

FOR OFFICIAL USE

--	--	--	--	--	--

G

K & U PS

--	--

Total Marks

3220/401

NATIONAL
QUALIFICATIONS
2002

MONDAY, 27 MAY
9.00 AM – 10.30 AM

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

- 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 1–5, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.
- For questions 6–20, 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.



K&U	PS

5. Deep in outer space, the rocket engine of a space probe is fired for a short time and then switched off.

When the engine is off the probe

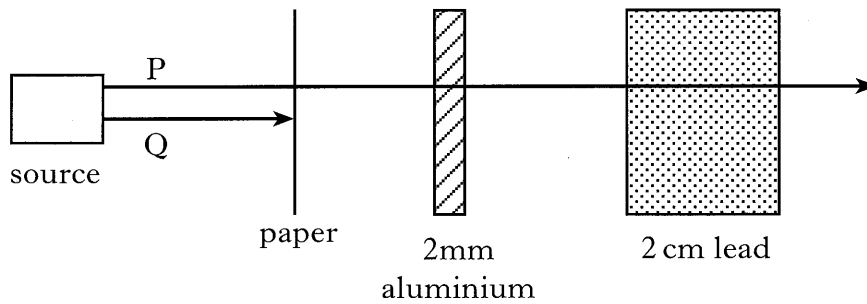
- A accelerates forwards
- B decelerates until it stops
- C changes direction
- D follows a curved path
- E moves at a steady speed.

Answer

Marks

1

6. A radioactive source emits two types of radiation, P and Q.
The diagram below shows the effect of different materials on these radiations.



Name the types of radiation, P and Q.

Radiation P is

Radiation Q is

2

7. Complete these statements about an atom, using all of the words from the following list.

electrons

neutrons

protons

The particles that make up the nucleus are.....

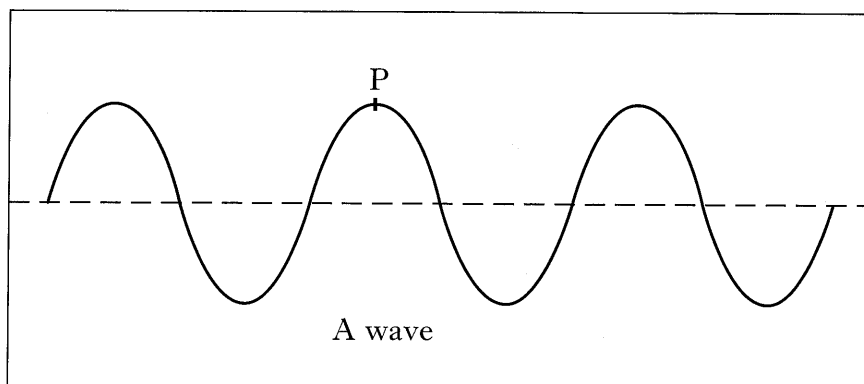
The particles that orbit the nucleus are.....

2

[Turn over

Marks

9. A diagram of a wave is shown below.



- (a) (i) On the diagram, mark a point Q that is exactly one wavelength from P.
- (ii) On the diagram, draw a line to mark an amplitude.
- (b) Some notes on waves taken by a physics student are shown below. The notes are incomplete.
- Use your knowledge of waves to complete the table.

1

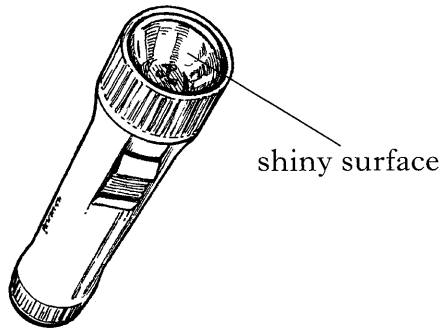
1

4

<i>Quantity</i>	<i>Definition</i>	<i>Unit</i>
wavelength	The shortest distance before the wave pattern repeats
.....	Number of waves that pass a point in one second
speed
amplitude	Distance from the rest position to the top of a crest or the bottom of a trough

Marks

10. A torch contains a battery, a lamp and a switch connected in series.



(a) Draw the circuit diagram for the torch, using the correct symbols.

Space for diagram

3

(b) Complete the passage below, using words from the following list.

voltage current charge

When the torch is on, moves around the circuit.

This movement is called a

2

(c) What is the **useful** energy transformation that takes place in the lamp when the torch is on?

..... to

1

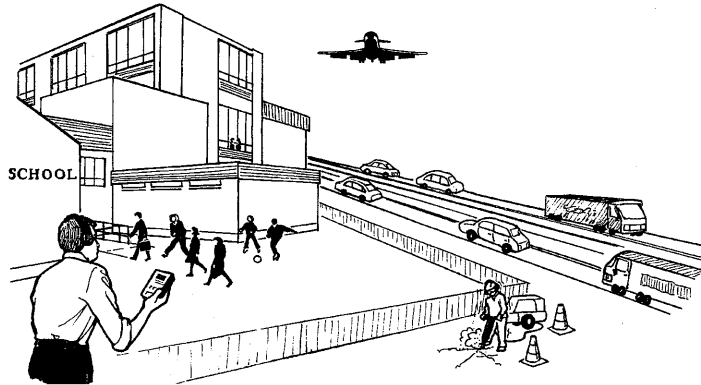
(d) Why is the surface behind the lamp shiny?

.....
.....

1

Marks

12. An Environmental Health Officer is measuring the level of noise pollution near a school.



- (a) From the picture, identify **two** sources of noise pollution.

.....
.....

2

- (b) Humans can only hear sounds above a certain **sound level**.
What is the value of this sound level?

.....

1

- (c) The Environmental Health Officer measures a sound level of 100 dB when a large lorry passes the school.

- (i) Why must the Environmental Health Officer wear ear protectors to reduce the sound level at his ears to below 80 dB?

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

2

- (ii) A student in a classroom measures the sound level at the same time as the Environmental Health Officer.

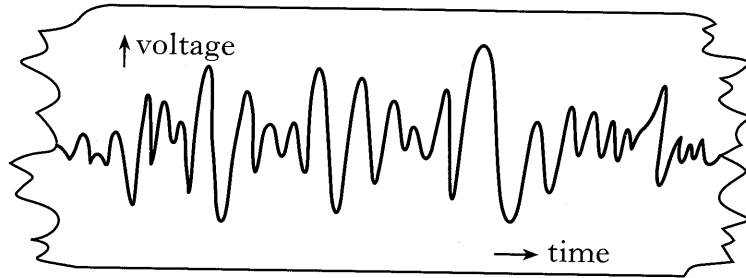
Explain whether the sound level measured by the student is higher or lower than the level measured by the Environmental Health Officer.

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

2

Marks

13. A thermocouple is used as a temperature sensor in a furnace. The thermocouple is attached to a chart recorder that records the voltage generated by the thermocouple over a period of time.



- (a) State the energy transfer that takes place in the thermocouple.
..... to

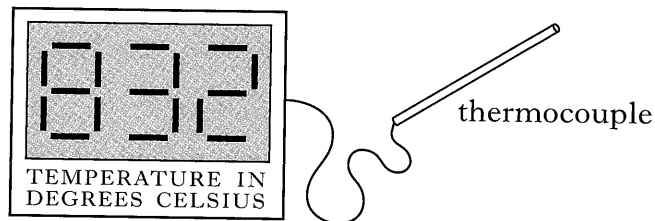
1

- (b) Circle the correct word in the sentence below.

The output of the chart recorder is $\left. \begin{array}{l} \text{(analogue)} \\ \text{binary} \\ \text{(digital)} \end{array} \right\}$.

1

- (c) The thermocouple is now connected to a circuit that has a digital display.



- (i) The resistance of the circuit is 500 ohms. At a particular temperature, the thermocouple generates a voltage of 0.8 volt. Calculate the current in the thermocouple circuit.

Space for working and answer

2

- (ii) Name a suitable output device that could be used for the digital display.

.....

1

Marks		K&U	PS
	1		
	1		
	1		
	2		

14. A public address system is used in a supermarket to make announcements. These announcements are made using a microphone, and the sound from loudspeakers is heard by customers.

A block diagram for this system is shown below.



(a) Name the input device.

.....

1

(b) The voltage gain of the amplifier is 2000.
What is meant by voltage gain?

.....
.....

1

(c) An input signal applied to the amplifier has a frequency of 5000 hertz.
What is the frequency of the output signal?

.....

1

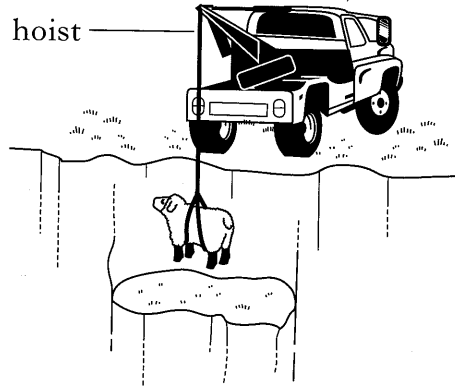
(d) The power output of the amplifier is 150 watts.
Calculate how many joules of energy are supplied by this amplifier in one minute.

Space for working and answer

2

Marks

15. A sheep of mass 40 kilograms is trapped on a ledge. A farmer uses a hoist to lift the sheep from the ledge.



- (a) Calculate the weight of the sheep.

Space for working and answer

2

- (b) What is the minimum force needed to lift the sheep at a steady speed?

.....

1

- (c) The sheep is lifted 7.5 metres.
Calculate the work done lifting the sheep.

Space for working and answer

2

- (d) The hoist takes 2 minutes to lift the sheep.
Calculate the minimum power output of the hoist.

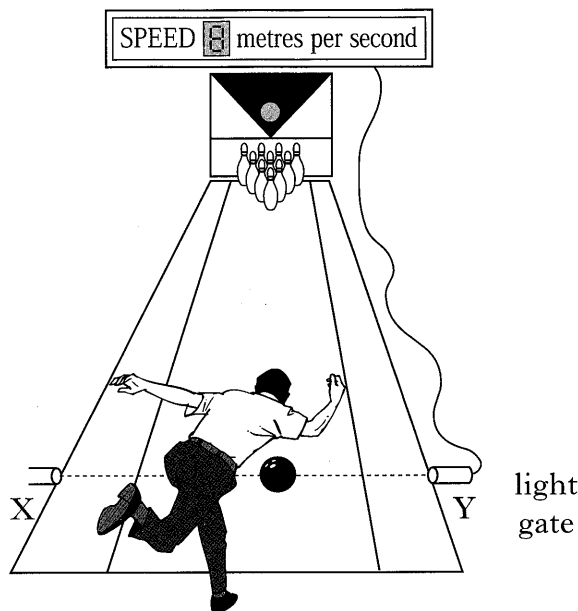
Space for working and answer

2

K&U	PS

Marks

16. At a bowling alley the speed of a ball is measured as it starts to roll along a horizontal lane.



- (a) A light gate is positioned at X–Y. The light gate is connected to a computer. The speed of the ball is measured using the light gate and the computer.

- (i) What **two** pieces of information does the computer need to calculate the speed of the ball?

.....
.....

2

- (ii) How is this information used to calculate the speed of the ball?

.....
.....

1

- (b) During one shot, a ball passes X–Y at a speed of 8 metres per second. Four seconds later, the ball is moving at 6 metres per second.

- (i) Name the force that causes the ball to slow down as it travels along the lane.

.....

1

Marks

16. (b) (continued)

(ii) Calculate the acceleration of the ball.

Space for working and answer

2

(iii) The ball has a mass of 5 kilograms.
Calculate the size of the force that causes the ball to slow down.

Space for working and answer

2

[Turn over

K&U	PS
-----	----

Marks

17. There are many sources of energy at present.

(a) (i) What is the main source of energy at present?

.....

1

(ii) State **one** of the problems with the main source of energy at present.

.....

.....

1

(b) Read the following passage about solar energy.

Some scientists have suggested that solar energy could be a solution to the problems that we have with our present main source of energy.

Solar energy is a free source of energy that is constantly being renewed. Solar energy produces no pollution.

Every year, each square metre of Northern Scotland receives 800 kilowatt hours of solar energy. Many people have rooftop solar panels to make use of solar energy for heating water in their houses.

(i) From the information given **in the passage**, state **one** advantage of solar energy.

.....

.....

1

(ii) A rooftop solar panel in Northern Scotland receives 2000 kilowatt hours of solar energy in one year.

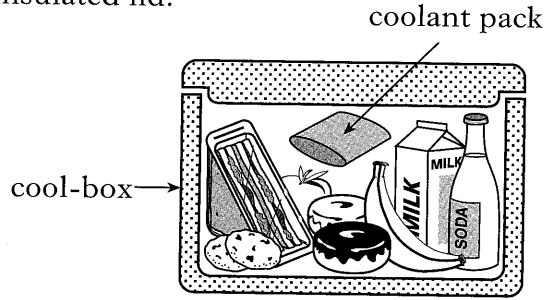
Calculate the area of this panel.

Space for working and answer

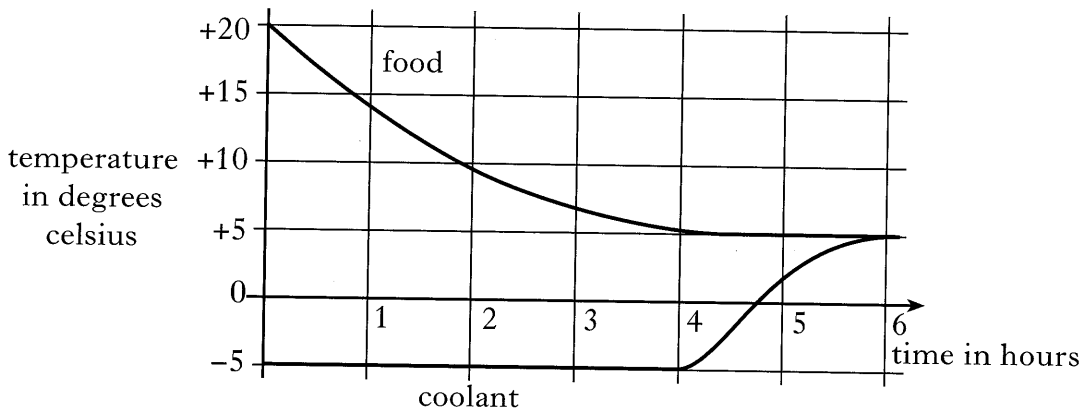
2

Marks

18. A “cool-box” is used to keep food cold for a picnic. The box is well insulated, and has an insulated lid.



Before food is put in the cool-box, a coolant pack is placed in a freezer. The coolant inside the pack changes from liquid to solid. The coolant pack is now placed in the cool-box with the food. The temperature changes of the food and the coolant over time are shown below.



- (a) What is the final temperature of the food?
 1
- (b) During the first 4 hours, the temperature of the coolant does not change but the temperature of the food falls.
- (i) What happens to the coolant during this time?

 1
- (ii) Explain why the temperature of the food falls during this time.

 2
- (c) Why is the box insulated?

 1

K&U	PS

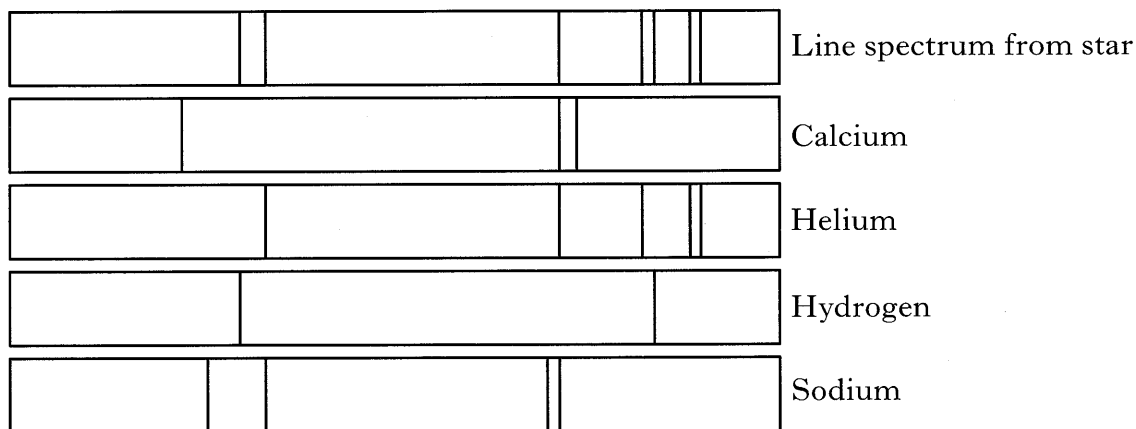
Marks

19. Light from a star is split into a line spectrum, of different colours.

(a) What is the name of a glass shape that is used to split light into different colours?

..... 1

(b) The line spectrum from the star is shown, along with the line spectra of the elements calcium, helium, hydrogen and sodium.

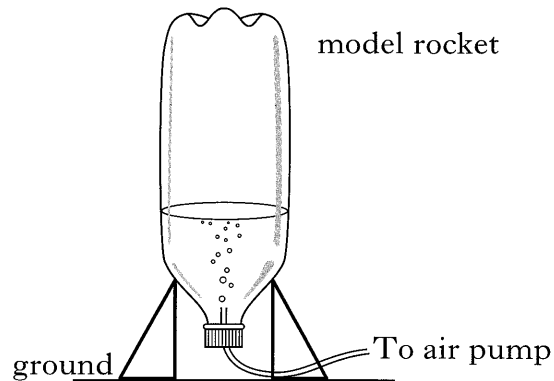


Use this information to identify the elements present in the star.

.....
..... 2

Marks

20. A model rocket is made from an upturned plastic bottle containing some water. Air is pumped into the bottle.



When the water is released, the rocket rises.

In the passage below, circle **one** word in each set of brackets to make the statements correct.

When the rocket rises, it exerts a force $\left\{ \begin{array}{l} \text{downwards} \\ \text{upwards} \end{array} \right\}$ on the $\left\{ \begin{array}{l} \text{ground} \\ \text{air} \\ \text{water} \end{array} \right\}$
 and the $\left\{ \begin{array}{l} \text{ground} \\ \text{air} \\ \text{water} \end{array} \right\}$ exerts a force $\left\{ \begin{array}{l} \text{downwards} \\ \text{upwards} \end{array} \right\}$ on the rocket.

2

[END OF QUESTION PAPER]

K&U	PS

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.

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.

[BLANK PAGE]