



**2007 Physics**

**Standard Grade – General**

**Finalised Marking Instructions**

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## Physics – Marking Issues

The current in a resistor is 1.5 amperes when the potential difference across it is 7.5 volts. Calculate the resistance of the resistor.

	<b>Answers</b>	<b>Mark + Comment</b>	<b>Issue</b>
1.	V=IR 7.5=1.5R R=5.0 Ω	(½) (½) (1)	Ideal answer
2.	5.0 Ω	(2) Correct answer	GMI 1
3.	5.0	(1½) Unit missing	GMI 2 (a)
4.	4.0 Ω	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0 \Omega$	(1½) Arithmetic error	GMI 7
7.	$R = \frac{V}{I} = 4.0 \Omega$	(½) Formula only	GMI 4 and 1
8.	$R = \frac{V}{I} = \text{_____} \Omega$	(½) Formula only	GMI 4 and 1
9.	$R = \frac{V}{I} = \frac{7.5}{1.5} = \text{_____} \Omega$	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 4.0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R = \frac{V}{I} = \frac{1.5}{7.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R = \frac{V}{I} = \frac{7.5}{1.5} = 5.0 \Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R = \frac{I}{V} = \frac{7.5}{1.5} = 5.0 \Omega$	(0) Wrong formula	GMI 5
14.	V = IR 7.5 = 1.5 × R R = 0.2 Ω	(1½) Arithmetic error	GMI 7
15.	V = IR $R = \frac{I}{V} = \frac{1.5}{7.5} = 0.2 \Omega$	(½) Formula only	GMI 20

Marks

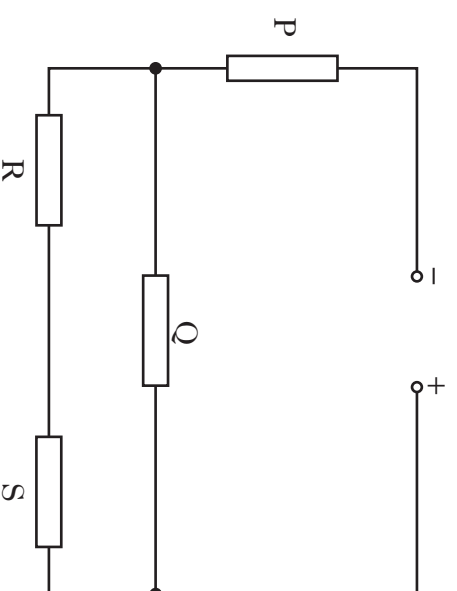
1. Which part of a radio receiver separates the audio signal from the carrier wave?
- A Aerial
  - B Tuner
  - C Decoder
  - D Amplifier
  - E Loudspeaker

Answer

**C**

1

2. Four **identical** resistors, P, Q, 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.

Answer

**B**

1

K&U	PS

3. Which row of values would result in the greatest kinetic energy?

	<i>Mass</i> (kilograms)	<i>Speed</i> (metres per second)
A	45	8
B	45	4
C	50	10
D	50	8
E	50	4

Marks

*Answer* **C**

1

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.

*Answer* **A**

1

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

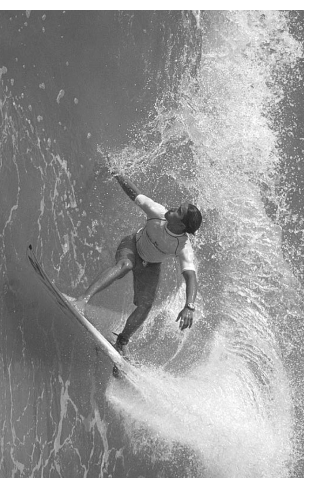
- A changes direction
- B moves at a steady speed
- C slows down
- D speeds up
- E follows a curved path.

*Answer* **B**

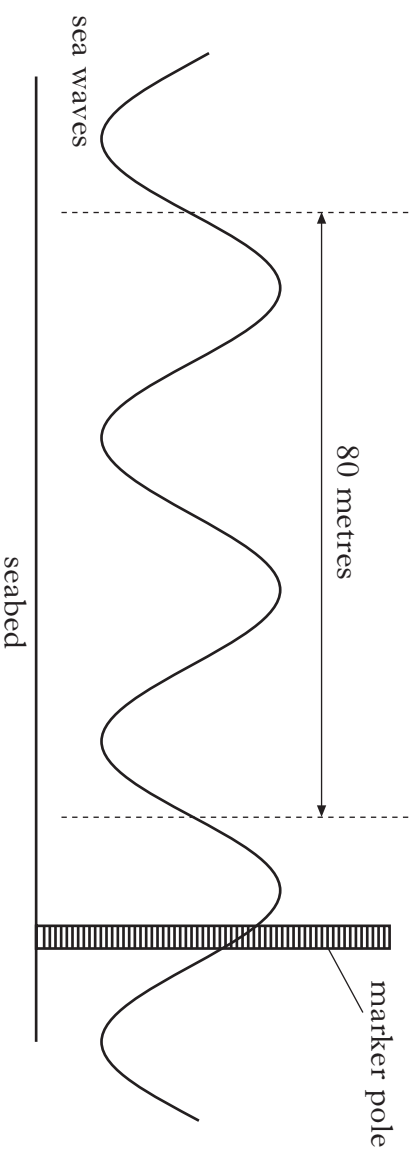
1

K&U	PS

6. A surfer rides the waves near a beach.



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



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

*Space for working and answer*

**2 wavelengths (or waves) in 80 m** <sup>(1/2)</sup>  
**1 wave in 40 m**  
**wavelength = 40 m (1)**

(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*

**speed =  $\frac{\text{distance}}{\text{time}}$**   
**=  $\frac{40}{5}$**   
**= 8 metres/second**

Marks

K&U PS

2

2

NOTES

(a) (ii) OR  $F = \frac{1}{T} = \frac{1}{5} = 0.2 \text{ Hz}$  <sup>(1/2)</sup> for both formulae

$$V = F\lambda$$

$$= 0.2 \times 40$$

$$= 8 \text{ m/s} \quad (1)$$

6. (a) (continued)

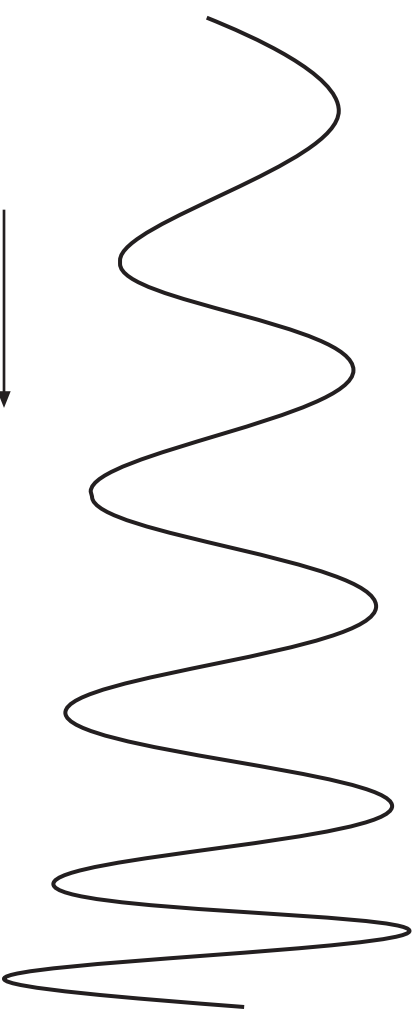
Marks

(iii) Calculate the frequency of the wave.

<i>Space for working and answer</i>					
$v = f\lambda$	( $\frac{1}{2}$ )	$f = \frac{v}{\lambda}$	( $\frac{1}{2}$ )	$f = \frac{1}{T}$	( $\frac{1}{2}$ )
$8 = 40 \times f$	( $\frac{1}{2}$ )	OR	$= \frac{8}{40}$	( $\frac{1}{2}$ )	OR
$f = 0.2 \text{ Hz}$	(1)		$= 0.2 \text{ Hz}$	(1)	$= \frac{1}{5}$
			$= 0.2 \text{ Hz}$	(1)	$= 0.2 \text{ Hz}$

2

(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, its wavelength { decreases / increases / stays the same }.
- (ii) As the wave approaches the beach, its amplitude { decreases / increases / stays the same }.

1

1

NOTES

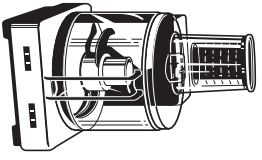

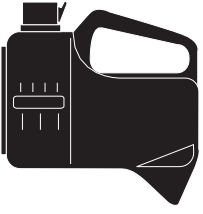
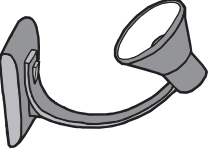
OR  $f = \frac{n}{t}$  ( $\frac{1}{2}$ )

$= \frac{2}{10}$  ( $\frac{1}{2}$ )

$= 0.2 \text{ Hz}$  (1)

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

Marks

Appliance	Rating plate
	230 volts 50 hertz 400 watts
	230 volts 50 hertz 1200 watts
	230 volts 50 hertz 2200 watts
	230 volts 50 hertz 60 watts

(a) State the **useful** energy output from the following appliances.

- (i) Lamp: electrical energy → ..... **LIGHT** ..... energy      **1**
- (ii) Kettle: electrical energy → ..... **HEAT** ..... energy      **1**

K&U	PS

(a) (i) NOT: light & heat

7. (continued)

Marks

(b) (i) Name **one** appliance from the table which requires an earth wire.

**food processor OR kettle** ..... **1**

(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

{

 blue  
 brown  
 green and yellow
 
}

**1**

(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:..... **3(A)**

(B) Hair dryer:..... **13(A)**

**1**

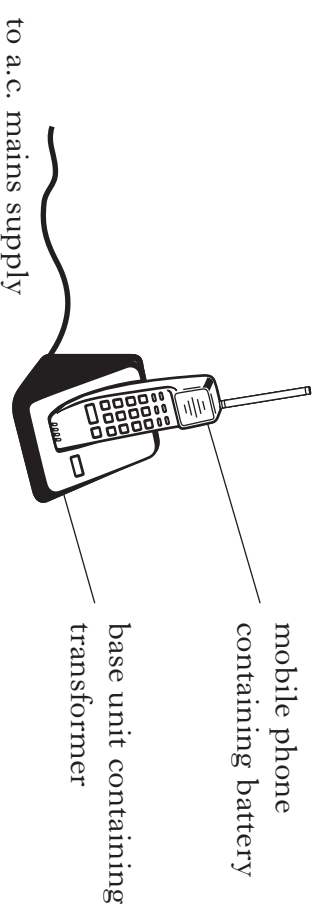
	K&U	PS

**no fuse values apart from 3A or 13A**



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.

Marks



- (a) What is the purpose of the mains supply?  
**to supply (electrical) energy/power/current/voltage**  
 ..... 1
- (b) Name the supply mentioned which is d.c.  
**(mobile phone) battery**  
 ..... 1
- (c) a.c. is short for alternating current.  
 Explain what is meant by alternating current.  
**a current that changes direction**  
 ..... 1
- (d) State the purpose of a transformer.  
**changes the size (or value) of (ac) voltage**  
 ..... 1
- (e) State **one** advantage of using a mobile phone.  
**can be used in different locations/portable**  
 .....  
**OR can be carried so you can be contacted anywhere**  
 ..... 1  
**OR does not have/need wires**

K&U	PS

(a) accept: to charge battery  
not: "to charge phone"  
 "to supply electricity"

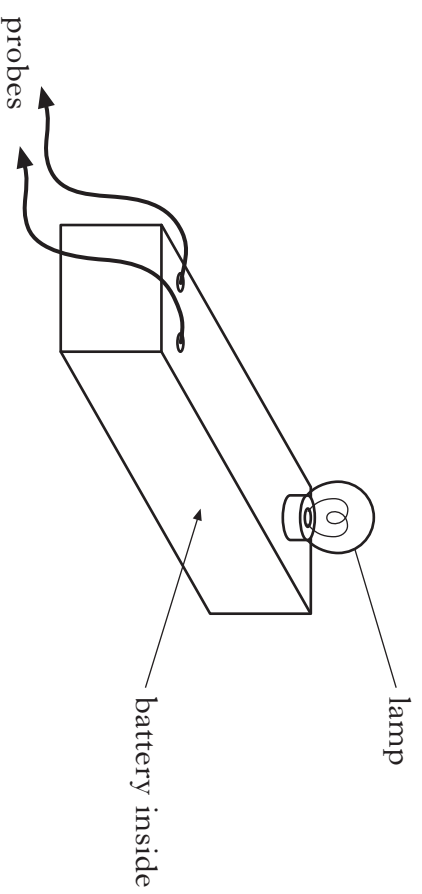
(c) answer must indicate a change in direction (not size)  
 eg a current which travels in opposite/both/two directions  
not: "travels in all directions"

(d) accept: to increase/decrease voltage/current  
 to step up/down voltage/current

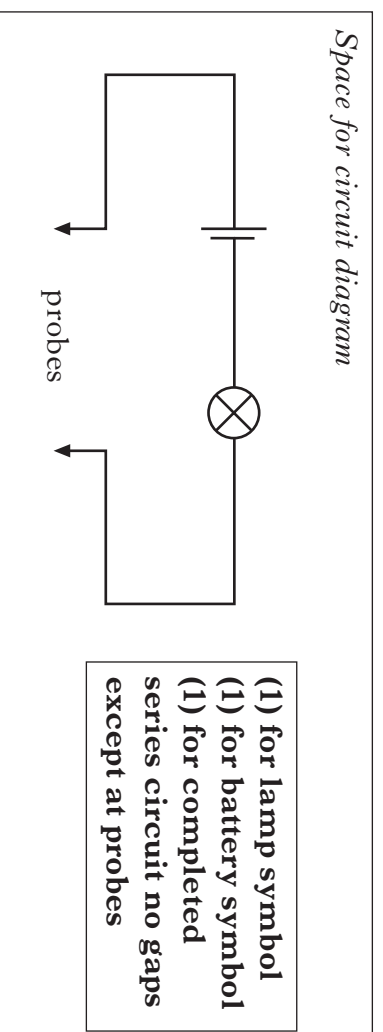
(e) not: small,  
 any privacy answer,  
 not connected to mains supply

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.

Marks



- (a) Complete the circuit diagram for the continuity tester:  
You must use the correct symbols for all components.



- (b) Describe how you could check that the continuity tester is working properly.  
**join probes together (1) OR Connect wire conductor to probes (1) OR Connect wire conductor to probes (1) OR lamp lights if working (1)**  
 .....  
 2
- (c) The continuity tester shows that the fault in the spotlight is an open circuit.  
 What is meant by an open circuit?  
**there is a break in the circuit**  
 .....  
 1

K&U	PS

NOTES

- (a) accept    for battery symbol

- (b) accept: “connect a voltmeter/ammeter to probes” only if accompanied by an explanation  
do not accept: “connect to a working appliance”/fuse

- (c) accept: “there is a gap/space in the circuit”  
 “wire has become detached”  
not: “fuse has blown”  
 “not making a complete circuit”

10. Different types of radiation are used to detect and treat illnesses and injuries. Four of these radiations are

Marks

infrared	laser light	ultraviolet	X-rays
----------	-------------	-------------	--------

- (a) What type of radiation is used to treat skin conditions such as acne?  
ultraviolet (UV) OR laser (light) ..... 1

(b)



- (i) State **one** medical use of X-rays.  
detect broken bones ..... 1
- (ii) What can be used to detect X-rays?  
photographic/film paper/X-ray film/radiation film/badge ..... 1

K&U	PS

NOTES

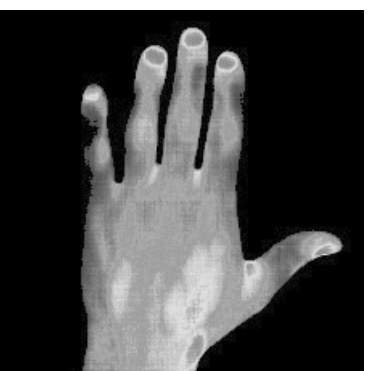
(a) not: "light" alone

(b) (i) accept: "to examine teeth"  
"to detect/treat tumours/cancer"  
CT scans  
radiotherapy

(b) (ii) not: X-ray camera, digital camera, X-ray sensor, GM tube

10. (continued)

(c)

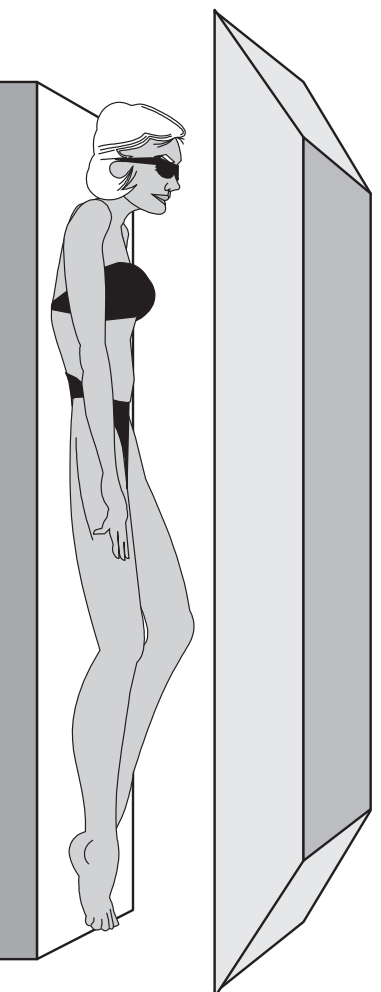


Colour photographs called thermograms are used to find the temperature variation in a patient's body.

Name the radiation used to make thermograms.

**infra red (IR) OR heat** .....

(d)



Explain why people need to be protected from overexposure to ultraviolet radiation.

**(ultraviolet radiation) can cause skin cancer** .....

Marks

K&U	PS

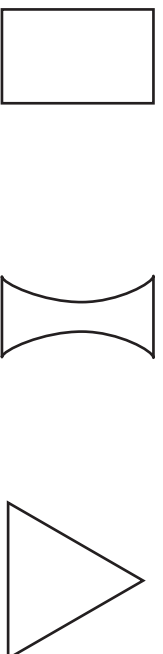
NOTES

**(d) accept: "can damage eyes"**  
**"can cause sunburn/cataracts/melanoma"**  
**"can kill/damage skin cells"**

**not: cancer**  
**skin disease**

Marks

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)

1 mark for correct shape  
1 mark for correct orientation

2

(b)

1 mark for shape only  
1 mark for workable size and orientation

2

(c)

1 mark for correct shape  
1 mark for correct orientation

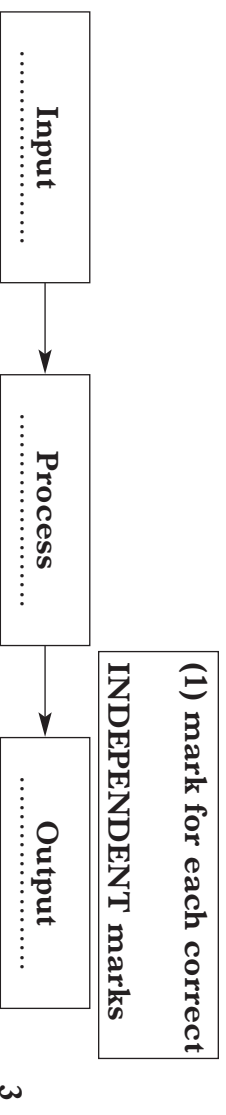
2

K&U	PS

need not show paths of rays inside dotted boxes

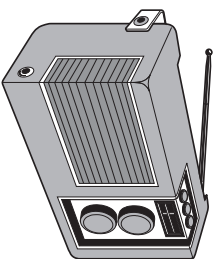
12. A radio and a computer mouse are examples of electronic systems.

- (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.

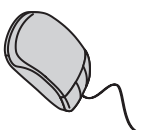


Draw an analogue signal.

any "waveform" which shows an analogue signal

*Space for drawing*

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



Draw a digital signal.

any "waveform" which shows digital signal

*Space for drawing*

*Marks*

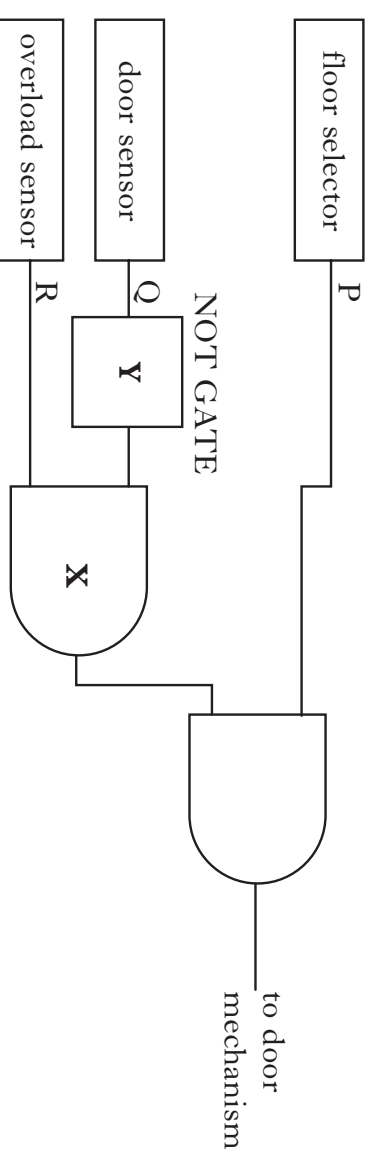
	K&U	PS
3	1	2
1	1	1

**NOTES**

Marks

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 **X**.

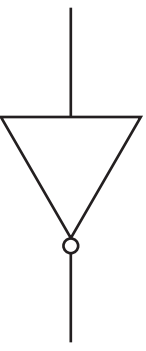
.....**AND**..... **1**


13. (continued)

- (b) (i) Gate **Y** is a NOT gate.  
Draw the symbol for a NOT gate.

*Space for symbol*

**Must show both connections**



1

- (ii) Complete the truth table for a NOT gate.

<i>Input</i>	<i>Output</i>
0	1
1	0

1

- (c) (i) State the logic levels needed at P, Q and R to close the lift doors.

Logic level at P ..... **1** (1)

Logic level at Q ..... **0** (1)

Logic level at R ..... **1** (1)

3

- (ii) What output device could be used for the door opening and closing mechanism?

**(electric) motor OR solenoid**

1

Marks

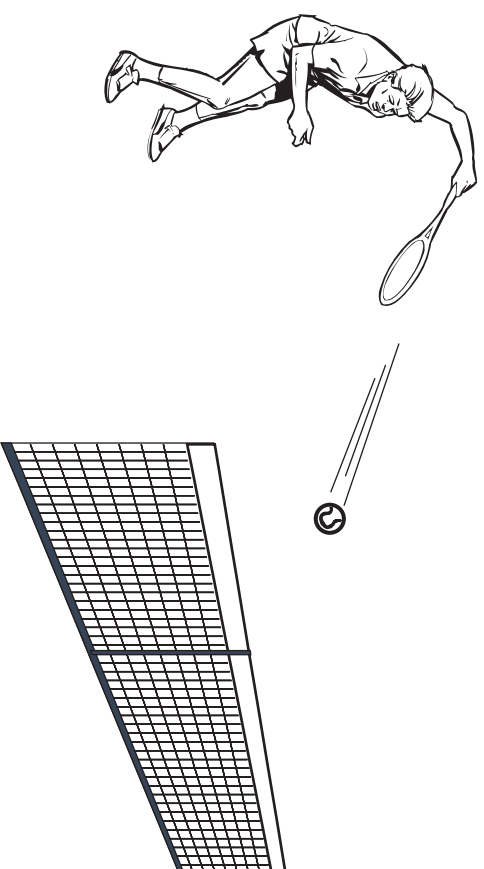
K&U PS

not: relay, electromagnet



Marks

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*

$\text{time} = \frac{\text{distance}}{\text{speed}}$ $= \frac{24}{40}$ $= 0.6 \text{ seconds}$	OR	$v = \frac{d}{t} \quad (1/2)$ $40 = \frac{24}{t} \quad (1/2)$ $t = 0.65 \quad (1)$
--	----	--

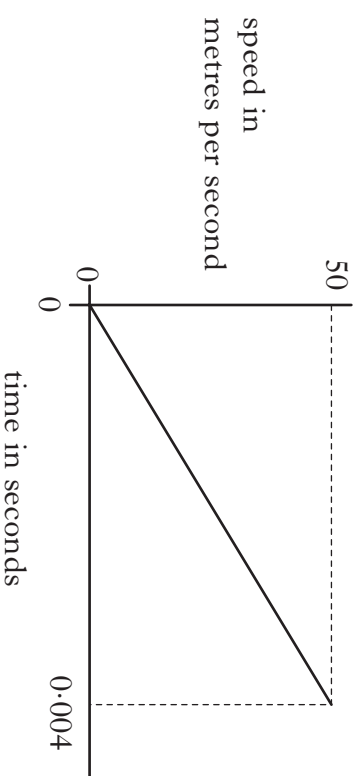
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K&U	PS
-----	----

**14. (continued)**

Marks

- (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*

**acceleration =  $\frac{\text{change in speed}}{\text{time}}$**

**=  $\frac{50}{0.004}$**

**= 12 500 metres per second per second**

- (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?  
**(speed is) less OR smaller OR lower (than before) OR slower** .....

	K&U	PS	
2			
1			

**NOTES**

not:  $a = \frac{v}{t}$

15. A skier takes part in a downhill competition.



Marks

(a) State **two** ways the skier can reduce friction in order to reach high speeds.  
**tight clothing OR tucked positioning**

**streamlined helmet OR skis waxed OR use smoother skis** ..... 2

(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.

**the forces are the same size OR forces are balanced/equal/same** ..... 1

(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*

$$E_w = F \times d$$

$$= 346 \times 500$$

$$= 173000 \text{ J}$$

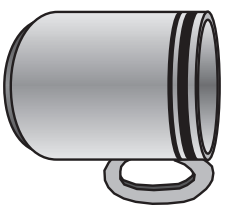
2

K&U	PS

(a) accept: “use thinner skis”, “change length of skis”

Marks

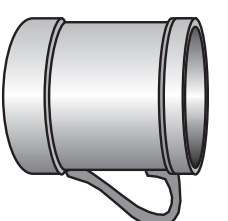
16. A student carries out an experiment to find out which mug is the best at keeping drinks hot. Each mug is made from a different material.



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.

**description should appropriately refer to:**  
**timer (½) OR method where the order of temperature drop is mentioned (½)**

**thermometer (½)**

**time interval (½)**

**temperature change (½)**

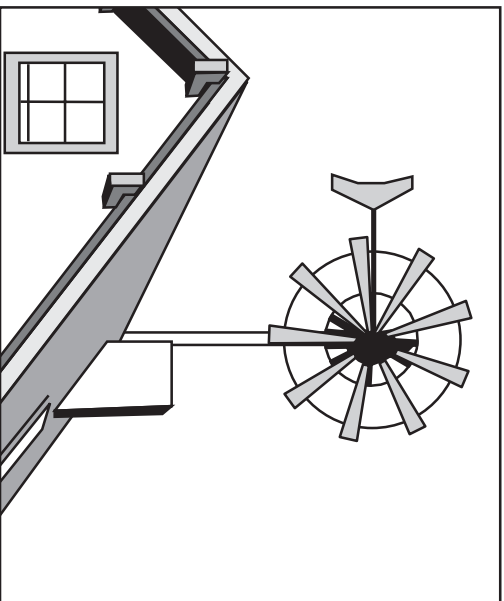
**conclusion which is definite (1)**

- (b) How could the heat lost from the mugs be reduced?  
**insulate mugs OR use lid**

K&U	PS

Marks

17. A householder installs a wind turbine electricity generator.



The table gives information about the wind turbine.

Rated power output	1.5 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*

$$\begin{aligned} \text{energy} &= P \times t \\ &= 1.5 \times 2000 \\ &= 3000 \text{ kilowatt-hours} \end{aligned}$$

2

K&U PS

**if KW or hours converted into different units then deduct (½)**

17. (continued)

Marks

- (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.

*Space for working and answer*

<b>cost</b>	
= total energy × cost per unit	(½)
= 3000 × 8	(½)
= 2400 p	(1)
(= £240)	

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.

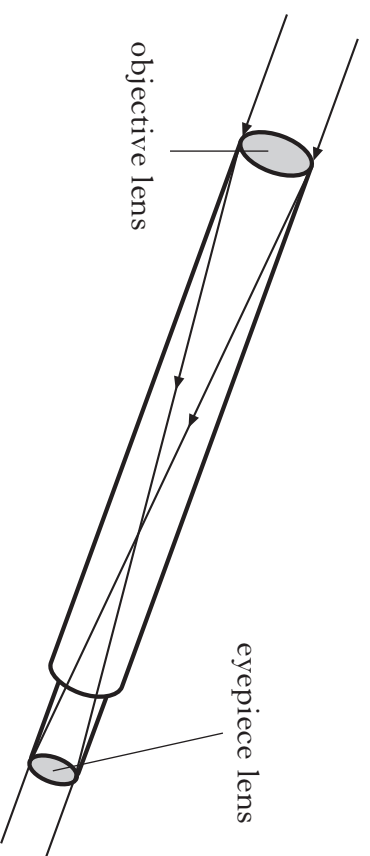
*Space for working and answer*

<b>Money saved in 20 years from generating electricity</b>	
= 240 × 20 = £4800	(1 mark)
<b>Total saved</b>	= 4800 – 1600 = £3200 (1 mark)

2

K&U	PS
2	
2	

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



Marks

- (a) (i) Which lens, the objective or the eyepiece, has the longer focal length?  
**objective (lens)** ..... **1**
- (ii) What is the purpose of the eyepiece lens?  
**to magnify the image (from the objective lens)** ..... **1**

K&U	PS

NOTES

(a) (ii) **accept: "to make image bigger"**

**18. (continued)**

Marks

(b) The table gives information about some of the planets in our Solar System.

Planet	Diameter (kilometres)	Distance from Sun (million kilometres)	Weight of one kilogram at surface (newtons)	Time to go around the Sun once (years)	Time for one complete spin (in Earth days or hours)
Mercury	4800	58	4	0.25	59 days
Venus	12 000	110	9	0.6	243 days
Earth	12 750	150	10	1	24 hours
Mars	7000	228	4	1.9	25 hours
Jupiter	140 000	780	26	12	10 hours
Saturn	120 000	1430	11	30	10 hours
Neptune	50 000	4500	12	165	16 hours

(i) Which planet has the longest day?

**Venus** .....

(ii) Which planet has the longest orbit?

**Neptune** .....

(iii) On which planet would a 4 kilogram mass have the greatest weight?

**Jupiter** .....

(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.

**kinetic (energy) to heat (energy)** .....

(d) Stars and planets belong to galaxies.

What is a galaxy?

**a collection or group of stars** .....

	K&U	PS
(i) Which planet has the longest day?		
(ii) Which planet has the longest orbit?		
(iii) On which planet would a 4 kilogram mass have the greatest weight?		
State the energy change when the meteorite enters the atmosphere.		
What is a galaxy?		

[END OF MARKING INSTRUCTIONS]

(c) not: movement to heat energy