges from 32 degrees celsius to 42 degrees celsius. The temperature sensor used in this thermometer is a device that has a resistance which changes as the temperature changes.

Use information given in the passage to answer the following questions.

(a)	Name the type of radiation given out by the human body.		
		1	
(b)	Give a reason why the scale of the ear thermometer ranges from 32 degrees celsius to 42 degrees celsius only.		
		1	
(c)	Suggest a temperature sensor that could be used in the ear thermometer.		
		_	

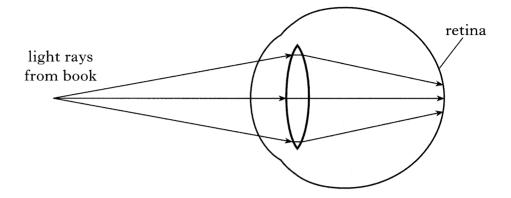
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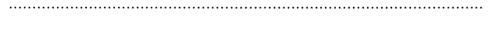
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- A student has a sight defect and is unable to see near objects clearly.
 - (a) The following diagram shows what happens to light rays when the student is reading a book.

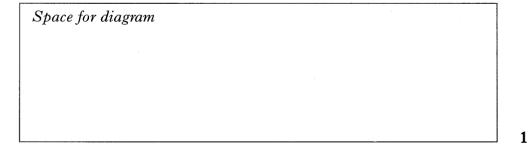


(i)	By referring to the diagram, ex	xplain why	the student	sees a blurred
	image.			

(ii) Name this sight defect.



(iii) In the space below, draw the shape of the lens that would correct this sight defect.



(iv) When this sight defect has been corrected, the student looks at a picture printed in the book.

Which statement describes the image on the retina of the student's eye compared to the actual picture?

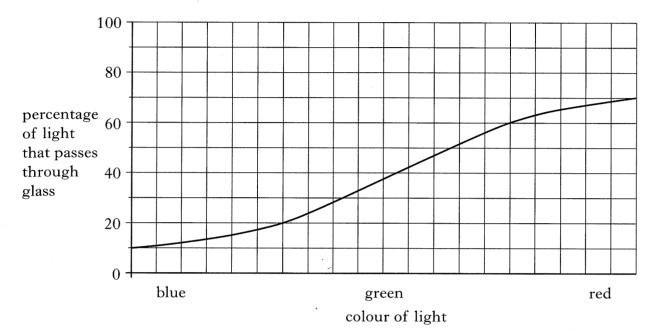
- A The image is the same way up and larger.
- B The image is upside down and larger.
- C The image is the same way up and smaller.
- D The image is upside down and smaller.

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11. (continued)

(b) Another student has a different eye defect. This student is prescribed spectacles that have red tinted glass. The graph below shows the percentage of light of different colours that passes through this glass.



(i) Which colour of light is blocked most by the tinted glass?

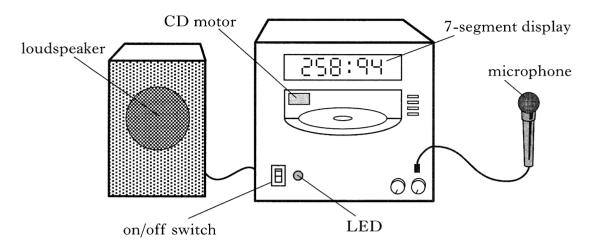
(ii) List the three colours given on the graph in order of **decreasing** wavelength.

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12. A karaoke machine contains various input and output devices.



(<i>a</i>)	State two	output dev	vices labelled	l on	the	diagram.
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Device 1

(b) State two input devices labelled on the diagram.

Device 1

(c) The karaoke machine has an LED.

(i) State the useful energy transfer that takes place in the LED.

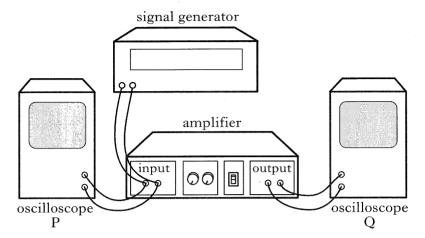
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(ii) In the space below draw the symbol for an LED.

Space for symbol

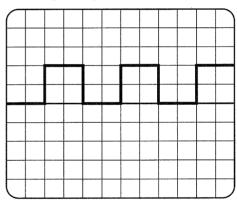
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13. A technician uses a signal generator and two oscilloscopes as shown to test an amplifier.



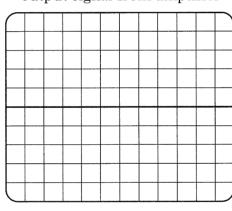
(a) The screens of both oscilloscopes are shown below.

input signal to amplifier



oscilloscope P

output signal from amplifier



oscilloscope Q

The settings on both oscilloscopes are identical.

(i) Complete the diagram to show the amplified output signal seen on oscilloscope Q.

(ii) Circle the correct answer in the statement below.

The signal shown on oscilloscope
$$P$$
 is $\left\{ egin{array}{l} analogue \\ decimal \\ digital \end{array} \right\}$.

(b) Which of the following devices contains an amplifier?

	lamp	radio	relay	transformer
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14. A rowing crew takes part in a race.



The time for their boat at each stage of the race is shown.

		Time fr	Time from start		
		minutes	seconds		
Start:	0 metres	00	00		
	500 metres	01	40		
-	1000 metres	03	50		
	1500 metres	05	50		
Finish:	2000 metres	07	45		

(a)	Describe how to find the average speed of the boat from the start of the race to the finish.
	······································
(b)	Calculate the average speed of the boat during the first 500 metres of the race.
	Space for working and answer

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14. (continued)

(c)		crew supplies a force to move the boat forward. When the boat is ing, a force opposes the motion of the boat.		
	(i)	Name the force that opposes the motion of the boat.		
			1	
	(ii)	During the first 500 metres, there is a constant unbalanced force acting on the boat.		
		Describe the motion of the boat during this section of the race.		
			1	
	(iii)	During one stage of the race, the speed of the boat is constant.		
		What can be said about the forces acting on the boat during this stage?		
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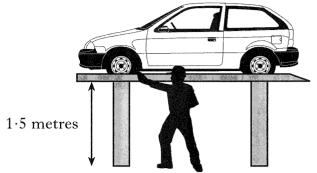
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15. A car is being repaired in a garage. The car is on a ramp and is raised to a height of 1.5 metres.



The car has a mass of 1200 kilograms.

(a) Calculate the weight of the car.

Space for working and answer

(b) Calculate how much gravitational potential energy the car has gained when it is 1.5 metres above the garage floor.

Space for working and answer

- (c) The car is raised in 12 seconds.
 - (i) Calculate the minimum power needed to lift the car 1.5 metres in 12 seconds.

Space for working and answer

(ii) In practice, the power needed to raise the car in this time is greater than the minimum power.

Explain why.

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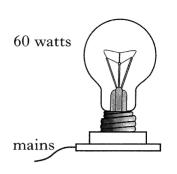
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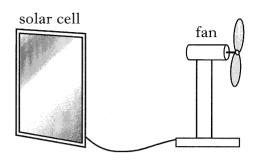
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16.	A	fan	operates	using	a solar	cell	and a	ı light bull	o.
			- P						•





(a)	What energy	transformation	takes pla	ace in	the solar	cell?
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- (b) When the lamp is on, the fan turns slowly.
 - (i) Suggest **two** changes that could be made which would make the fan turn faster.

Change 1	

(ii) The 60 watt lamp operates for 2 minutes.

Calculate how much energy is transformed by the lamp in this time.

Space for working and answer

- (c) Solar energy is a renewable source of energy.
 - (i) Name **one** other renewable source of energy.

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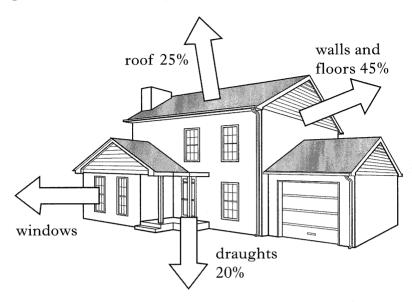
(ii) Name a non-renewable source of energy.

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17. The diagram shows all the ways in which heat is lost from a house.



(a) Using information from the diagram, calculate the percentage of heat lost through windows.

Space for working and answer				

(b) Various windows of area one square metre are tested for rate of heat loss. The results are shown in the table.

Window	Rate of heat loss (joules per second)
single glazed	80
double glazed	60
triple glazed	50

v many joules	of heat are	lost per	square	metre	from a	single
ed window ev	ery second	?				
			ed window every second?			v many joules of heat are lost per square metre from a ed window every second?

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17. (b) (continued)

- (ii) All the windows in a particular house are single glazed. Every second a total of 500 joules of heat is lost through the windows in this house.
 - (A) Calculate the total area of the windows.

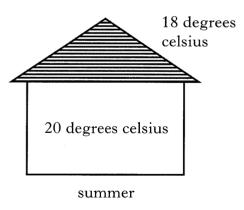
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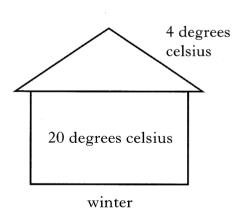
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(B) Describe **one** way of reducing heat loss through the windows in this house.

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(c) A householder keeps the temperature in a house at 20 degrees celsius all year.





At which time of the year is the rate of heat loss from this house greater? Explain your answer.

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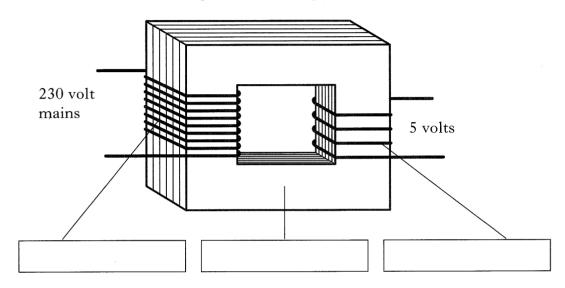
18. A 5 volt battery in a mobile phone is recharged from the mains using a charger containing a step down transformer.

(a) The transformer consists of three parts.

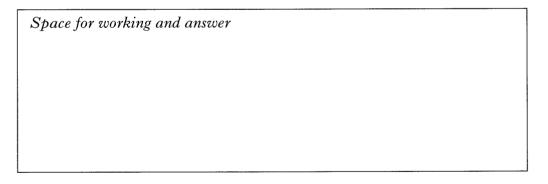
core primary coil

secondary coil

Label each of these parts on the diagram below.



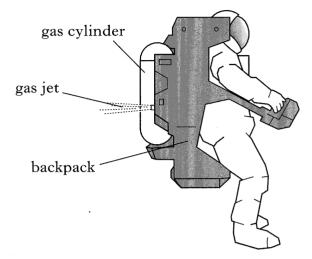
(b) There are 11 500 turns on the primary coil of the transformer. Calculate the number of turns on the secondary coil.



(c) **Explain** why a transformer cannot be used to step down the voltage from a battery.

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19. A spacecraft is far out in space. An astronaut wearing a backpack leaves the spacecraft. The astronaut uses the backpack to move around. The backpack contains a pressurised gas cylinder connected to a valve. When the valve is opened, a jet of gas is released.



(a) Complete the passage below by circling the correct answer.

When the astronaut opens the valve, the cylinder pushes gas backwards.

The gas pushes the $\left\{ \begin{array}{l} cylinder \\ jet \\ spacecraft \end{array} \right\}$ forwards.

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- (b) The astronaut and backpack have a combined mass of 120 kilograms. The jet of gas exerts a constant thrust of 24 newtons.
 - (i) Calculate the acceleration of the astronaut when the jet is switched on.

Space for working and answer

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(ii) The jet is now switched off.

Describe the motion of the astronaut.

Explain your answer.

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[END OF QUESTION PAPER]

YOU MAY USE THE SPACE ON THIS PAGE TO REWRITE ANY ANSWER YOU HAVE DECIDED TO CHANGE IN THE MAIN PART OF THE ANSWER BOOKLET. TAKE CARE TO WRITE IN CAREFULLY THE APPROPRIATE QUESTION NUMBER.