

FOR OFFICIAL USE

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K & U PS

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Total Marks

3220/401

NATIONAL
QUALIFICATIONS
2001

MONDAY, 4 JUNE
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

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Scottish 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 1–5, write down, in the space provided, the letter corresponding to the answer you think is correct. There is only **one** correct answer.
- For questions 6–16, 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. Which of the following is the part of a radio receiver that selects one station from many?

- A Aerial
B Tuner
C Decoder
D Amplifier
E Loudspeaker

Answer

1

2. A baby alarm needs an output device that transforms electrical energy into sound energy.

Which of the following is suitable?

- A Electric motor
B LED
C Loudspeaker
D Relay
E Solenoid

Answer

1

3. Which of the following gives the correct order of **increasing** wavelength for the colours named?

- A Blue, green, red
B Blue, red, green
C Green, blue, red
D Red, blue, green
E Red, green, blue

Answer

1

4. A fish of mass 2 kilograms is hung on a Newton balance. The fish and the balance are dropped and fall freely to the sea below.

What is the reading on the Newton balance **while falling**?

- A 0 newton
B 1 newton
C 2 newtons
D 10 newtons
E 20 newtons

Answer

1

5. When a spacecraft re-enters the Earth's atmosphere, some
- A heat is transferred to potential energy
 - B heat is transferred to kinetic energy
 - C kinetic energy is transferred to potential energy
 - D potential energy is transferred to heat
 - E kinetic energy is transferred to heat.

Answer

Marks

1

6. Draw the circuit symbol for a light emitting diode (LED) in the space below.

Space for diagram

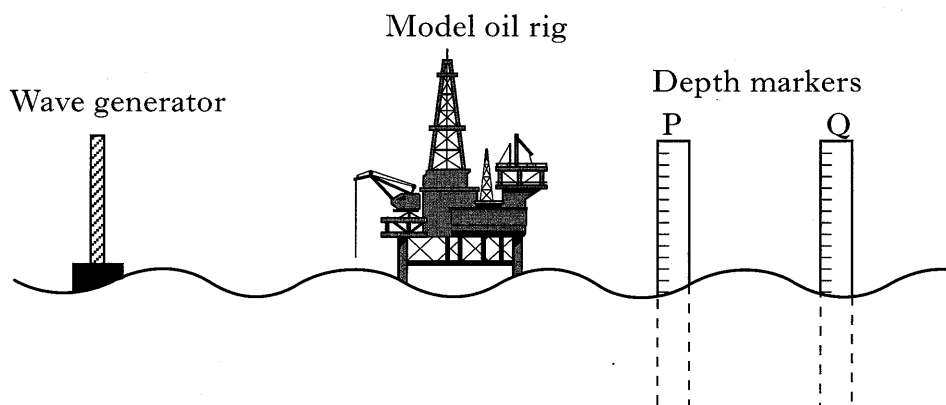
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7. The diagram shows part of an experimental wave tank used to test model oil rigs.



There is a wave generator at one end of the tank. Two depth markers, P and Q, are fixed to the bottom of the tank.

- (a) (i) Ten waves are made in 5 seconds.
Calculate the frequency of the waves.

Space for working and answer

2

- (ii) The distance from the wave generator to the other end of the tank is 12 metres. Eight complete waves are made in this distance.
Calculate the wavelength of the waves.

Space for working and answer

2

- (iii) Calculate the speed of the waves.

Space for working and answer

2

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7. (continued)

- (b) (i) As the waves travel along the tank, the length of depth marker P seen above the water changes from 15 centimetres to 13 centimetres. Calculate the amplitude of the waves at depth marker P.

<i>Space for working and answer</i>

2

- (ii) Why is the amplitude of the waves at depth marker Q smaller than at P?

.....

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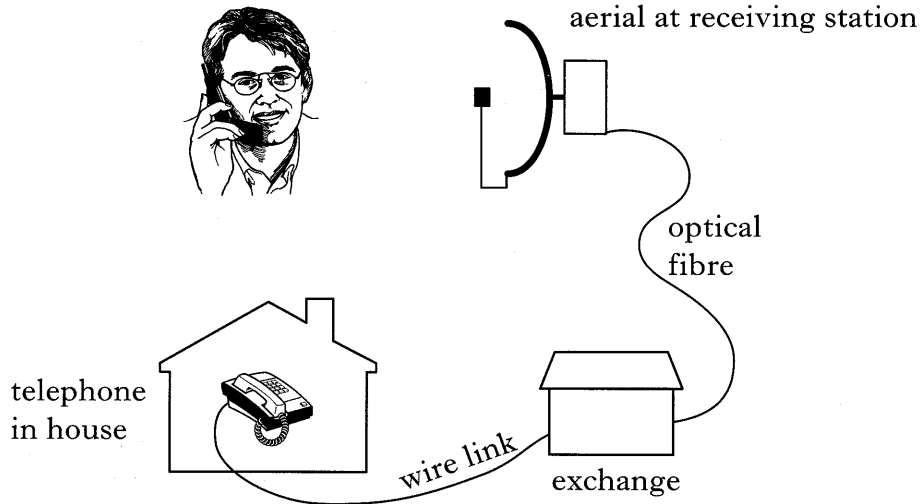
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8. A caller makes a telephone call using a mobile phone. The call is received at a telephone in a house.



The message from the caller reaches the person receiving the call in four stages.

Stage 1—The caller speaks into the mobile phone.

Stage 2—The mobile phone transmits a signal to an aerial at a receiving station.

Stage 3—The signal is transmitted along an optical fibre to an exchange.

Stage 4—The exchange is connected by a wire link to the telephone in the house.

- (a) (i) Use words from the list below to show how the message is transmitted at each of the above stages.

electrical light microwave sound

Stage	How the message is transmitted
1	
2	
3	
4	

1

1

1

1

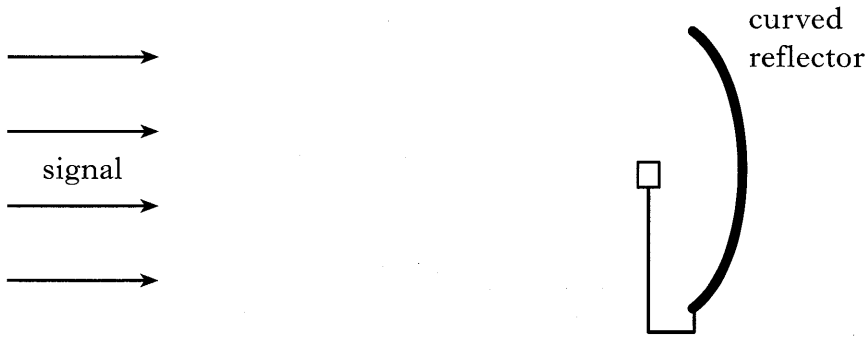
- (ii) During which stage (from the table above) does the message travel **most slowly**?

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1

8. (continued)

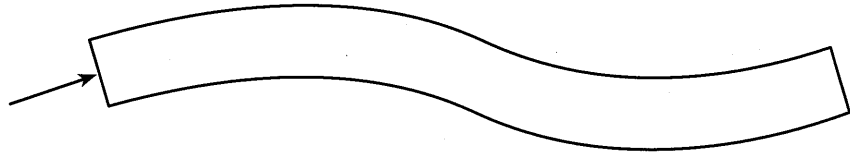
(b) Complete the diagram below to show the effect of the curved reflector at the receiving station.



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2

(c) A section of the optical fibre used in Stage 3 is shown below.



Complete the diagram to show how the signal is transmitted along the optical fibre.

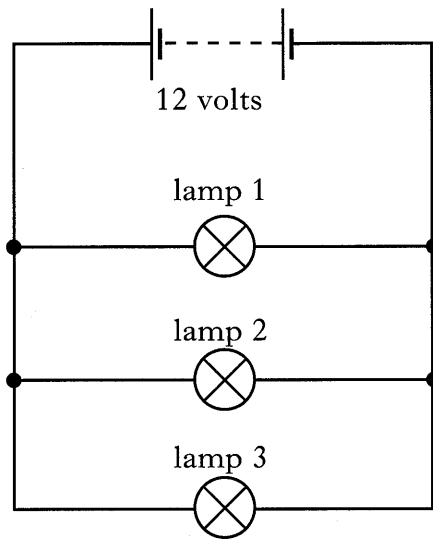
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9. (a) Three identical lamps are shown in Circuit 1 below.



Circuit 1

(i) The battery has a voltage of 12 volts and supplies a current of 0.9 ampere to the circuit.

Complete the table below to show the current in each lamp and the voltage across each lamp.

	<i>Lamp 1</i>	<i>Lamp 2</i>	<i>Lamp 3</i>
<i>Current</i> (amperes)			
<i>Voltage</i> (volts)			

1

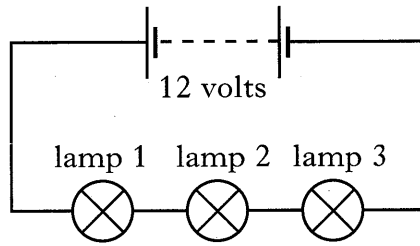
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9. (a) (continued)

- (ii) The three lamps and battery are now reconnected as shown in Circuit 2 below. The current from the battery is now 0.1 ampere.



Circuit 2

Complete the table below to show the current in each lamp and the voltage across each lamp.

	<i>Lamp 1</i>	<i>Lamp 2</i>	<i>Lamp 3</i>
<i>Current</i> (amperes)			
<i>Voltage</i> (volts)			

- (b) (i) Which of the circuits, Circuit 1 or Circuit 2, shown in (a) is similar to a household lighting circuit?

.....

- (ii) Name an electrical appliance used in the home that requires two or more switches to be used in series.

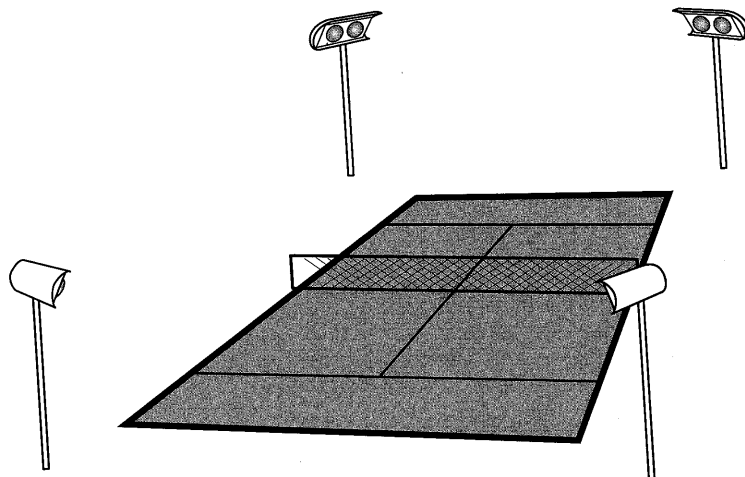
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10. A tennis court has four columns of floodlights.



Each column has two lamps. Each lamp has a power rating of 800 watts. The lamps are all connected in parallel with the mains supply.

(a) What is the value of the mains voltage?

.....

1

(b) Give **two** advantages of connecting the lamps in parallel.

.....

.....

.....

.....

2

(c) (i) Calculate the total power delivered by the four columns of floodlights, in kilowatts.

Space for working and answer

2

Marks

10. (c) (continued)

(ii) (A) All the lamps are switched on for a tennis match. The match lasts for 3 hours.

Calculate how many kilowatt-hours of electrical energy are used during this match.

Space for working and answer

1

(B) The cost of 1 kilowatt-hour of electrical energy is 5 pence.

Calculate the cost of the energy used for the lighting during this match.

Space for working and answer

2

(d) A fuse is included in the floodlight circuit to protect the wiring.

Name **one** other device that could be used instead of a fuse.

.....

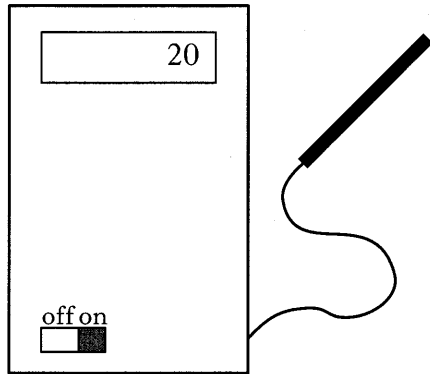
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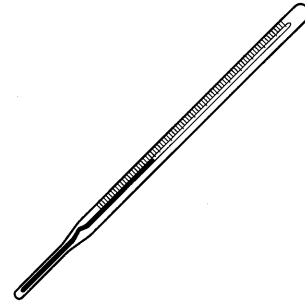
Marks

11. (a) Information on two types of thermometer, P and Q, is given below.



Thermometer P

Digital thermometer with probe
Temperature range:
-10 degrees celsius to
110 degrees celsius
in divisions of 1 degree celsius



Thermometer Q

Clinical mercury thermometer
Temperature range:
35 degrees celsius to
42 degrees celsius
in divisions of 0.1 degree celsius

(i) Which thermometer would be better for measuring the temperature of melting ice?

Explain your answer.

.....

.....

.....

2

(ii) Which thermometer would be better for measuring a patient's body temperature?

Explain your answer.

.....

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11. (continued)

(b) Describe how body temperature is measured using a clinical thermometer.

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

2

(c) A doctor measures a patient's body temperature as 39 degrees celsius. Explain how this measurement assists the doctor in making a diagnosis.

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2

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12. An automatic light circuit for a porch is being constructed. The design for the circuit uses two sensors, so that the lamp in the circuit will only operate when it is dark and when a person approaches the porch.

One sensor detects heat from a person's body. The second sensor detects the presence of visible radiation.

- (a) There is a choice of three sensors as follows:

infrared detector light dependent resistor ultraviolet detector.

- (i) Which sensor should be used to detect body heat?

..... 1

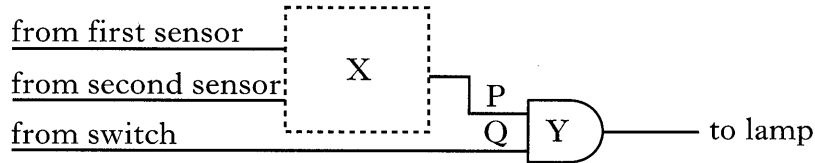
- (ii) Which sensor should be used to detect visible radiation?

..... 1

- (b) The diagram below shows part of the circuit that is designed.

The diagram shows the inputs from the sensors and from the on/off switch for the circuit.

The circuit has two logic gates X and Y. The symbol for gate X is not shown.



- (i) (A) What type of logic gate is Y?

..... 1

- (B) Complete the truth table for the logic gate that you have named in (b)(i)(A).

Input P	Input Q	Output
0	0	
0	1	
1	0	
1	1	

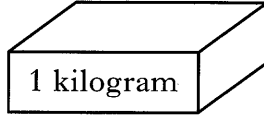
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- (ii) What type of logic gate is X?

..... 1

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13. A student carries out an experiment to measure the weight of a block. The block is marked as having a mass of 1 kilogram as shown.

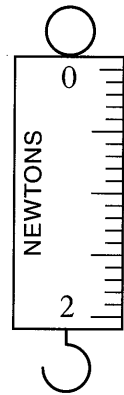


- (a) Complete the following passage.

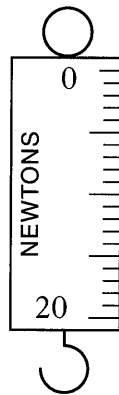
Weight is a and is the Earth's pull on an object. 1

The weight of a mass of 1 kilogram is 1

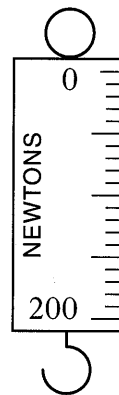
- (b) In doing the experiment, the student has the choice of the Newton balances shown below to measure the weight of the block.



Balance P



Balance Q



Balance R

- (i) Which balance could **not** be used to measure the weight of the block?

Give a reason for your choice.

.....

2

- (ii) The student decides to use balance R.

Why is this **not** the best balance to use?

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14. A tropical fish tank is filled with water at 18 degrees celsius. The tank holds 120 kilograms of water when it is full. Tropical fish live in water at a temperature of 34 degrees celsius and so the tank has a heater to heat the water.

- (a) (i) Calculate how much heat energy is needed to heat the water in the tank from 18 degrees celsius to 34 degrees celsius.
[The specific heat capacity of water is 4180 joules per kilogram degree celsius.]

<i>Space for working and answer</i>

3

- (ii) The heater has a power rating of 200 watts.
Calculate the minimum time it takes to heat the water in the tank.

<i>Space for working and answer</i>

2

- (b) Why does the heater need to be switched on at regular intervals to keep the temperature of the water at 34 degrees celsius?

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15. In a pumped hydroelectric scheme, water is stored in a reservoir 400 metres above the power station.

(a) (i) Describe what is meant by a **pumped** hydroelectric scheme.

.....

2

(ii) Give **one** advantage of a pumped hydroelectric scheme.

.....

1

(b) Calculate the potential energy transferred by one kilogram of water in moving from the reservoir to the power station.

Space for working and answer

2

[Turn over

Marks

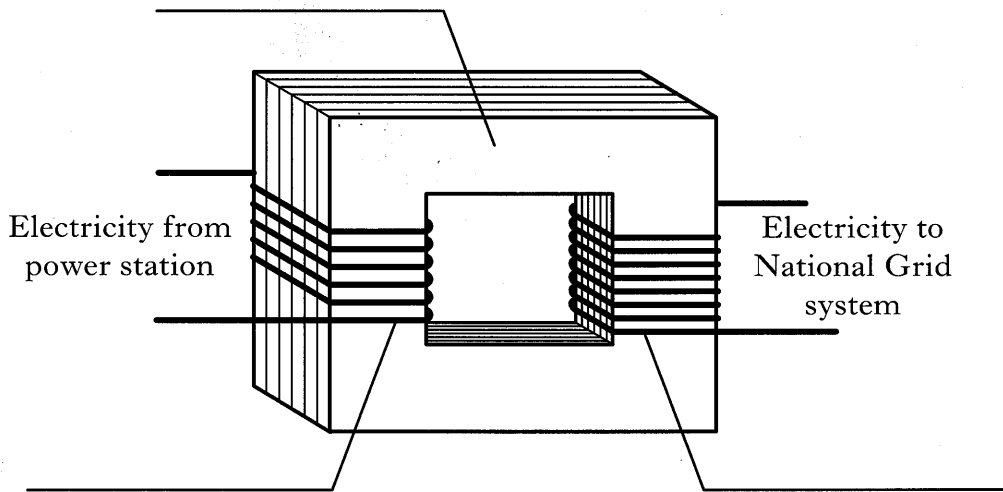
15. (continued)

(c) The power station generates electricity at 25 000 volts. This voltage is stepped up to 275 000 volts by a transformer. Electricity at this higher voltage is transmitted across the country using the National Grid system.

(i) A transformer consists of three parts.

Label each of these three parts on the diagram, using the names given.

core primary coil secondary coil



3

(ii) The number of turns on the primary coil of the transformer is 15 000.

Calculate the number of turns on the secondary coil.

Space for working and answer

2

(iii) Why is a very high voltage used by the National Grid system to transmit electrical energy?

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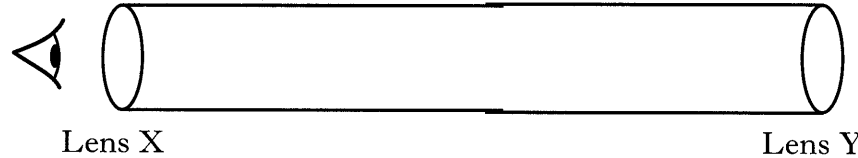
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16. (a) An astronomer views the following objects in the night sky:

- Jupiter, which orbits the Sun;
- Europa, which orbits Jupiter;
- the Andromeda Galaxy.

- (i) Which of the objects mentioned is a moon?
..... **1**
- (ii) Which of the objects mentioned is a planet?
..... **1**
- (iii) Which of the objects mentioned is a star?
..... **1**

(b) A telescope consists of two lenses, X and Y, in a light-tight tube.



Complete the following statements about the lenses in this telescope, using the words or phrases from the list.

- eyepiece objective magnify collect light**

- (i) Lens X is called the lens. Its purpose is to
..... **1**
- (ii) Lens Y is called the lens. Its purpose is to and produce an image of the object. **1**

[END OF QUESTION PAPER]

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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.