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## 3220/401



Total Marks

NATIONAL QUALIFICATIONS 2007

WEDNESDAY, 16 MAY
9.00 AM - 10.30 AM

## PHYSICS <br> STANDARD GRADE General Level

Fill in these boxes and read what is printed below.

Full name of centre
$\square$
Forename(s)


Town
$\square$
Surname


Date of birth


Reference may be made to the Physics Data Booklet.
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 book.

3 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.

4 For questions 6-18, write your answer where indicated by the question or in the space provided after the question.

5 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.

6 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.

1. Which part of a radio receiver separates the audio signal from the carrier wave?
A Aerial
B Tuner
C Decoder
D Amplifier
E Loudspeaker

2. Four identical resistors, $\mathrm{P}, \mathrm{Q}, \mathrm{R}$ and S are connected as shown.


In which of the resistors is the current the same?
A P and Q only
B R and S only
C P, R and S only
D Q, R and S only
E P, Q, R and S.
3. Which row of values would result in the greatest kinetic energy?

|  | Mass <br> (kilograms) | Speed <br> (metres per second) |
| :---: | :---: | :---: |
| A | 45 | 8 |
| B | 45 | 4 |
| C | 50 | 10 |
| D | 50 | 8 |
| E | 50 | 4 |

Answer $\square$
4. A rocket is pushed forwards because its engine gases

A are pushed backwards
B spread outwards
C are pushed forwards
D surround the rocket
E spread inwards.

5. In outer space, the engine of a space probe is switched on for a short time. When the engine is switched off, the rocket

A changes direction
B moves at a steady speed
C slows down
D speeds up
E follows a curved path.

[Turn over
6. A surfer rides the waves near a beach.

(a) The diagram below shows a wave some distance from the beach.

seabed
(i) Using information from the diagram, calculate the wavelength of the wave.

Space for working and answer

2
(ii) The time between one crest and the next crest passing the marker pole is 5 seconds.
Calculate the speed of the wave.
Space for working and answer
6. (a) (continued)
(iii) Calculate the frequency of the wave.

Space for working and answer
(b) The drawing below shows changes in the wave as it approaches the beach.


Complete the sentences below by circling the correct answers.
(i) As the wave approaches the beach,

$$
\text { its wavelength }\left\{\begin{array}{l}
\text { decreases } \\
\text { increases } \\
\text { stays the same }
\end{array}\right\} \text {. }
$$

(ii) As the wave approaches the beach,

$$
\text { its amplitude }\left\{\begin{array}{l}
\text { decreases } \\
\text { increases } \\
\text { stays the same }
\end{array}\right\} .
$$

7. Appliances convert electrical energy into other forms of energy.

| Appliance | Rating plate |
| :--- | :---: |
| Food processor | 230 volts <br> 50 hertz <br> 400 watts |
| Hair dryer | 230 volts <br> 50 hertz <br> $\square$ |
| Kettle |  |

(a) State the useful energy output from the following appliances.
(i) Lamp: electrical energy $\longrightarrow$............................. energy
(ii) Kettle: electrical energy $\longrightarrow$............................. energy

## 7. (continued)

(b) (i) Name one appliance from the table which requires an earth wire.
$\qquad$
(ii) Circle one word or phrase in the passage below to make the statement correct.

The colouring of the insulation around the earth wire is
$\left\{\begin{array}{l}\text { blue } \\ \text { brown } \\ \text { green and yellow }\end{array}\right\}$.
(iii) Each appliance is fitted with either a 3 ampere or 13 ampere fuse. State the correct value of fuse for the following appliances.
(A) Lamp:
(B) Hair dryer:
8. A mobile phone contains a battery which is charged using a base unit. The base unit contains a transformer and is connected to the a.c. mains supply.

(a) What is the purpose of the mains supply?
$\qquad$
(b) Name the supply mentioned which is d.c.
$\qquad$
(c) a.c. is short for alternating current.

Explain what is meant by alternating current.
$\qquad$
$\qquad$
(d) State the purpose of a transformer.
$\qquad$
$\qquad$
(e) State one advantage of using a mobile phone.
$\qquad$
$\qquad$
9. One of the spotlights on a stage does not work. A continuity tester is used to find the fault. The continuity tester contains a lamp and a 1.5 volt battery.

(a) Complete the circuit diagram for the continuity tester.

You must use the correct symbols for all components.

## Space for circuit diagram


(b) Describe how you could check that the continuity tester is working properly.
$\qquad$
$\qquad$
(c) The continuity tester shows that the fault in the spotlight is an open circuit.
What is meant by an open circuit?
$\qquad$
10. Different types of radiation are used to detect and treat illnesses and injuries. Four of these radiations are

| infrared | laser light | ultraviolet |
| :---: | :---: | :---: | X-rays

(a) What type of radiation is used to treat skin conditions such as acne?
$\qquad$ 1
(b)

(i) State one medical use of X-rays.
$\qquad$
(ii) What can be used to detect X-rays?
$\qquad$
10. (continued)
(c)


Colour photographs called thermograms are used to find the temperature variation in a patient's body.
Name the radiation used to make thermograms.
$\qquad$
(d)


Explain why people need to be protected from overexposure to ultraviolet radiation.
$\qquad$
11. A class investigates the effects of the following shapes of glass on rays of white light.


The teacher sets up three experiments, covering the glass shape with card. The paths of the light rays entering and leaving the different shapes of glass are shown.
For each of the three experiments, draw the shape and position of the glass block that was used.
(a)

(b)

(c)

12. A radio and a computer mouse are examples of electronic systems.
(a) An electronic system can be represented by a block diagram as shown.

Complete the block diagram by filling in the missing labels.

(b) Output signals from an electronic system can be either analogue or digital.
(i) The output signal from a radio is analogue.


Draw an analogue signal.

| Space for drawing |
| :--- |
|  |
|  |
|  |
|  |
|  |

(ii) The output signal from a computer mouse is digital.


Draw a digital signal.
13. An electronic system is used to control a lift. When a floor has been selected, two checks are made:
there are no obstructions to the doors; the lift is not overloaded.

Part of the circuit is shown below.


The logic states are as shown for the floor selector, the sensors and the door mechanism.

|  |  | logic level |
| :---: | :--- | :---: |
| floor selector | not pressed | 0 |
|  | pressed | 1 |
| door sensor | no obstruction | 0 |
|  | obstruction | 1 |
| overload sensor | overloaded | 0 |
|  | not overloaded | 1 |
| door mechanism | doors open | 0 |
|  | doors closed | 1 |

(a) Name logic gate $\mathbf{X}$.
$\qquad$

## 13. (continued)

(b) (i) Gate $\mathbf{Y}$ is a NOT gate.

Draw the symbol for a NOT gate.
Space for symbol
(ii) Complete the truth table for a NOT gate.

| Input | Output |
| :---: | :---: |
| 0 |  |
| 1 |  |

(c) (i) State the logic levels needed at $\mathrm{P}, \mathrm{Q}$ and R to close the lift doors.

Logic level at P $\qquad$
Logic level at Q $\qquad$

Logic level at R $\qquad$
(ii) What output device could be used for the door opening and closing mechanism?
$\qquad$
14. In a tennis match, the player hits the ball to serve.

(a) The ball travels 24 metres from the server's racquet to the opponent's racquet at an average speed of 40 metres per second.
Calculate the time taken.

## Space for working and answer

## 14. (continued)

(b) A graph showing how the speed of the ball changes while in contact with the racquet during the serve is shown.


Calculate the acceleration of the ball during the serve.
Space for working and answer
(c) For a second serve, the server hits the ball with a smaller force.

What effect does this have on the speed of the ball when it leaves the racquet?
$\qquad$
15. A skier takes part in a downhill competition.

(a) State two ways the skier can reduce friction in order to reach high speeds.
$\qquad$
$\qquad$
(b) When the skier reaches the maximum speed of 65 metres per second, this speed is maintained over the rest of the course.
State how the size of the downhill force compares with the size of the frictional force during this part of the course.
$\qquad$
(c) At the end of the course, the frictional force brings the skier to rest over a horizontal distance of 500 metres. During this distance, the average frictional force is 346 newtons.
Calculate the work done to bring the skier to rest.
Space for working and answer
16. A student carries out an experiment to find out which mug is the best at keeping drinks hot.
Each mug is made from a different material.

plastic

metal

ceramic

The same volume of hot water is added to each mug.
(a) Describe how the student could carry out the experiment.

Your description should include:
what apparatus would be used;
what measurements are made;
how you reach a conclusion.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(b) How could the heat lost from the mugs be reduced?
$\qquad$
17. A householder installs a wind turbine electricity generator.


The table gives information about the wind turbine.

| Rated power output | $1 \cdot 5$ kilowatts |
| :--- | :--- |
| Product life | 20 years |
| Installation cost | $£ 1600$ |

(a) In the year 2006, the wind turbine generated electricity for 2000 hours.

Calculate the energy generated in kilowatt-hours during 2006.
Space for working and answer

## 17. (continued)

(b) An electricity supplier charges 8 pence per kilowatt-hour.

Calculate the cost of buying the same amount of electricity as generated by the wind turbine in 2006.


2
(c) The wind turbine costs $£ 1600$ to install. It is used to generate energy for 20 years. Each year it generates the same amount of energy as it did in 2006.

Calculate how much money the householder will save if the turbine is used to generate electricity over this time.

Space for working and answer
18. The diagram below shows a refracting telescope, which is used by astronomers to view distant stars, planets and galaxies.

(a) (i) Which lens, the objective or the eyepiece, has the longer focal length?
$\qquad$
(ii) What is the purpose of the eyepiece lens?
$\qquad$
18. (continued)
(b) The table gives information about some of the planets in our Solar System.

| Planet | Diameter <br> (kilometres) | Distance from <br> Sun <br> (million <br> kilometres) | Weight of one <br> kilogram at <br> surface <br> (newtons) | Time to go <br> around the <br> Sun once <br> (years) | Time for one <br> complete spin <br> (in Earth days <br> or hours) |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Mercury | 4800 | 58 | 4 | $0 \cdot 25$ | 59 days |
| Venus | 12000 | 110 | 9 | $0 \cdot 6$ | 243 days |
| Earth | 12750 | 150 | 10 | 1 | 24 hours |
| Mars | 7000 | 228 | 4 | $1 \cdot 9$ | 25 hours |
| Jupiter | 140000 | 780 | 26 | 12 | 10 hours |
| Saturn | 120000 | 1430 | 11 | 30 | 10 hours |
| Neptune | 50000 | 4500 | 12 | 165 | 16 hours |

(i) Which planet has the longest day?
$\qquad$
(ii) Which planet has the longest orbit?
$\qquad$
(iii) On which planet would a 4 kilogram mass have the greatest weight?
$\qquad$
(c) A meteorite is the name given to an object which enters the Earth's atmosphere from space. When they enter the atmosphere, meteorites heat up.
State the energy change when the meteorite enters the atmosphere.
$\qquad$
(d) Stars and planets belong to galaxies.

What is a galaxy?

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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