

## AUTOMATED SYSTEMS

Question Type	Typical Answer
Why use automated systems?	<ul style="list-style-type: none"> <li>• they are fast – computers can react in fractions of a second</li> <li>• They can operate in dangerous environments – eg nuclear reactors, North Sea oil platforms, chemical factories</li> <li>• They can cope with repetitive tasks – can carry out the same tasks over and over again with making mistakes or slowing down</li> <li>• they are accurate – they follow precise instructions this guarantees 100% accuracy</li> <li>• They are efficient – because they are accurate and don't make mistakes or waste time or materials</li> <li>• They are adaptable – can be designed to be flexible and handle a range of different tasks</li> </ul>
State two arguments that the factory manager could use to persuade the company to invest in new automated systems.	<ul style="list-style-type: none"> <li>• (Long term savings) don't have to pay as much in wages or provide facilities for humans</li> <li>• (Increased productivity) as - automated equipment will work constantly(24/7) - OR no holidays/breaks/illness) -</li> <li>• producing more goods in a set time</li> <li>• less wastage</li> </ul>
He decides to buy intelligent robots. Name two hardware features of an intelligent robot.	<ul style="list-style-type: none"> <li>• large memory/backing storage</li> <li>• powerful processors</li> <li>• a wide variety of sensors</li> <li>• ability to communicate with other computers and robots</li> </ul>
Parts of a robot	<ul style="list-style-type: none"> <li>• Mobile joints – eg waist, shoulder, wrist</li> <li>• End-effector – tool fitted to the end of the arm and can be changed for different jobs (adaptability)</li> <li>• Power units – motors which provide the robot with mechanical energy to perform its tasks</li> </ul>
Types of robots	<ul style="list-style-type: none"> <li>• Stationary – fixed to one spot</li> <li>• Mobile – fitted with wheels or tracks and powered by electric motors to enable them to move about</li> </ul>

<p>Finding their way about</p>	<ul style="list-style-type: none"> <li>• Magnetic guidance systems <ul style="list-style-type: none"> <li>○ Cable giving off a magnetic field</li> <li>○ Set in factory floor</li> <li>○ Robot fitted with sensors can detect magnetic field</li> </ul> </li> <li>• Light guidance system <ul style="list-style-type: none"> <li>○ White line painted on factory floor</li> <li>○</li> </ul> </li> </ul>
<p>Factories often use mobile robots to carry heavy components from one place to another Describe two different methods of guiding these mobile robots along their routes.</p>	<ul style="list-style-type: none"> <li>• Method 1 Robot has a light sensor</li> <li>• follows a (white) line painted on a floor.</li> <li>• <b>Advantage</b> for Light Guidance - It will be easier/cheaper to change or extend the route the robot would follow.</li> <li>• Method 2 Robot has a magnetic sensor</li> <li>• follows cables/wires that are under the floor.</li> <li>• <b>Advantage</b> for Magnetic Guidance - There won't be a problem with dirt or litter on the floor obscuring the route.</li> </ul>
<p>An engineering firm building the SpaceRanger uses mobile robots to transport parts around the factory. (i) State two safety features that may be required in the factory. 2</p>	<ul style="list-style-type: none"> <li>• Sirens or sounds on robot</li> <li>• bump sensors on robot</li> <li>• lights</li> <li>• clear routes for robot</li> <li>• warning signs.</li> <li>• <b>NOT fenced off or restricted areas or motion sensor.</b></li> </ul>
<p>The finished robots come with a range of sensors. State two types of sensor</p>	<ul style="list-style-type: none"> <li>• Pressure</li> <li>• Heat</li> <li>• Motion</li> <li>• Light</li> <li>• Magnetic</li> <li>• Bump</li> <li>• Laser</li> <li>• Distance</li> <li>• optical.</li> </ul>
<p>CAD/CAM</p>	<ul style="list-style-type: none"> <li>• Computer Aided Design – used for commercial design work</li> <li>• Computer Aided Manufacture – use of computer controlled machines to produce objects</li> </ul>
<p>Pupils and staff at Kulross Academy are about to move into a purpose-built, brand-new school. It was designed using the latest CAD technology to enable the designers to view the school from inside and out using a virtual reality simulation. What do the letters CAD stand for?</p>	<ul style="list-style-type: none"> <li>• Computer Aided Design</li> </ul>

Write down the names of two input devices that would be used specifically in a virtual reality system.	<ul style="list-style-type: none"> <li>o Data glove</li> <li>o motion sensor</li> <li>o headset</li> <li>o VRbody suit</li> <li>o joystick</li> <li>o Microphone</li> <li>o rackball</li> </ul>
State an example of an output device that could be used specifically in a virtual reality system.	<ul style="list-style-type: none"> <li>o Data helmet/visor</li> <li>o VR helmet/VR visor</li> <li>o VR goggles</li> <li>o VR headset</li> </ul>
Control of automated systems	<p>Controlled by software</p> <ul style="list-style-type: none"> <li>• Programmable – flexible and can be reprogrammed for different tasks</li> <li>• Use a control language – has specific words associated with robots HLL</li> </ul>
The program controlling the VR system is stored on ROM. State two advantages of storing software on ROM.	<ul style="list-style-type: none"> <li>o Faster to load</li> <li>o permanent copy cannot be lost</li> <li>o not affected by viruses</li> <li>o immediately available at switch on</li> </ul>
Open Loop systems	Carry out the tasks – will follow a set of instructions regardless eg toaster
Closed loop systems	Uses sensors and feedback to determine actions taken

How do sensors work?	They detect and measure levels of energy
Analogue to digital	Sensors produce analogue signals which need to be changed to digital <ul style="list-style-type: none"> <li>• Analogue – signal varies</li> <li>• Digital – signal two states eg on or off</li> </ul>
Interface	Translates the signals coming into the computer so that it can be understood – analogue to digital converter
Real-time processing	Processing the data immediately and responding immediately
Why use a ROM chip	This avoids the need for constant loading and storing operations between backing storage and RAM
Effects on people	<ul style="list-style-type: none"> <li>• Have to be retrained to use new equipment</li> <li>• Change their working practices</li> <li>• Change jobs or leave</li> </ul>
Systems Analyst	<ul style="list-style-type: none"> <li>• Designing new factory – looks at the present system and operations and finds where a computer can do the job better</li> </ul>
SpaceRanger robots are designed to work on Mars. Virtual Reality was used during the design process. Explain what virtual reality is.	<ul style="list-style-type: none"> <li>• Real life/seems real even though it is not while running on computer or program.</li> </ul>
State two reasons why the space program is using robots instead of humans	<ul style="list-style-type: none"> <li>• Implications of safety/use in dangerous situations</li> <li>• cope with temperature conditions</li> <li>• work 24 hours</li> <li>• <b>Must relate to situation in space.</b></li> </ul>