

FOR OFFICIAL USE

Presenting Centre No.	Subject No. <b>3220</b>	Level	Paper No.	Group No.	Marker's No.
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**3220/101**

K & U	PS
Total Marks	

SCOTTISH  
CERTIFICATE OF  
EDUCATION  
1997

THURSDAY, 15 MAY  
9.30 AM – 11.00 AM

PHYSICS  
STANDARD GRADE  
General Level

Fill in these boxes and read what is printed below.

Full name of school or college

Town

First name and initials

Surname

Date of birth

Day Month Year

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Candidate number

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Number of seat

- All questions should be answered.
- The questions may be answered in any order but all answers must be written clearly and legibly in this book.
- For questions 1–9, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.
- For questions 10–23, write your answer where indicated by the question or in the space provided after the question.
- If you change your mind about your answer you may score it out and replace it in the space provided at the end of the answer book.
- Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

Marks

1. The part of a radio which picks up all radio signals from the air is called the

- A modulator
- B amplifier
- C tuner
- D aerial
- E decoder.

Answer  (1)

2. The instrument used to detect sounds produced within the human body is called

- A an oscilloscope
- B an endoscope
- C a stethoscope
- D a thermogram
- E a spectroscope.

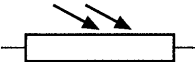
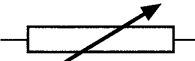
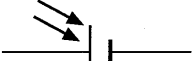
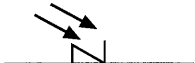
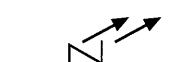
Answer  (1)

3. Which of the following particles are in orbit around the nucleus of an atom?

- A Electrons only
- B Protons only
- C Electrons and protons
- D Protons and neutrons
- E Protons, neutrons and electrons

Answer  (1)

4. Which of the following is the circuit symbol for a light emitting diode (LED)?

- A 
- B 
- C 
- D 
- E 

Answer  (1)



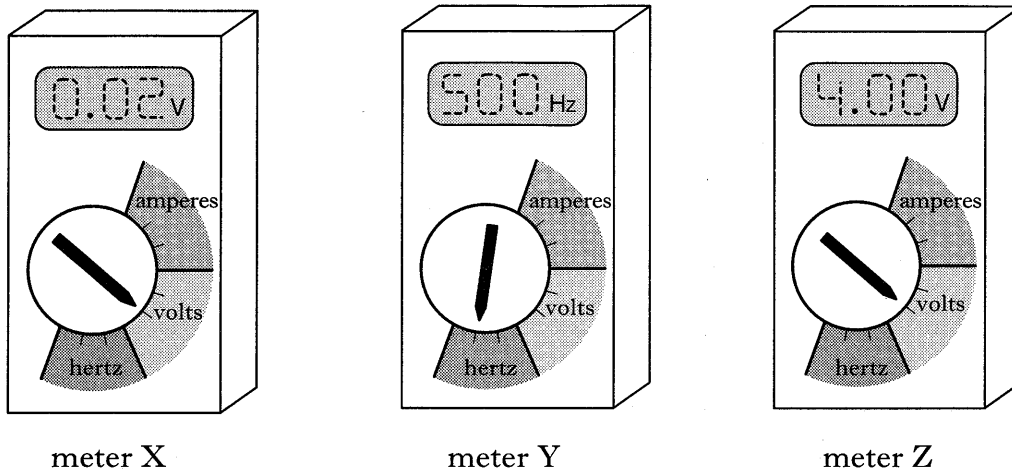




Marks

11. An electrical signal is applied to the input of an audio amplifier. A pupil measures the frequency and voltage of the electrical signal. The output voltage from the amplifier is also measured.

Three meters X, Y and Z are used in the measurements. The readings on the meters are shown in the diagram below.



(a) Which meter is used to measure the output voltage from the amplifier?

..... (1)

(b) Calculate the voltage gain of the amplifier.

*Space for working and answer*

(3)

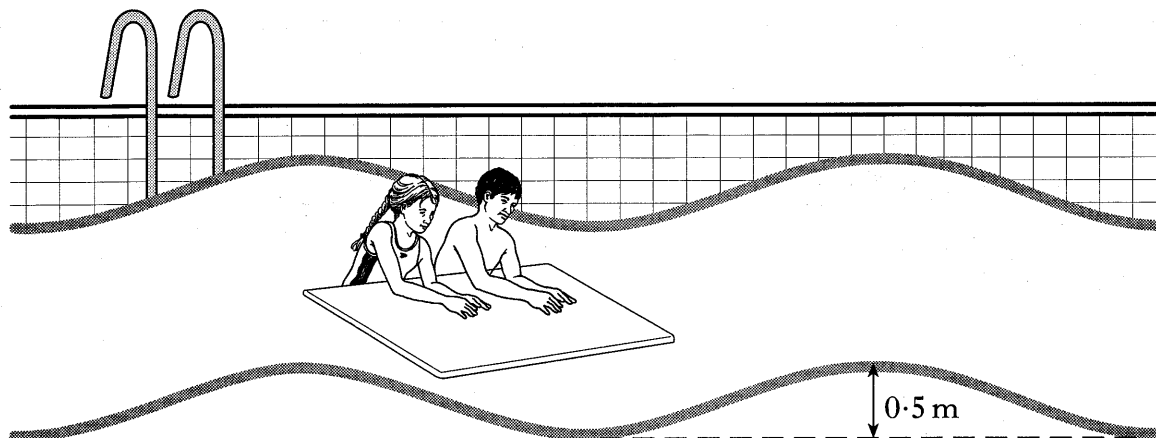
(c) What is the frequency of the

(i) input signal to the amplifier; .....

(ii) output signal from the amplifier? ..... (2)

Marks

12. The diagram shows children using a large float in the swimming pool of a sports complex. A wave machine in a swimming pool generates 24 waves per minute on the surface of the pool.



- (a) Show that the frequency of the wave machine is 0.4 hertz.

*Space for working and answer*

(2)

- (b) The wavelength of the waves in the pool is 4.0 metres.  
Calculate the speed of the waves in the pool.

*Space for working and answer*

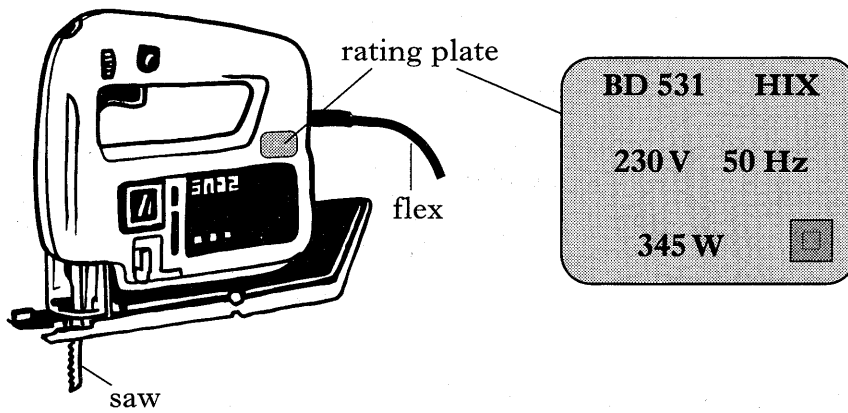
(2)

- (c) The large float moves up and down on the waves. The vertical distance through which the float rises is 0.5 metres.  
What is the amplitude of the waves?

..... (1)

Marks

13. The rating plate of an electric saw is shown below.



(a) Calculate the current drawn from a 230 V supply.

*Space for working and answer*

(2)

(b) How many wires are there in the flex connecting the saw to the supply?

.....

(1)

(c) Name the wires in the flex.

.....

(1)

(d) State the colours of the insulation on the wires in the flex.

You must indicate clearly which colour applies to each wire.

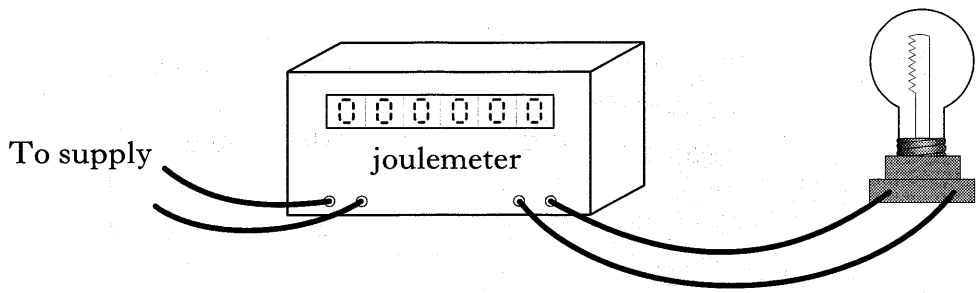
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(1)



Marks

14. The diagram below shows a joulemeter being used to measure the electrical energy transferred by a lamp.



(a) The joulemeter display is set at zero. The power of the lamp is 24 watts. The lamp is switched on for five minutes.

What is the reading on the joulemeter at the end of the five minute period?

*Space for working and answer*

(2)

(b) The filament lamp is replaced by a fluorescent tube, which also has a power of 24 watts. The fluorescent tube is run for five minutes.

How does the amount of light energy emitted by the fluorescent tube compare with that given out by the filament lamp? Explain your answer.

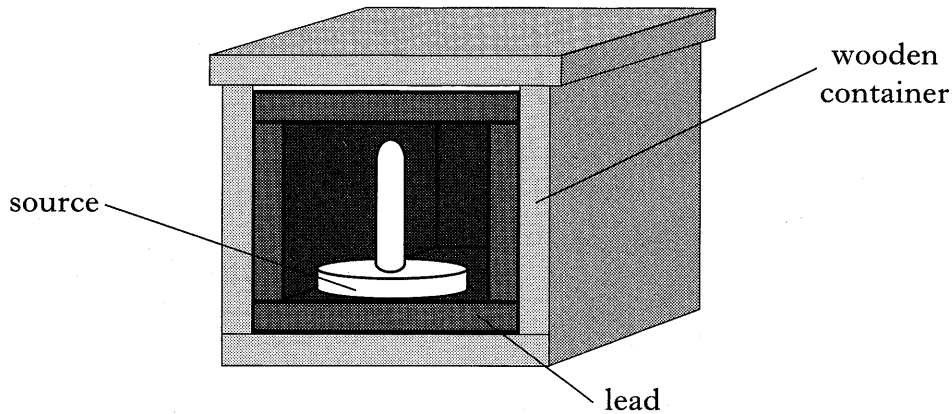
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.....

(2)

[Turn over

15. Radioactive sources are often stored in lead lined containers as shown.



(a) Explain why the container is lead-lined.

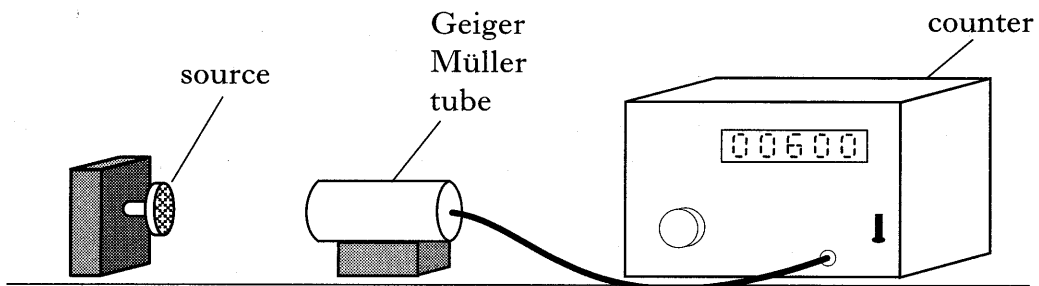
..... (1)

(b) Describe **two** safety precautions which should be taken when using the source.

(1) .....

(2) ..... (2)

(c) The source is placed in front of a Geiger Müller tube and counter as shown below.



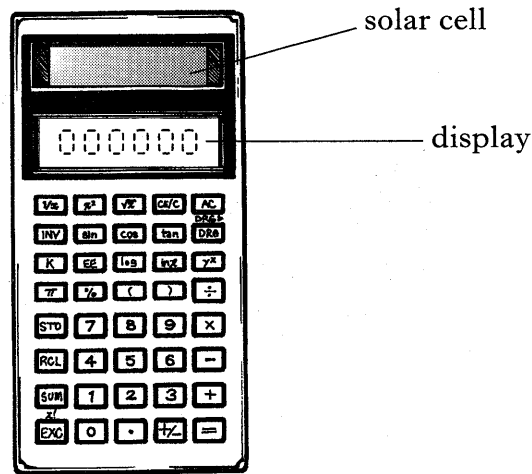
The counter registers 600 counts in one minute.

An identical experiment is repeated two years later using the same source. The reading on the counter is now 500 counts in one minute.

Explain why the count rate has decreased.

..... (1)

16. The diagram below shows a calculator which is powered by a solar cell.



(a) State the energy transfer occurring in the solar cell.

..... (1)

(b) The circuit powered by the solar cell has a resistance of 100 ohms. The solar cell produces a voltage of 0.5 volt. Calculate the current in the solar cell circuit.

*Space for working and answer*

..... (2)

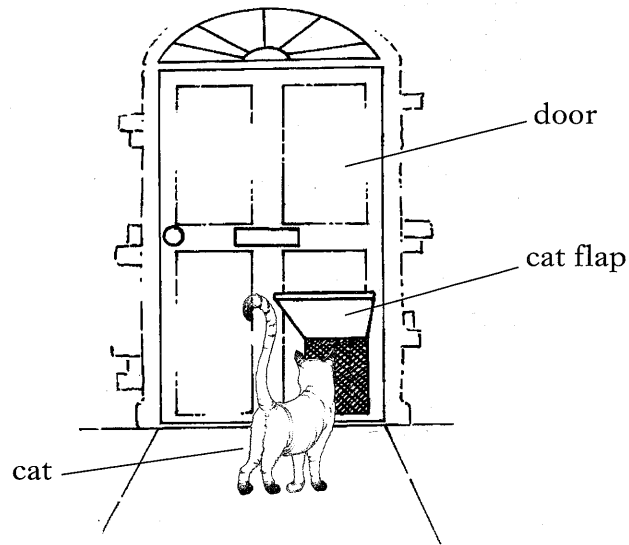
(c) Name a suitable output device which could be used in the display of the calculator.

..... (1)

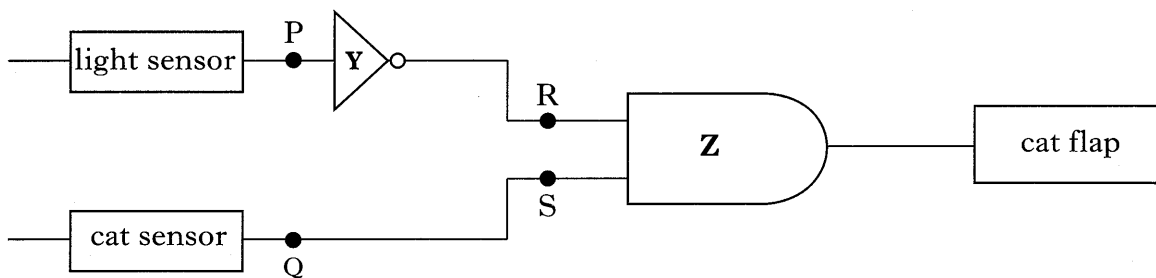
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Marks

17. A pupil designs an electronic system to control the opening and shutting of a cat flap in a door. The flap opens when the cat approaches the door in daylight.



The diagram below shows the electronic system which is used by the pupil.



When the cat approaches, the logic level at Q changes from logic 0 to logic 1.

In daylight, the logic level at P is logic 0.

In darkness, the logic level at P is logic 1.

The cat flap opens when the output from Z goes to logic 1.

- (a) Name the logic gate Z.

..... (1)

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Marks

**17. (continued)**

(b) In the space below, draw the truth table for logic gate Z.

*Space for table*

(1)

(c) Explain why the NOT gate Y is required.

.....

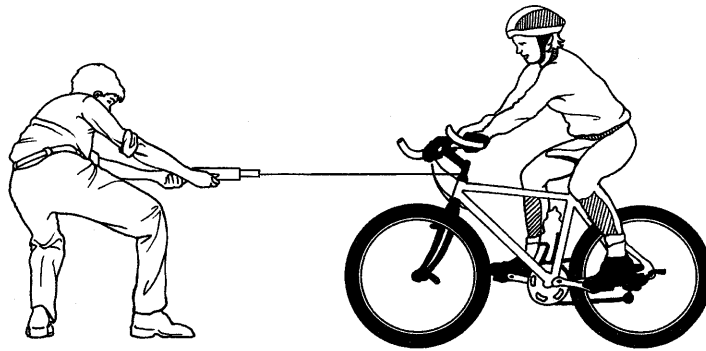
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(2)

**[Turn over**

Marks

18. (a) Two pupils wish to investigate the force of friction affecting their mountain bike. One pupil sits on the bike, without pedalling, while the other pulls the bike along at a steady speed.



(i) How do the pulling force and the frictional force on the bike compare when the bike moves at a steady speed?

..... (1)

(ii) Name an instrument which could be used to measure the pulling force.

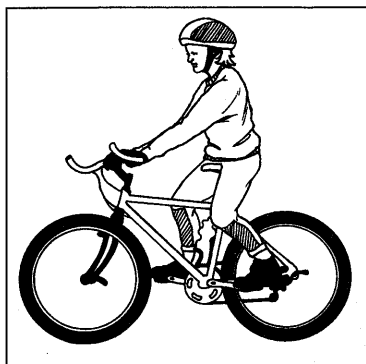
..... (1)

(b) The pupils are supplied with a measuring tape and a stopwatch. Describe how they could measure the average speed with which one of them rides the bike.

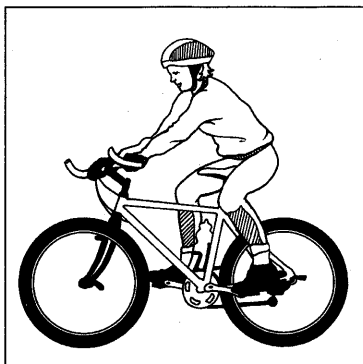
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.....  
.....  
.....  
..... (3)

18. (continued)

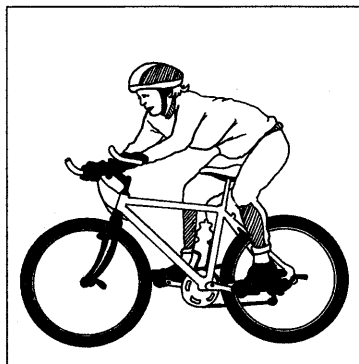
(c) The pictures below show three possible positions X, Y and Z which the pupils could use when free wheeling down a hill.



Position X



Position Y



Position Z

(i) Which of the three positions would give the rider the greatest speed at the bottom of the hill?

..... (1)

(ii) Why does this position give the greatest speed?

..... (1)

**[Turn over**

Marks

19. An assistant is pushing a long row of trolleys across the car park of a garden centre. The trolleys are pushed at a steady speed along the horizontal ground for a distance of 50 metres using a force of 400 newtons.



- (a) Calculate the work done in moving the trolleys.

*Space for working and answer*

(2)

- (b) The assistant pushes the trolleys for 80 seconds.  
Calculate the average power produced by the assistant.

*Space for working and answer*

(2)



20. Read the following passage about the Cruachan pumped storage system.

Here's how the Cruachan pumped storage system works.

Water is stored in a high level reservoir on Ben Cruachan. At times of peak demand for electricity, water from the reservoir is released through pipes to the power station 400 metres below.

The powerful surge of water spins turbine blades which turn generators to produce electrical power.

The National Grid distributes the electrical power throughout Scotland by means of transmission lines.

At times of low demand, electrical power from other sources is taken from the National Grid and is used to pump water from Loch Awe back up to the reservoir.

The water stored in the reservoir is then used to generate electricity at times of peak demand.

(a) State the form of energy gained by the water after it has been raised to the reservoir.

..... (1)

(b) State the direction in which water flows in the pipes at times of low demand.

..... (1)

(c) What is the reason for pumping water to the reservoir?

..... (1)

(d) Name the device used to produce electrical power.

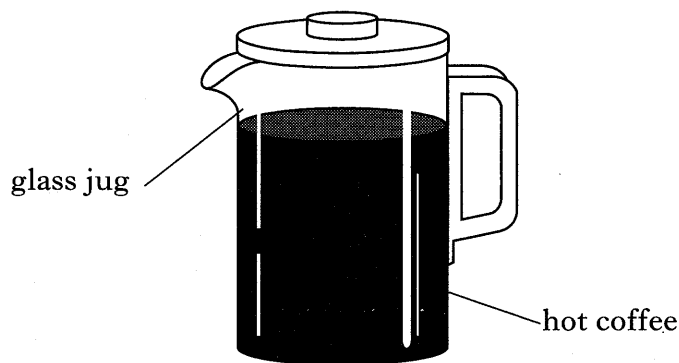
..... (1)

(e) What is the purpose of the National Grid?

..... (1)

Marks

21. A glass jug contains coffee at 80 degrees celsius. The coffee is found to cool quickly.



- (a) Use words from the following list to complete the sentence below.

temperature      energy      gains      loses

The ..... of the coffee is higher than that of its surroundings  
and as it cools the coffee ..... (2)

- (b) The jug contains 0.5 kilogram of coffee which has cooled to 20 degrees celsius.

Calculate how much heat energy is required to raise the temperature of the coffee from 20 degrees celsius to 80 degrees celsius.

[specific heat capacity of coffee = 4000 joules per kilogram per degree celsius]

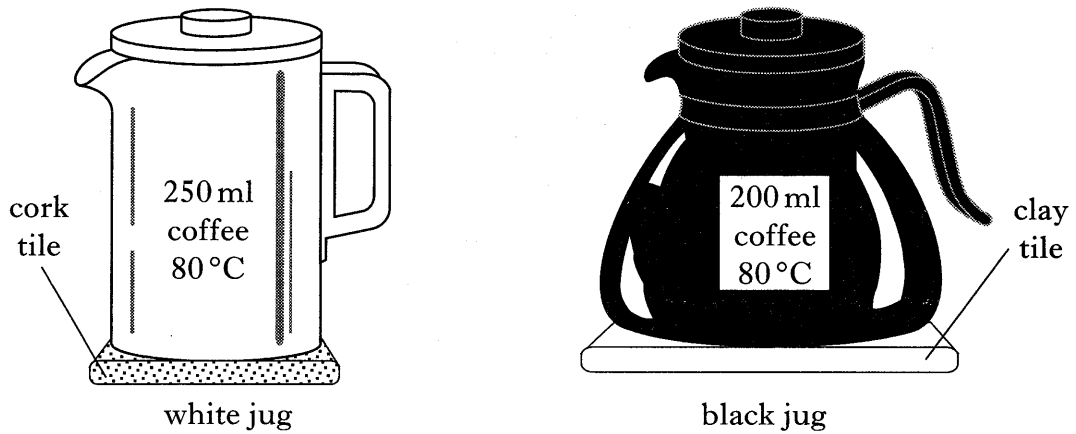
*Space for working and answer*

(2)

Marks

21. (continued)

(c) It is decided to investigate whether the colour of the jug affects the cooling of the coffee. Two jugs are filled with coffee as shown in the diagrams below.



The temperature of the coffee is noted at the start and after ten minutes.

Give **two** reasons why this is not a fair test.

(1) .....

.....

(2) .....

.....

(2)

[Turn over





**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.**

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