

FOR OFFICIAL USE

Presenting Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.
	<b>3220</b>				

Total Marks	K&U	PS

[3220/259]

1991

SCOTTISH CERTIFICATE OF EDUCATION

# PHYSICS

Standard Grade—GENERAL LEVEL

Wednesday, 15th May—9.30 a.m. to 11.00 a.m.

**Fill in these boxes and read what is printed below.**

*Full Name of school or college*

*Town*



*Christian Name|First Name, Initial(s) (of other|middle name(s))*

*Surname*



*Date of Birth*

*Day    Month    Year*

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*Number of seat occupied at examination*

1. All questions should be answered.
2. The questions may be answered in any order but all answers must be written clearly and legibly in this booklet.
3. For questions 1–13, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only ONE correct answer.
4. For questions 14–27, write your answer where indicated by the question or in the space provided after the question.
5. You may score out your original answer and replace it in the space provided at the end of the answer booklet.
6. Any necessary data will be found in the DATA SHEET on page two.

## **DATA SHEET**

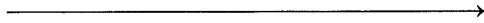
*The weight of a mass of 1 kilogram at (or near) the Earth's surface is 10 newtons.*





7. Which of the following lists shows, from left to right, colours of light with increasing wavelength?

wavelength increasing



- A green      blue      red
- B blue      red      green
- C red      green      blue
- D blue      green      red
- E red      blue      green

Answer

1

8. Which of the following is the circuit symbol for a fuse?

- A
- B
- C
- D
- E

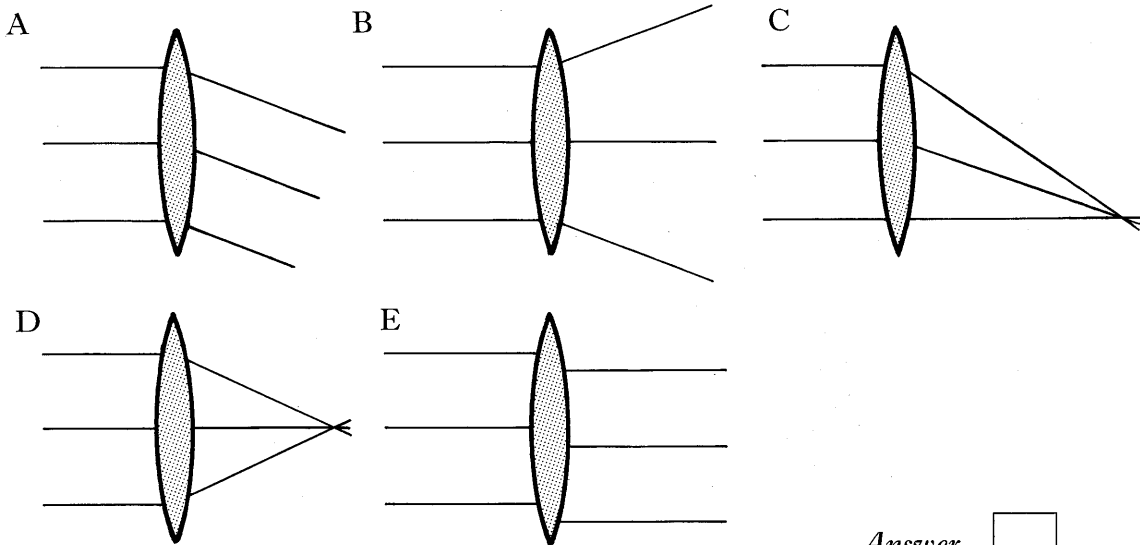
Answer

1

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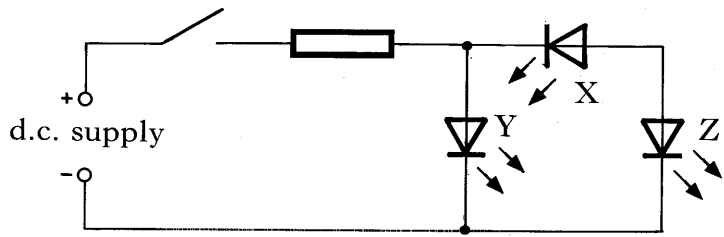
11. Which of the following shows how parallel rays of light pass through a convex lens?



Answer

1

12. The circuit diagram shows three light emitting diodes (LEDs) connected to a d.c. supply.



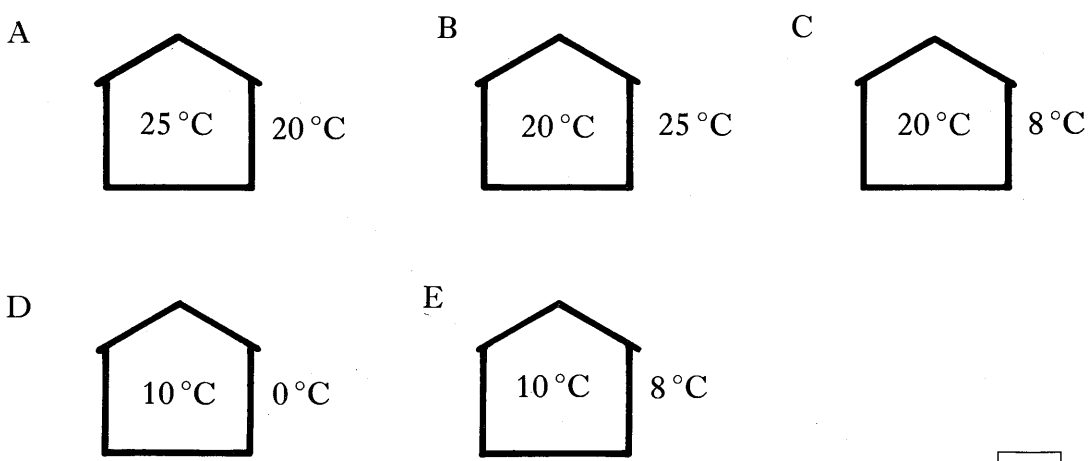
Which of the LEDs will light when the supply is switched on?

- A X only
- B Y only
- C Z only
- D X and Z
- E X, Y and Z

Answer

1

13. The diagrams show the temperatures inside and outside the same house on different days. In which case is the heat loss from the house, in a given time, greatest?



Answer

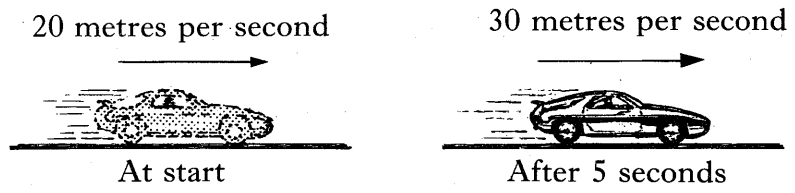
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2	
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18. A car, travelling at 20 metres per second, accelerates to 30 metres per second, along a straight section of motorway, in a time of 5 seconds.



(a) Calculate the acceleration of the car.

*Space for working and answer*

2

(b) The mass of the car and passengers is 1200 kilograms.  
What size of force is required to give the acceleration?

*Space for working and answer*

2

(c) The Highway Code suggests that a car travelling at 30 metres per second needs a distance of 70 metres to stop from the instant the brakes are applied.  
Why will a distance greater than this be required when the driver of a car, travelling at 30 metres per second, has to make an emergency stop?

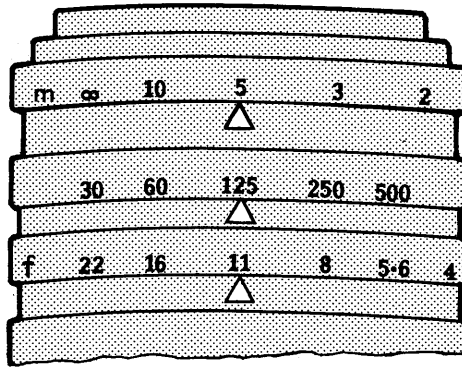
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19. A photographer takes photographs at an athletics meeting.

- (a) The diagram below shows her camera correctly set to take a photograph of a group of spectators.



How far from the group was the photographer standing?

.....

1

- (b) The table below shows the recommended aperture settings for her film under different lighting conditions.

<i>Shutter speed — 1/125 second</i>			
<i>bright sun</i>	<i>hazy sun</i>	<i>slight cloud</i>	<i>overcast sky or shade</i>
f16	f11	f8	f5.6

Use the table to find the lighting conditions when the photograph was taken.

.....

1

- (c) The photographer wishes to take a sharp photograph of an athlete jumping a hurdle.

- (i) Which shutter speed setting should the photographer choose? Explain your answer.

.....  
 .....

2

- (ii) What aperture setting should be used with this shutter speed?

.....

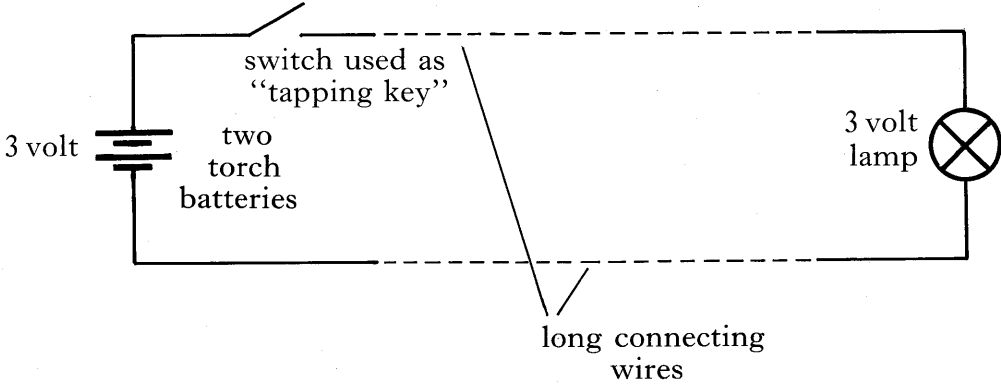
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20. (a) In communication systems, what name is given to the part which sends out signals?

.....

(b) Heather, Eric and Sharon wish to send a message in Morse code from one room to another. The circuit they use for their system is shown below.



Describe how Heather could send the coded message to Eric and Sharon in the other room.

.....  
.....

(c) When the circuit is set up, the lamp does not work, although all the components are in good working order.

They consider the changes they could make:  
Eric suggests, “Leave one battery near the tapping key and put the other battery near the lamp.”  
Heather suggests, “Use one battery instead of two.”  
Sharon suggests, “Use connecting wire with less resistance.”  
The pupils try each of the suggested changes and find that only **one** works.

(i) Who made the correct suggestion?  
.....

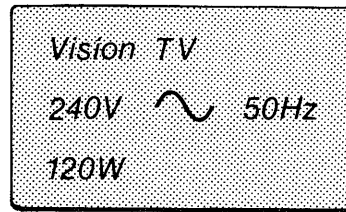
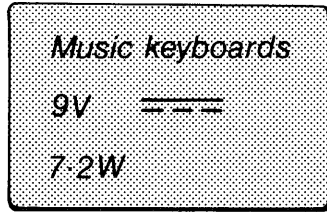
(ii) Explain why this change was suitable.  
.....  
.....

(iii) Explain why the other two changes were not suitable.  
.....  
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3	

21. The diagrams below show the rating plates attached to a musical keyboard and to a television.



(a) Which appliance should be connected to an alternating current supply?

.....

(b) Explain, in terms of current, the difference between direct current and alternating current.

.....  
.....  
.....

(c) Use the information on the rating plate to calculate the current to the keyboard.

*Space for working and answer*

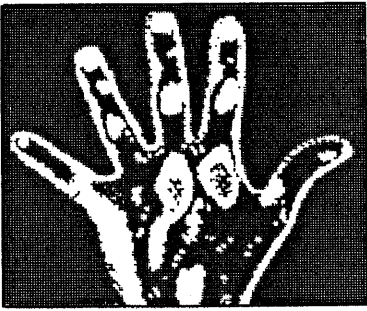
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22. Read the following passage.

“Come in, Chris,” said the doctor. “We are going to take a thermogram of your hand.”

“What’s a thermogram?” asked Chris.

“Your body gives out radiation, called infra red,” explained the doctor. “This is similar to light but it has a longer wavelength. We have a special camera which makes use of this radiation to take a photograph of your hand. The photograph is called a thermogram and is similar to the one shown in the diagram.”



Thermogram

“What are the different patches in the photograph?” asked Chris.

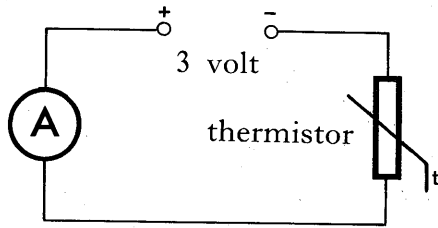
“In a real thermogram,” answered the doctor, “your hand will show up as patches of different colour. Each colour is due to a different temperature. The coldest parts are blue and the hottest parts are white. We can use the thermogram to detect unhealthy tissue since it is warmer than healthy tissue and so shows up as a different colour.”

“Have you heard of any other type of radiation used in medicine?” asked the doctor. “Do you know how it is used?”

- (a) Name the type of radiation given out by the human body.  
..... 1
- (b) How does the wavelength of this radiation compare with that of light?  
..... 1
- (c) If Chris did have unhealthy tissue in his hand, suggest how this would be detected on the thermogram.  
..... 1
- (d) Answer the doctor’s last question to Chris by naming another type of radiation used in medicine and stating its use.  
Radiation: ....  
Use: ....  
..... 2

[Turn over

23. (a) A thermistor is connected to a 3 volt d.c. supply in the circuit shown below. The table gives some information about the thermistor.



Position of thermistor	Resistance of thermistor (ohms)
Inside a freezer	2000
In a warm room	500
Inside a hot oven	100

Calculate the reading on the ammeter when the thermistor is placed in a warm room.

*Space for working and answer*

- (b) The thermistor is used as a temperature probe and is placed in a chicken inside an oven as shown in figure 1. The thermistor is connected to an LED as shown in the circuit diagram in figure 2. The LED in the circuit is visible from the outside of the oven.

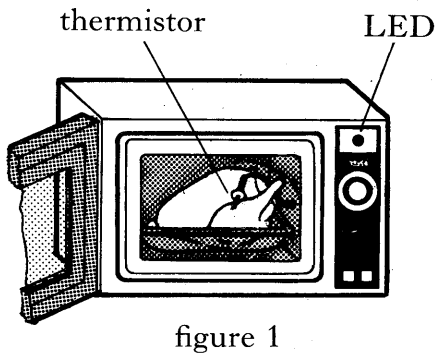


figure 1

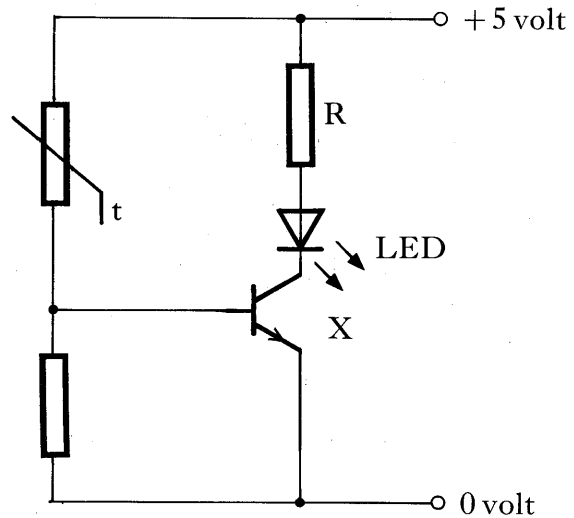


figure 2

- (i) What is the name of the component marked X in figure 2?  
 .....
- (ii) What happens to the LED when the temperature reaches a high value?  
 .....
- (iii) What is the purpose of resistor R which is connected in series with the LED?  
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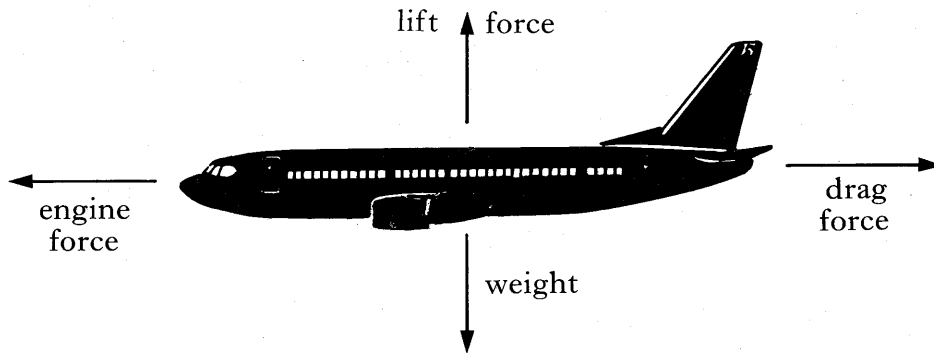
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24. The diagram below shows the forces acting on an aeroplane which is flying at a constant height.



(a) How do the engine force and the drag force compare when the aeroplane is travelling at a steady speed?

.....

(b) The aeroplane has a mass of 62 000 kilograms.

(i) What is the weight of the aeroplane?

.....

(ii) What will be the lift force when the aeroplane is flying at a constant height?

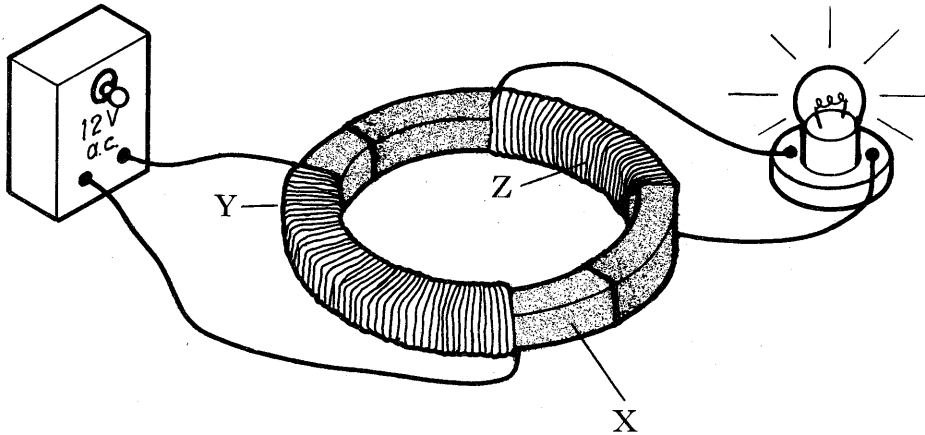
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25. (a) The diagram below shows a transformer being used to operate a 3 volt lamp correctly from a 12 volt a.c. supply.



Name the parts of the transformer labelled X, Y and Z.

X: .....

Y: .....

Z: .....

3

(b) The table below gives information about three transformers.

<i>Transformer</i>	<i>Number of turns in primary</i>	<i>Number of turns in secondary</i>	<i>Primary voltage</i>
P	800	200	240
Q	750	3 000	415
R	220	440	110

(i) Which is a step down transformer?

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(ii) Which transformer is designed to be connected to the mains supply in Britain?

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(iii) In which transformer would the output voltage be four times the input voltage?

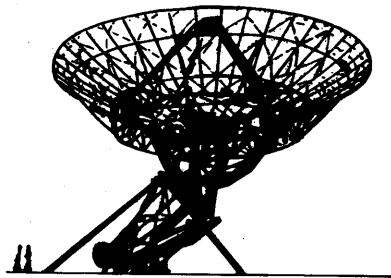
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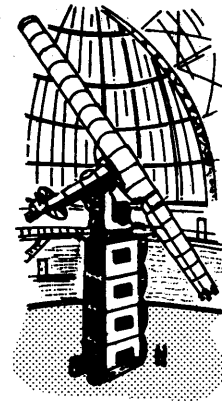
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27. Radio telescopes and optical telescopes are used to observe stars.



Radio telescope



Optical telescope

- (a) The waves detected by the radio and optical telescopes have different wavelengths.

How does the speed of the waves detected by the radio telescope compare with the speed of the waves detected by the optical telescope?

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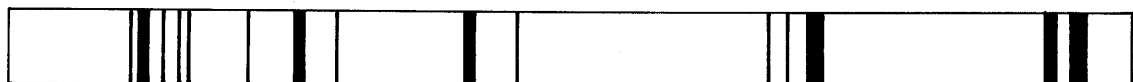
- (b) Why is a **large** curved reflector necessary on a radio telescope which detects radio waves from a distant star?

.....

1

- (c) Light, collected by an optical telescope, from a star, can be used to produce a line spectrum of the star.

An example of the star's spectrum is shown below.



- (i) What use is made of such a spectrum by astronomers studying the star?

.....  
 .....

1

- (ii) What would you use to split a beam of white light into different colours?

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1

[END OF QUESTION PAPER]

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