



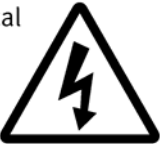
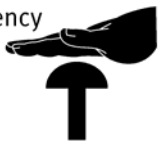
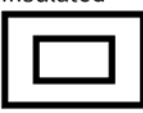
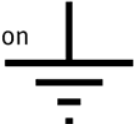




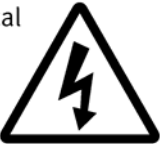
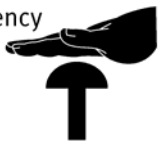
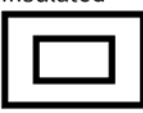
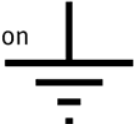




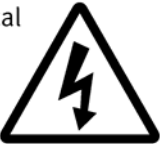
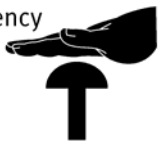
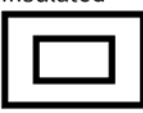
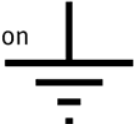


## Contents

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There are no further activities or notes associated with this module.

Further guidance


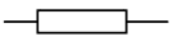
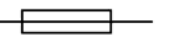

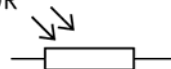

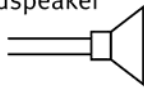
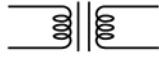
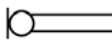

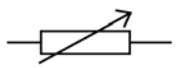
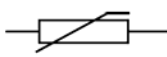






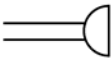


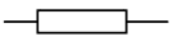
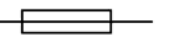

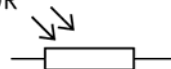

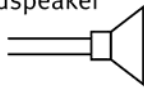
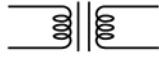
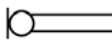

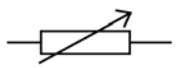
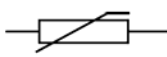






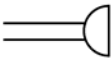


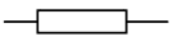
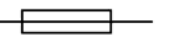

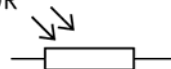

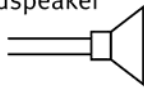
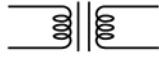
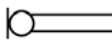

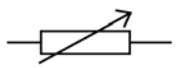
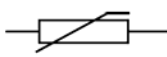






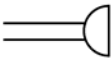

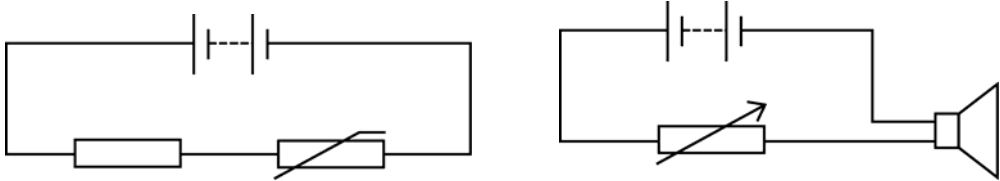
A5 Communications – Workbook answers

1	a	i	<ul style="list-style-type: none"> <li>• Hazard symbols transfer information in — visual form.</li> <li>• Morse code transfers characters of the alphabet as — a code of dots and dashes.</li> <li>• Sirens transfer information in — the form of sounds.</li> </ul>												
		ii	<p>For example:</p> <ul style="list-style-type: none"> <li>• traffic lights</li> <li>• fire alarm</li> <li>• semaphore</li> </ul>												
	b		Missing words: signals, current, copper, fibres, light, infrared, signals, frequency												
	c		<p>For example:</p> <table border="1"> <thead> <tr> <th>Effect</th> <th>Example 1</th> <th>Example 2</th> </tr> </thead> <tbody> <tr> <td>improved the quality of human communications</td> <td>hearing aids</td> <td>digital telephone</td> </tr> <tr> <td>increased the quantity of human communication</td> <td>mobile phones</td> <td>email</td> </tr> <tr> <td>increased the distance of human communications</td> <td>international TV broadcasts</td> <td>GPRS (satellite) text</td> </tr> </tbody> </table>	Effect	Example 1	Example 2	improved the quality of human communications	hearing aids	digital telephone	increased the quantity of human communication	mobile phones	email	increased the distance of human communications	international TV broadcasts	GPRS (satellite) text
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	d		<ul style="list-style-type: none"> <li>• range — how far a communications system can transfer information accurately</li> <li>• error rate — the percentage of transmitted bits which have errors</li> <li>• decoding — changing a coded message back into a plain message</li> <li>• encoding — changing a message into code</li> <li>• data transmission rate — how much data the system can transmit in a given time</li> </ul>												
2	a	i	<table border="1"> <tbody> <tr> <td>BSI kitemark </td> <td>danger </td> <td>electrical shock hazard </td> <td>emergency stop </td> </tr> <tr> <td>double insulated </td> <td>earth connection </td> <td>First aid point </td> <td>laser </td> </tr> </tbody> </table>	BSI kitemark 	danger 	electrical shock hazard 	emergency stop 	double insulated 	earth connection 	First aid point 	laser 				
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## Further guidance

	<b>ii</b>	<table border="1"> <thead> <tr> <th>hazard</th> <th>what is the risk?</th> <th>how to control the risk</th> </tr> </thead> <tbody> <tr> <td>fire from a current which is too large</td> <td>high</td> <td>fuse</td> </tr> <tr> <td>while you repair a computer, someone puts the plug back into a mains socket</td> <td>medium</td> <td>remove fuse</td> </tr> <tr> <td>shock from current escaping to earth</td> <td>medium</td> <td>earth-leakage device</td> </tr> <tr> <td>shock from live wire</td> <td>high</td> <td>colour-coded wires</td> </tr> <tr> <td>shock from metal chassis</td> <td>high</td> <td>earth lead connected to chassis</td> </tr> <tr> <td>unknown hazard</td> <td>unknown</td> <td>look for hazard symbols</td> </tr> </tbody> </table>	hazard	what is the risk?	how to control the risk	fire from a current which is too large	high	fuse	while you repair a computer, someone puts the plug back into a mains socket	medium	remove fuse	shock from current escaping to earth	medium	earth-leakage device	shock from live wire	high	colour-coded wires	shock from metal chassis	high	earth lead connected to chassis	unknown hazard	unknown	look for hazard symbols
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	<b>iii</b>	<ul style="list-style-type: none"> <li>• earth-leakage device — cuts off the electricity if a fault produces a new current path</li> <li>• over-current device — cuts off the electricity when there is too much current</li> <li>• double insulation — prevents users from touching the live wire if there is a fault</li> </ul>																					
	<b>iv</b>	Fuse, circuit breaker																					
<b>b</b>		<ul style="list-style-type: none"> <li>• In a block diagram, each block represents — a processing, input or output stage.</li> <li>• The arrows on the lines show — the links between the stages.</li> <li>• The lines between blocks represent — the direction of information flow between the blocks.</li> </ul>																					
<b>c</b>	<b>i</b>	<ul style="list-style-type: none"> <li>• scanner — changes information from pictures into voltage pulses</li> <li>• microphone — changes information from sound into alternating voltage</li> <li>• phone keypad — changes information from fingers into pulse of tones</li> </ul>																					
	<b>ii</b>	<ul style="list-style-type: none"> <li>• loudspeaker — information sensed by hearing</li> <li>• phone vibrator — information sensed by touch</li> <li>• computer monitor — information sensed by sight</li> </ul>																					
	<b>iii</b>	<ul style="list-style-type: none"> <li>• computer CPU — used in an email system</li> <li>• amplifier — used in a public address system</li> <li>• satellite — used in a long-distance telephone system</li> </ul>																					

## Further guidance

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e	i	<ul style="list-style-type: none"> <li>Circuit diagrams show all connections between the components</li> </ul>																				
	ii	<table border="1"> <tbody> <tr> <td>battery of cells </td> <td>fixed resistor </td> <td>fuse </td> <td>capacitor </td> </tr> <tr> <td>LDR </td> <td>LED </td> <td>loudspeaker </td> <td>transformer </td> </tr> <tr> <td>microphone </td> <td>switch </td> <td>variable resistor </td> <td>thermistor </td> </tr> <tr> <td>junction </td> <td>wire </td> <td>photodiode </td> <td>amplifier </td> </tr> <tr> <td>integrated circuit </td> <td>earth connection </td> <td>buzzer </td> <td>diode </td> </tr> </tbody> </table>	battery of cells 	fixed resistor 	fuse 	capacitor 	LDR 	LED 	loudspeaker 	transformer 	microphone 	switch 	variable resistor 	thermistor 	junction 	wire 	photodiode 	amplifier 	integrated circuit 	earth connection 	buzzer 	diode 
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f	i	<p>(Note: the voltage in the diagram should be 6V not 1.5V)</p> $I = 6 \text{ V} / 120 \text{ } \Omega = 0.05 \text{ A} = 50 \text{ mA}$																				
	ii	$I = 6 \text{ V} / 180 \text{ } \Omega = 0.033 \text{ A} = 33 \text{ mA}$																				
	iii	<ul style="list-style-type: none"> <li><math>P = 6 \text{ V} \times 0.05 \text{ A} = 0.3 \text{ W} = 300 \text{ mW}</math></li> <li><math>P = 6 \text{ V} \times 0.033 \text{ A} = 0.2 \text{ W} = 200 \text{ mW}</math></li> </ul>																				

Further guidance

	iv	<ul style="list-style-type: none"> <li>500 mW</li> <li>250 mW</li> </ul>																		
g	i	$P = VI$ so $I = P/V$ $I = 500 \text{ mW} / 6\text{V} = 0.083 \text{ A} = 83 \text{ mA}$																		
	ii	<ul style="list-style-type: none"> <li><math>6 \text{ V} / 10 \Omega = 0.6 \text{ A}</math>      <math>0.6 \text{ A} &gt; 0.083 \text{ A}</math> so <u>not safe</u></li> <li><math>6 \text{ V} / 100 \Omega = 0.06 \text{ A}</math>      <math>0.006 \text{ A}</math> is just less than <math>0.083 \text{ A}</math> so <u>just safe</u></li> <li><math>6 \text{ V} / 1000 \Omega = 0.006 \text{ A}</math>      <math>0.006 \text{ A} &lt; 0.083 \text{ A}</math> so <u>safe</u></li> </ul>																		
	iii	$P = VI$ so heating power = voltage x current <ul style="list-style-type: none"> <li><math>6 \text{ V} \times 10 \text{ mA} = 60 \text{ mW}</math>      <math>60 \text{ mW} &lt; 125 \text{ mW}</math> so <u>safe</u></li> <li><math>12 \text{ V} \times 10 \text{ mA} = 120 \text{ mW}</math>      <math>120 \text{ mW}</math> is similar to <math>125 \text{ mW}</math> so <u>just about safe</u></li> <li><math>24 \text{ V} \times 10 \text{ mA} = 240 \text{ mW}</math>      <math>240 \text{ mW} &gt; 125 \text{ mW}</math> so <u>not safe</u></li> </ul>																		
	h*	$I = V/R$ so $R = V/I$ $I = 30 \text{ mA} = 30 \times 10^{-3} \text{ A}$ so $R = 2 \text{ V} / (30 \times 10^{-3}) \text{ A} = 0.067 \times 10^3 \Omega = 670 \text{ k}\Omega$																		
	i*	Missing labels (clockwise from top left): 100 mA, 20 mA, 20 mA																		
	j*	Missing voltmeter reading: 2 V																		
	k	Lithium PP3																		
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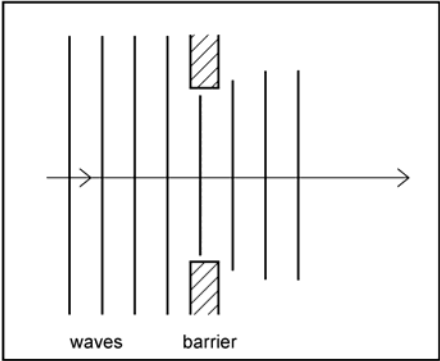
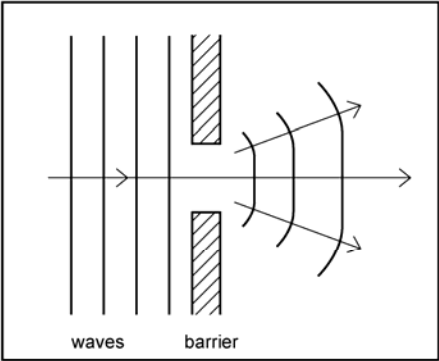
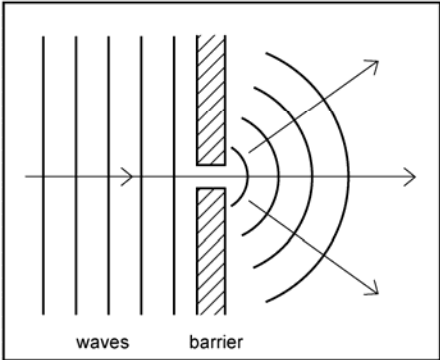
## Further guidance

	<b>c</b>	A = analogue, B = digital <ul style="list-style-type: none"> <li>In signal A the voltages can take any value, so it is analogue</li> <li>In signal B the voltages can take only 2 values (high or low), so it is digital</li> </ul>
	<b>d</b>	<b>i</b> <ul style="list-style-type: none"> <li>Whether the phone can be charged from the car battery, while he is travelling</li> <li>Whether it has an external speaker and microphone, so he can use the phone while travelling</li> </ul>
		<b>ii</b> Network coverage
	<b>e</b>	<ul style="list-style-type: none"> <li>The communication system does not depend on the mains supply.</li> <li>The system is portable.</li> </ul>
	<b>f</b>	<b>i</b> $4 \text{ cm} \times 2 \text{ V per cm} = 8 \text{ V}$
		<b>ii</b> $2 \text{ cm} \times 2 \text{ V per cm} = 4 \text{ V}$
		<b>iii</b> $4 \text{ cm} \times 2 \text{ ms per cm} = 8 \text{ ms}$
		<b>iv</b> $1 / \text{time for 1 cycle} = 1 / 8 \text{ ms} = 125 \text{ Hz}$
	<b>g*</b>	Information about the system tells us what the voltage signal should be like between each block. A voltmeter can measure the size of the signal and this can be compared with the expected size. An oscilloscope can show the pattern <u>and</u> the size of the signal and this can be compared with the expected pattern and size. If the size of the pattern is different from the expected one, the <u>previous</u> block is malfunctioning.
<b>4</b>	<b>a</b>	Recording engineers, electronics engineers, TV camera operators, design engineers
	<b>b</b>	Three examples, e.g. memory stick, flash card, CD-ROM
	<b>c</b>	<ul style="list-style-type: none"> <li>bit — a single binary digit</li> <li>byte — 8 bits</li> <li>word — a string of bits that can be any length</li> <li>bit rate — the number of bits transmitted in a second</li> <li>sample rate — the number of samples taken in a second</li> <li>binary — having two values, 1 or 0</li> </ul>
	<b>d</b>	<b>i</b> Missing words: pixels, rows, frame
		<b>ii</b> <p>1: 8</p> <p>2: <math>100 \times 100 = 10\,000</math> pixels</p> <p>3: <math>8 \times 10\,000 = 80\,000</math> bits</p> <p>4: 10</p> <p>5: <math>10 \times 80\,000 = 800\,000</math> bits per second</p>
	<b>e*</b>	<b>i</b> The amount of information is decreased.
		<b>ii</b> It takes less time to send one frame.
		<b>iii</b> The image quality can be the same.

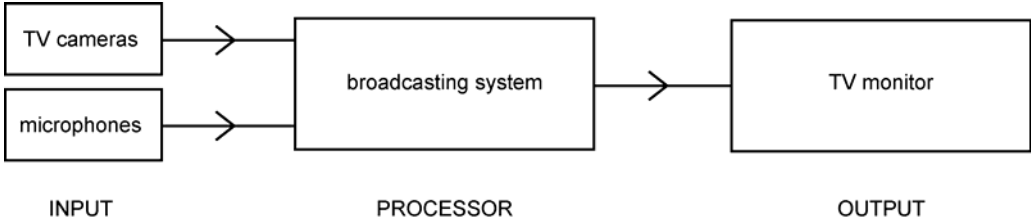

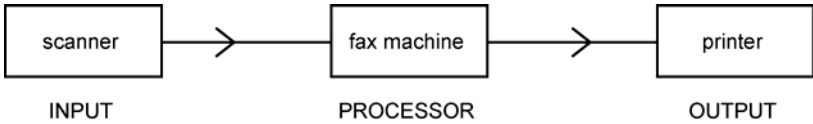
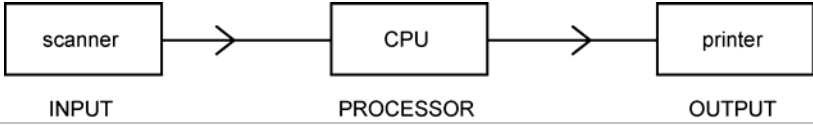
## Further guidance

		<b>iv</b>	A faster frame rate can be achieved.																
		<b>v</b>	The quality of the video can be better.																
		<b>vi</b>	It is a measure of how accurately a communication system transfers information. A high value means that errors in transmission are unlikely to happen.																
<b>5</b>	<b>a</b>	<b>i</b>	<ul style="list-style-type: none"> <li>• microphone – converts sound energy into an electrical signal</li> <li>• amplifier – increases the strength of the electrical signal</li> <li>• modulator – adds the signal to the carrier</li> <li>• transmitter aerial – transmits the modulated signal</li> <li>• oscillator – produces the carrier wave</li> </ul>																
		<b>ii</b>	It increases the amplitude of the signal																
		<b>iii</b>	Missing words: carrier, signal, modulating																
	<b>b*</b>	<b>i</b>	The range of frequencies required to transmit a signal down a link																
		<b>ii</b>	<ul style="list-style-type: none"> <li>• the amplitude of the signal</li> <li>• the frequency of the signal</li> </ul>																
		<b>iii</b>	<p>A amplitude modulated carrier</p> <p>B unmodulated carrier</p> <p>C frequency modulated carrier</p>																
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	<b>d</b>		<ul style="list-style-type: none"> <li>• 2.4 GHz — Bluetooth / WiFi</li> <li>• 10 GHz — mobile phones and satellite communications</li> <li>• 600 MHz — terrestrial TV</li> <li>• 150 Hz – 300 Hz — long-distance radio</li> <li>• 500 kHz – 1.5 MHz — local AM radio</li> <li>• 90 MHz – 110 MHz — local FM radio</li> </ul>																
	<b>e</b>		Each radio station broadcasts on a different frequency. The radio receiver has to be tuned to this frequency, because the aerial can receive signals over a range of frequencies.																
	<b>f</b>		Missing words: absorbed, reflect, interfere, cancel, reception, interference																

Further guidance

<p>g*</p>	<table border="1"> <thead> <tr> <th>Radio station</th> <th>Frequency</th> <th>Wavelength in m</th> </tr> </thead> <tbody> <tr> <td>Viking FM</td> <td>98 MHz</td> <td>3.1</td> </tr> <tr> <td>WNYC</td> <td>93.9 MHz</td> <td>3.2</td> </tr> <tr> <td>BBC World Service</td> <td>660 kHz</td> <td>455</td> </tr> <tr> <td>BBC4</td> <td>130 kHz</td> <td>2300</td> </tr> </tbody> </table>	Radio station	Frequency	Wavelength in m	Viking FM	98 MHz	3.1	WNYC	93.9 MHz	3.2	BBC World Service	660 kHz	455	BBC4	130 kHz	2300
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<p>6 a</p>	<ul style="list-style-type: none"> <li>• selling licenses to broadcast in regions of the electromagnetic spectrum</li> <li>• creating markets for competing communications firms</li> <li>• publishing agreed protocols for messages</li> </ul>															
<p>b</p>	<ul style="list-style-type: none"> <li>• The communication system does not depend on the mains supply.</li> <li>• The system is portable.</li> </ul>															

Further guidance

<p><b>c</b></p>	<p><b>i</b></p>	<p>TV system</p>  <pre> graph LR     subgraph INPUT         A[TV cameras]         B[microphones]     end     subgraph PROCESSOR         C[broadcasting system]     end     subgraph OUTPUT         D[TV monitor]     end     A --&gt; C     B --&gt; C     C --&gt; D     </pre>
	<p><b>ii</b></p>	<p>Telephone system</p>  <pre> graph LR     A[telephone] --&gt; B[exchange]     B --&gt; C[telephone]     </pre>
	<p><b>iii</b></p>	<p>Fax system (one fax machine sends documents to another)</p>  <pre> graph LR     A[scanner] --&gt; B[fax machine]     B --&gt; C[printer]     </pre>
	<p><b>iv</b></p>	<p>Scanner and printer</p>  <pre> graph LR     A[scanner] --&gt; B[CPU]     B --&gt; C[printer]     </pre>
<p><b>d</b></p>	<p><b>i</b></p>	<p>For example: Headphones are linked to an MP3 player by copper wire, because it is cheap and simple technology is needed.</p>
	<p><b>ii</b></p>	<p>For example: Large organisations used fibre optics for communicating inside a large building. The fibres can carry many different signals and the information is secure.</p>
	<p><b>iii</b></p>	<p>For example: Rescue teams use radios to keep in touch with each other. They can transmit information to the rest of the team, wherever they are within the search area.</p>
<p><b>7</b></p>	<p><b>a</b></p>	<p>6, 3, 1, 4, 2, 5, 7, 8</p>
	<p><b>b</b></p>	<ul style="list-style-type: none"> <li>• The customer can choose how to program each device.</li> <li>• It is cheaper to make many similar devices.</li> <li>• The customer pays less for each device.</li> </ul>

Further guidance

c			<b>Analogue or digital?</b>	<b>Advantage or disadvantage?</b>
	Transmitters and receivers can be simple	analogue	advantage	
	A true representation of the original signal is possible	analogue	advantage	
	Information is always distorted and degraded in transmission	analogue	disadvantage	
	It is difficult to compress and encrypt (convert into code)	analogue	disadvantage	
	It is transferred with little loss of quality	digital	advantage	
	Multimedia is possible	digital	advantage	
	It can be manipulated	digital	advantage	
	Complex circuitry is needed at transmitter and receiver	digital	disadvantage	
	It involves distortion as not all values are possible	digital	disadvantage	
8	a	<b>Reason for encryption</b>	<b>Example</b>	
		keeps banking details private	Internet shopping	
		keeps conversations private	mobile phone communication	
		prevents unauthorized access to information	wireless computer networks	
		avoids being prosecuted	crime	
		keeps national or industrial secrets	espionage	
		ensures people pay for a service	encoding premium rate TV channels	
b	i	<pre> graph LR     A[TV cameras] --&gt; B[mobile transmitter]     C[microphones] --&gt; B     B --&gt; D[editing suite (TV gallery)]     D --&gt; E[communication satellite]     E --&gt; F[ground-based TV transmitter]     F --&gt; G[domestic TV receiver]             </pre> <p>(Note change in workbook page 22: 'ground-based TV transmitter' is one item, and 'TV gallery should read 'TV editing suite' - corrected at reprint.)</p>		

Further guidance

	ii	<p>The managers give clear instructions to the staff and they must make sure the instructions are carried out.</p> <p>The sound engineer makes sure nothing is too loud or too quiet.</p> <p>The producer is in charge of what goes into the programme.</p> <p>The production assistant makes sure the timing is right.</p> <p>The director gives instructions to the presenters and camera operators.</p> <p>The vision mixer controls what pictures the viewers will see.</p>
c	i	Missing labels: analogue, digital, analogue
	ii	<p>For example: email message</p> <pre> graph LR     A[INPUT keyboard] --&gt; B[CPU]     B --&gt; C[ISP computer]     C --&gt; D[CPU]     D --&gt; E[OUTPUT monitor]     </pre> <p style="text-align: center;">digital                      digital                      digital                      digital</p>