FOR OFFICIAL USE

Presenting Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.
	3220				

	K&U	PS
Total Marks		

[3220/256] 1990

SCOTTISH CERTIFICATE OF EDUCATION

PHYSICS

Standard Grade—GENERAL LEVEL

Friday, 27th April—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*

Number of seat occupied at examination

1. **All questions should be answered.**
2. **For questions 1–16, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only ONE correct answer.**
3. **The questions may be answered in any order but all answers must be written clearly and legibly in this booklet.**
4. **For questions 17–27, 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.**

UCP 3220/256 6/3/10910

DATA SHEET

Gravitational field strengths at the surface of planets:

Planet	*Gravitational Field Strength in newtons per kilogram*
Venus	9
Earth	10
Mars	4
Jupiter	26

1. The main energy change taking place at the mouthpiece of a telephone is

A chemical to sound
B sound to chemical
C electrical to sound
D sound to electrical
E electrical to chemical.

Answer ☐ **1**

2. The pictures seen on a colour television screen are produced by mixing the following colours of light

A	red	yellow	green
B	red	yellow	blue
C	red	green	blue
D	green	yellow	blue
E	green	blue	violet.

Answer ☐ **1**

3. Which of the following gives the voltage and frequency of the mains electrical supply in British homes?

	Voltage (volt)	*Frequency (hertz)*
A	240	0
B	120	0
C	120	60
D	240	60
E	240	50

Answer ☐ **1**

4. Household electrical appliances are connected in parallel so that they have the same

A power supplied
B voltage applied
C current supplied
D resistance to a.c.
E flex rating.

Answer ☐ **1**

[Turn over

5. A car headlamp is marked 12 volts/48 watts. Which of the following is measured in watts?

A Current
B Charge
C Resistance
D Power
E Energy

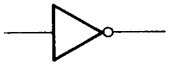
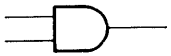
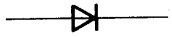
Answer ☐ 1

6. The nucleus (or core) of an atom contains

A electrons only
B neutrons only
C neutrons and electrons
D protons and neutrons
E protons, electrons and neutrons.

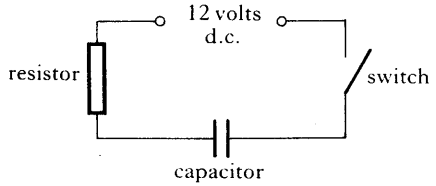
Answer ☐ 1

7. Which of the following is the circuit symbol for an AND gate?

A 
B 
C 
D 
E 

Answer ☐ 1

8. An uncharged capacitor is connected in the circuit shown.
The capacitor used has a large value.

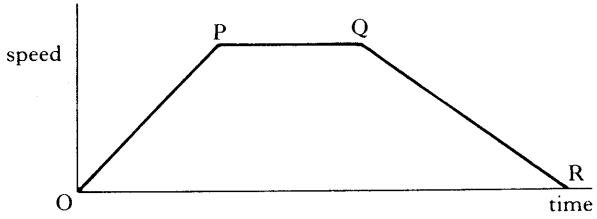


When the switch is closed, the voltage across the capacitor

A remains at 12 volts
B gradually rises to 12 volts
C immediately drops from 12 volts to 0 volts
D gradually drops from 12 volts to 0 volts
E remains at 0 volts.

Answer ☐ 1

9. The graph below shows the way in which the speed of a train changes as it moves between stations.



Which of the following describes the motion of the train?

	Between O and P	*Between P and Q*	*Between Q and R*
A	Acceleration	Constant speed	Deceleration
B	Constant speed	Acceleration	Constant speed
C	Constant speed	Deceleration	Constant speed
D	Deceleration	Constant speed	Acceleration
E	Acceleration	Deceleration	Acceleration

Answer ☐ 1

10. During a test drive, a car goes from 0 to 40 miles per hour in 8 seconds. Which of the following gives the acceleration of the car in miles per hour per second?

A 0·2
B 5
C 32
D 48
E 320

Answer ☐ 1

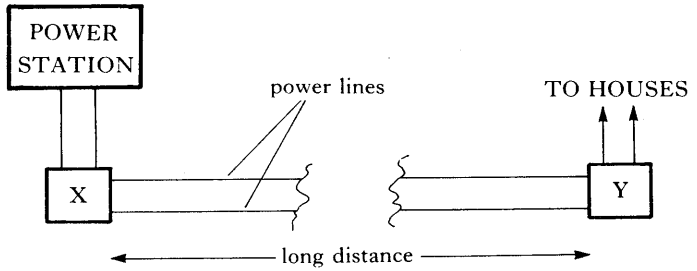
[Turn over

11. Which of the following household appliances depends on the latent heat of a substance to make it work?

A A food mixer
B A vacuum cleaner
C A refrigerator
D A bathroom shower
E A vacuum (thermos) flask

Answer ☐ 1

12. The diagram shows the system for sending electrical energy from a power station to our homes.



What are the devices X and Y if the electrical energy has to be transmitted over a long distance?

	Device X	*Device Y*
A	Step down transformer	Transistor
B	Transistor	Step up transformer
C	Step up transformer	Step up transformer
D	Step down transformer	Step up transformer
E	Step up transformer	Step down transformer

Answer ☐ 1

13. Ultra violet, infra red, microwaves and radio waves are all types of radiation which, in a vacuum,

A travel at the same speed as light
B have the same frequency as light
C have the same amplitude as light
D have the same wavelength as light
E are unable to be transmitted.

Answer ☐ 1

14. The time taken for light to reach us from the Sun is approximately

A 1 second
B 8 seconds
C 1 minute
D 8 minutes
E 1 hour.

Answer ☐ 1

15. The table below shows some information about amplifiers.

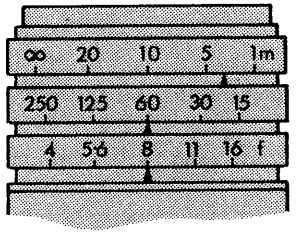
Amplifier model number	*Input voltage*	*Output voltage*
XHE 400	0·5	4·0
XZJ 250	0·1	8·0
XHE 400 L	2·0	16·0
XTK 950	2·0	10·0

Which amplifier(s) has a voltage gain of 8?

A XHE 400 only
B XZJ 250 only
C XTK 950 only
D both XZJ 250 and XTK 950
E both XHE 400 and XHE 400 L

Answer ☐

16. The diagram below shows the settings on a camera.



What are these settings?

	APERTURE	*SHUTTER SPEED*	*DISTANCE*
A	f/8	1/60 s	3 m
B	f/60	1/8 s	3 m
C	f/8	1/3 s	60 m
D	f/60	1/3 s	8 m
E	f/3	1/60 s	8 m

Answer ☐

The following questions should be answered in the spaces provided.

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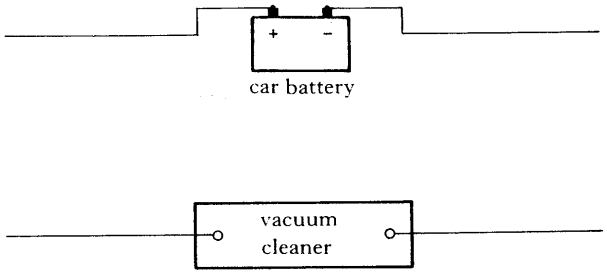
17. A car accessories shop sells a vacuum cleaner which works from a car battery. A motorist buys the vacuum cleaner and decides to check its power rating.

(*a*) Complete the circuit diagram below to show how this could be done using an ammeter and voltmeter.



2

(*b*) How would the motorist use the meter readings to find the power rating of the vacuum cleaner?

.....

1

18. Complete the table below by placing the following energy sources in the correct column.

COAL GAS TIDES WIND

RENEWABLE	*NON-RENEWABLE*

2

K&U

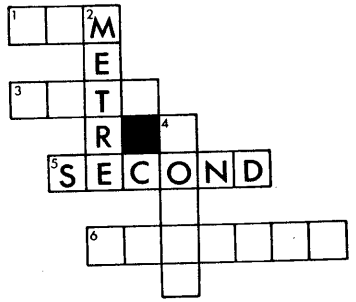
19. The transformer used for an electric door bell has to change the mains voltage of 240 volts to 6 volts to operate the bell. The transformer has 1000 turns in the primary coil.

Calculate the number of turns required in the secondary coil.

Space for working and answer

2

20. A pupil sees the following crossword puzzle on scientific units in a magazine. Complete the puzzle.



Across: 1. The resistance unit.
3. A Scottish scientist gave his name to this power unit.
5. The unit of time.
6. Unit of temperature.

Down : 2. Distance is measured in this.
4. A measurement of energy.

[Turn over

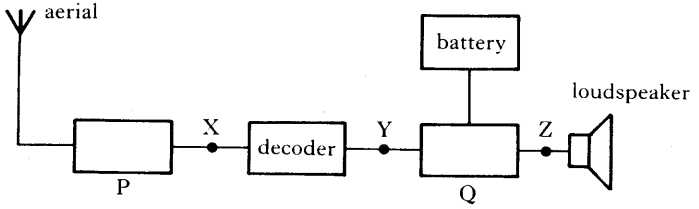
K&U	PS

21. (*a*) A number of different stations can be heard on a radio.

Which electronic part of the radio allows you to choose the station you wish to hear?

..... 1

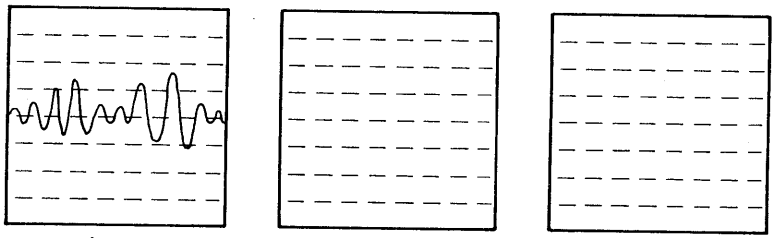
(*b*) The block diagram of a radio is shown below.



(i) Write the names of the parts P and Q on the block diagram. 2

(ii) Oscilloscopes are connected at X, Y and Z to examine the waveforms of the electrical signals at these points.

The waveform at point X is shown below.



waveform at X waveform at Y waveform at Z

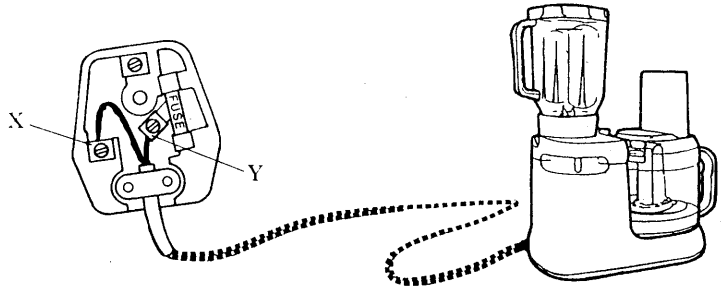
Draw the waveforms at Y and Z in the above diagrams. 2

(iii) The power of the signal received by the aerial of this radio is very small. The power from the loudspeaker is much larger.

What provides this extra power?

..... 1

22. The diagram shows a food processor correctly connected to a three pin plug.



22. (Continued)

(*a*) Complete the table below naming the colour of the insulation on the wires connected to the pins X and Y.

Wire	*Colour of insulation*
X	
Y	

2

(*b*) One pin in the plug has not been used because the food processor is double insulated.

(i) What name is given to the pin which has not been used?

..... 1

(ii) Draw the double insulation symbol in the space below.

Space for answer

1

(*c*) The rating plate for the food processor is shown below.

Type	Code
162	210
360 W	
240 V ∿ 50/60 Hz	
Made in U.K.	

(i) State the rating of the fuse which should be in the plug of the food processor.

..... 1

(ii) Calculate the current in the food processor when operating at its maximum power rating.

Space for working and answer

3

[Turn over

K&U	PS

23. Martin was in an accident and breaks a bone.

(*a*) To find the position of the break a doctor could use:

(A) ultra violet rays; (B) X-rays; (C) gamma rays.

(i) Which of the above should the doctor use?

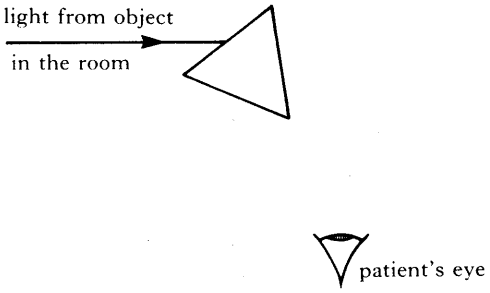
..... 1

(ii) Explain why **one** of the other rays would **not** have been suitable.

.....

..... 2

(*b*) As a result of his injuries, Martin will have to spend a long time on his back unable to raise his head. His classmates design a pair of special spectacles using triangular glass prisms instead of lenses. One of these prisms is shown below.



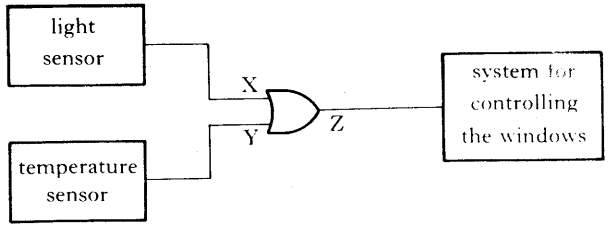
(i) Complete the above diagram to show clearly the effect of the prism on the light and how the light gets to Martin's eye from objects in the room. 2

(ii) What name is given to this effect which the prism has on the light?

..... 1

K&U

24. The diagram below shows a simple version of an electronic system which a gardener could use to control automatically the windows of a greenhouse when either the light level or the temperature changes.



(*a*) What name is given to the logic gate used in the system?

..... 1

(*b*) Complete the following truth table for the logic gate.

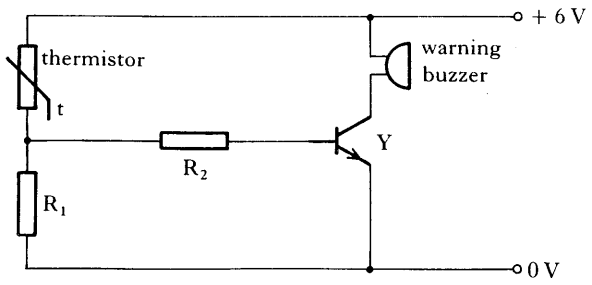
Input X	*Input Y*	*Output Z*

2

[Turn over

24. (continued)

(*c*) The gardener sees the following circuit in an electronics book. He thinks he could use it.



(i) What name is given to component Y?

..... 1

(ii) What is the purpose of component Y?

..... 1

(iii) What happens to the resistance of the thermistor as the temperature rises?

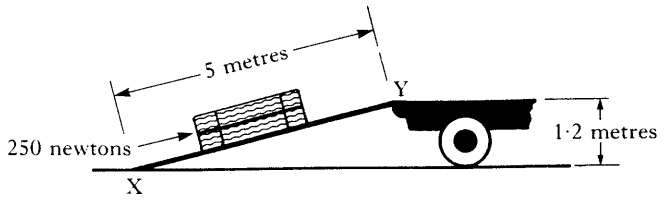
..... 1

(iv) State **one** practical use for this circuit.

.....

..... 1

25. A boy pushes a bale of straw of mass 45 kilograms up a ramp on to a trailer by applying a force of 250 newtons as shown. The length of the ramp is 5 metres and the height of the trailer above the ground is 1·2 metres.



(*a*) How much work does the boy do pushing the bale up the ramp from X to Y?

Space for working and answer

2

(*b*) What is the weight of the bale of straw?

..... 1

(*c*) How much work does a man do in lifting an identical bale vertically from the ground on to the trailer?

Space for working and answer

3

(*d*) Why does it take more work to push the bale up the ramp than to lift the bale vertically on to the trailer?

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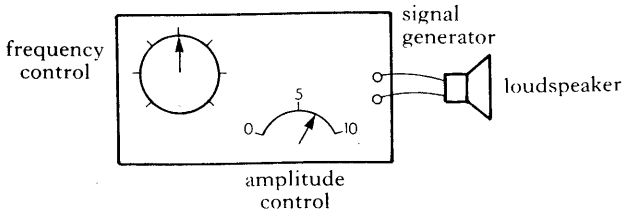
[Turn over

K&U	PS

26. Anne sets up the experiment below to measure the highest frequency Jim can hear.

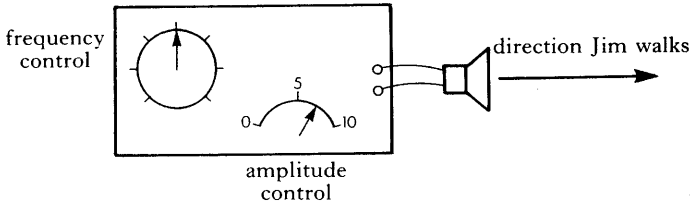


(*a*) What is the highest frequency you would expect Jim to hear?

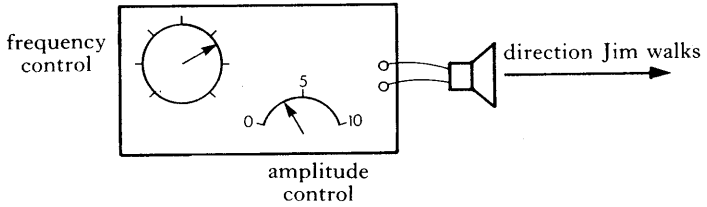
..... 1

(*b*) Anne now decides to find out how far away from the loudspeaker Jim can be and still be able to hear this frequency.

She sets up the apparatus shown below. Jim walks away from the loudspeaker and stops when he can no longer hear the sound. Anne measures the distance from the loudspeaker to Jim.



Anne asks her friend Wan to check this result using the **same** equipment. Wan sets up the apparatus as shown.



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

.....

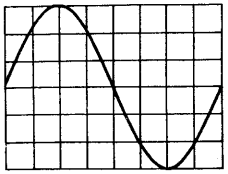
.....

..... 2

26. (continued)

(*c*) Anne now connects an oscilloscope across the loudspeaker. She sets the controls of the signal generator so that a **loud** sound of frequency 256 hertz is heard.

The trace on the oscilloscope is shown below.



(i) Anne then sets the signal generator to give a **quieter** sound **one octave higher**.

On the same diagram show the trace obtained on the oscilloscope.

(ii) What is the frequency of this quieter sound?

..... 1

(iii) Anne asks Wan to calculate the wavelength of the note of frequency 256 hertz. She tells him that the speed of sound in air is 320 metres per second and that he can use the same formula as is used for water waves, that is,

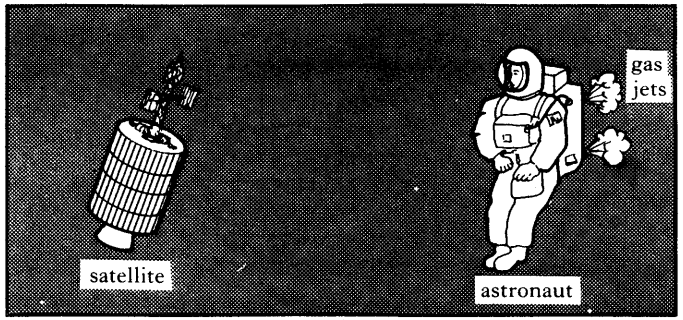
speed of waves = frequency × wavelength

What value should Wan obtain for the wavelength of the note?

Space for working and answer

[Turn over

27. A spacecraft is far out in space. An astronaut leaves the spacecraft to go to a small artificial satellite nearby. She has a jet pack strapped to her back.



The astronaut and her equipment have a mass of 70 kilograms and the jets can exert a constant thrust of 14 newtons when switched on.

(*a*) Calculate the acceleration of the astronaut when she switches on the jets.

Space for working and answer

2

(*b*) Describe the motion of the astronaut if the jets are now switched off. Explain your answer.

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2

[*END OF QUESTION PAPER*]