

Patterns of Change: Technology

Headings	Notes
THE PRINTING PRESS	<ul style="list-style-type: none"> • Before the 1400s in Europe, books had to be handwritten (<i>manuscripts</i>). Not many books were in circulation due to being time consuming and expensive, making them very precious. • Johannes Gutenberg, a German goldsmith, is accredited with the invention of the moveable type printing press • The process involved placing individual metal letters into a frame to form words, coating them with ink and pressing the frame onto paper. The letters could then be rearranged in the frame for the next page. The first book Gutenberg printed was the Gutenberg Bible. • Gutenberg's invention spread quickly. By 1500, printing presses were operating in every major European city.
IMPACT AND CONTRIBUTION TO HISTORICAL CHANGE	<ul style="list-style-type: none"> • Printed books were far cheaper and quicker to produce than manuscripts. • More people learned to read and write (became literate). This also meant people read more and were introduced to new ideas. • Fiction became popular as people began to read for entertainment. • The Catholic Church's control over learning and ideas declined. People who challenged the Church could spread their ideas quickly and widely. This would be key to The Reformation. • The use of Latin declined as books were published in the vernacular (the language as spoken by people in their native country). • The invention of the moveable type printing press was the single most important factor in the spread of the Renaissance throughout Europe.
ADVANCES IN NAVIGATION	<ul style="list-style-type: none"> • Before the Age of Exploration, sailors stayed close to the shoreline. Advances in technology made navigation easier and made it possible for ships to sail out into the ocean to explore.
NEW MAPS	<ul style="list-style-type: none"> • Cartographers started using more detailed maps from Constantinople. • The Portuguese developed portolan charts, which mapped coastlines and harbours more accurately and also recorded currents, tides and depth. • Maps were regularly updated by returning explorers.
Keywords	Summary
Handwritten: Manuscripts	
Johannes Gutenberg	
Printing Press	
Gutenberg Bible; Literate	
Catholic Church: Renaissance	
Cartographers	
Constantinople	
Portolan Charts	

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NEW EQUIPMENT	<ul style="list-style-type: none">• A quadrant and an astrolabe were used to determine a ship's latitude (the distance from the equator) by the position of the stars and the sun.• A compass used magnetism to locate north and identify the direction of travel.• A log and line was used to measure a ship's speed in knots.• A line and lead weight was used to measure the depth of the water and ensure it was not too shallow for the ship.• The captain recorded all of this information regularly in a logbook.
NEW SHIP INNOVATIONS	<ul style="list-style-type: none">• The caravel was a new ship design that was large & sturdy enough to undertake long voyages and was able to sail in all winds. A nao was a later, bigger caravel.• Triangular lateen sails allowed ships to sail into the wind and made them easier to manoeuvre near coastlines.• Carvel-built hulls, where planks were fitted edge to edge rather overlapping, made ships much lighter. This meant they could be built larger and could carry more people and supplies.• A rudder made the ship easier to steer.• A castle at the back of the deck improved crew quarters and served as a lookout point and a defensible area if under attack.
IMPACT AND CONTRIBUTION TO HISTORICAL CHANGE	<ul style="list-style-type: none">• The new instruments allowed sailors to work out exactly where they were, based on how far they had travelled and how fast, their distance from the equator and the direction of travel.• Combined with new and improved maps and ships that were stronger and far more easily managed, these advances made long voyages safer and enabled Europeans to explore unknown regions.• The voyages of exploration, European conquest and colonisation of the Americas and the wider world, the Colombian exchange and the Atlantic slavery triangle all depended on the advances.
Keywords	Summary
Quadrant	
Astrolabe	
Compass	
Log and Line	
Line and lead weight	
Logbook	
Caravel: Castle	
Lateen Sails: Rudder	
Carvel-built hulls	

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THE INDUSTRIAL REVOLUTION	<ul style="list-style-type: none"> In the first half of the 18th Century, Britain was mainly an agricultural country. However, from 1750 onwards, this would change. Over the next 100 years, Britain became the first country to go through an Industrial Revolution: goods were now made in factories. Britain became the richest country in the world as well as experiencing social changes (how people lived) such as:
EARLY 18TH CENTURY BRITAIN	
STEAM POWER	<ul style="list-style-type: none"> The steam engine was the most important invention of the Industrial Revolution. Steam engines built by Thomas Newcomen were first used to pump water out of mines. These steam engines could only make an up-and-down motion. James Watt made improvements to the steam engines by adding a flywheel. This gave the engines a rotary (turning) motion which meant the engines could now be used to power other machines, leading the way to power factories.
DOMESTIC INDUSTRY TO FACTORY SYSTEM	<ul style="list-style-type: none"> The steam engine was used to power new inventions such as the Crompton's spinning mule and Cartwright's power loom. These inventions sped up the manufacturing of clothing. These new steam-powered machines meant that they could be used in mills and factories rather than houses, leading to the growth of factories throughout British cities.
THE TRANSPORT REVOLUTION	<ul style="list-style-type: none"> The invention of the steam engine speeded up the transport revolution. Britain depended on carts and canals for transporting goods; the development of the railways changed all that. The first railways were built to haul coal from coal mines but these railroads used huge stationary steam engines. When Richard Trevithick designed a small engine on wheels, the Railways Age had begun. 1825 saw the first goods train ran between Stockton and Darlington which was built by George Stephenson. Five years later, the first passenger line was built between Manchester and Liverpool - George and Robert Stephenson's Rocket ran this line.
Keywords	Summary
Steam engine	
Industrial Revolution	
Transport Revolution	
Thomas Newcomen	
James Watt	
Crompton's spinning mule	
Cartwright's power loom	
Richard Trevithick	
George Stephenson	

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TECHNOLOGICAL INVENTIONS	<ul style="list-style-type: none"> • 1705 – Steam Engine – used to pump water out of mines, invented by Thomas Newcomen • 1709 – Coke – coal without gasses, discovered by Abraham Darby • 1733 – Flying Shuttle – help speed up weaving, invented by John Kay • 1763 – Rotary Steam engine – improved the steam engine so it could be transported and used outside the mines, invented by James Watt, while a unit of measurement was named after him. • 1764 – Spinning Jenny – help speed up spinners, invented by James Hargreaves • 1769 – Water Frame – spinning machine powered by water, invented by Richard Arkwright • 1779 – Mule – combined the Spinning Jenny and Water Frame, invented by Samuel Crompton • 1784 – Ruddling and Rolling – created wrought iron (strong), invented by Henry Cort • 1785 – Power Loom – new weaving process – invented by Edmund Cartwright • 1856 – The Bessemer Converter – vassal for making steel
THE AGRICULTURAL REVOLUTION	<ul style="list-style-type: none"> • Between 1801 and 1851, the British population rose from 9 million to 22 million. Advances in agriculture went hand-in-hand with those in the Industrial and Transport Revolutions as farming became more efficient with increased food production which led to increased life expectancy. • The Norfolk System (Charles Townshend) replaced the open-field system, now rotating four crops (wheat, turnips, oats/barley and clover/grass) over four years, allowing each field to regain its nutrients without leaving a field fallow. • Enclosures grouped tenant farmers' fields together in one small farm, fenced off, instead of in strips all across the landlord's land. • Selective breeding (Robert Bakewell) was developed to have the largest or most suitable animals kept for breeding instead of being killed for meat. • The seed drill (Jethro Tull) was a machine pulled by a horse or ox that sowed seeds at the depth and in straight rows, avoiding waste which led to better harvests. • The mechanical reaper (Cyrus McCormack) invented this horse-drawn cart with a cutting blade that cut crops in straight rows neatly, making harvesting faster and preventing any waste.
Keywords	Summary
Agricultural Revolution	
Norfolk System	
Charles Townshend	
Enclosures	
Selective Breeding	
Robert Bakewell	
Seed Drill Jethro Tull	
Mechanical reaper	
Cyrus McCormack	

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MODERN MILITARY TECHNOLOGY	<ul style="list-style-type: none"> Between World War I and World War II, the involved parties (the Entente/Allies and the Axis/Central Powers) created and refined new weapons and technology in their attempts to gain an advantage over their enemies.
WORLD WAR I: A NEW EAR IN WARFARE	<ul style="list-style-type: none"> World War I saw the introduction of new military technology, including the first use of aeroplanes for reconnaissance, aerial combat and bombing. German submarines (U-boats) attacked any ships (military or civilian) in enemy waters. The British invented the tank to try to break the stalemate on the Western Front. The first use of chemical weapons: <ul style="list-style-type: none"> Phosgene – six times more deadly than chlorine gas. Responsible for 85% of chemical weapons fatalities during WWI. (slow acting poison) Chlorine Gas – first used 22 April 1915. A greenish-yellow cloud that smelled like bleach. Killed soldiers by asphyxiation. Mustard – caused severe blistering on it's victims. Caused blindness (slow acting poison) Within six months of fighting, medics observed a set of symptoms among the trenches that they called 'shell shock', now known as Post-Traumatic Stress Disorder (PTSD). Symptoms included: anxiety, nightmares, tremors, confusion, memory loss and sudden hearing/sight loss.
WORLD WAR II AT SEA	<ul style="list-style-type: none"> Better submarines and torpedoes were developed. Research went into ASDIC (sonar) and radar technology to scan the oceans. Aircraft carriers were seagoing air bases with a flight deck. Aircraft could refuel and take off from there, which helped to control the seas.
ON LAND	<ul style="list-style-type: none"> Germany developed many Panzer tanks. The heavily armoured Tiger tank weighed 54 tonnes, had a gun barrel diameter of 8.8 cm and had a top speed of 45 km/h. The Allies developed dummy tanks and amphibious tanks. Grenades, pistols, rifles and machine guns were also improved. The Germans invented a machine gun (the MG 42) that could fire 1,200 rounds in one minute.
Keywords	Summary
Aeroplanes: Tanks	
Submarines (U-boats)	
Phosgene Gas	
Chlorine Gas	
Mustard Gas	
PTSD: MG 42 Machine Gun	
Sonar and Radar	
Aircraft carriers	
Panzer and tiger tanks	

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IN THE AIR	<ul style="list-style-type: none">• The British Hurricane and Spitfire aircraft had Rolls Royce engines.• The B-29 Superfortress was a long-range bomber developed by the US in 1942.• In 1944, Germany invented the first jet fighter, the Messerschmitt ME 262.• German scientists invented long-range rockets. The V1 flew at speeds of 400 km/h, while the later V2 flew at supersonic speed, with a top speed of 5,760 km/h.
THE ATOMIC BOMB	<ul style="list-style-type: none">• The US feared that Germany would be the first to develop the atomic bomb and thus began a research programme called the Manhattan Project.• In 1945, the US air force dropped atomic bombs on the Japanese cities of Hiroshima and Nagasaki, killing at least 129,000
IMPACT AND CONTRIBUTION TO HISTORICAL CHANGE	<ul style="list-style-type: none">• By the time of the events of World War II, fighting was no longer confined to particular areas as it had been in World War I. The new technology was highly mobile and so units and 'fronts' could move very quickly, as in the Blitzkrieg invasions of Poland and France.• The destructive power of the new technology was far greater than ever before. In World War I, roughly 10 million soldiers while in World War II that roughly doubled to 15-20 million.• War affected civilian populations in a way it had never before; it is estimated that 38-55 million civilians died during World War II while it is estimated it was 13 million civilians in World War I.• Numerous cities were utterly destroyed, for example: Coventry (Britain), Dresden (Germany), Warsaw (Poland), Leningrad (Russia) and Hiroshima (Japan).• The invention of the atomic bomb made it possible to obliterate large areas at the touch of a button. This threat would hang over both the US and the Soviet Union during the Cold War.
THE SPACE RACE	<ul style="list-style-type: none">• Throughout the Cold War, both the US and the Soviet Union spent huge sums of money on scientific research. This arms race led to the development of more powerful nuclear weapons, as well as more deadly aircraft, tanks and naval vessels. In particular, the superpowers invested heavily in 'the space race'.
Keywords	Summary
Hurricane and Spitfire	
B-29 Superfortress	
Messerschmitt ME 262	
Manhattan Project	
Hiroshima and Nagasaki	
Atomic and hydrogen bombs	
Blitzkrieg	
Cold War: Arms Race	
The Space Race	

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THE SPACE RACE	<ul style="list-style-type: none"> The rockets designed to carry satellites (and later astronauts) into space could also be used to carry nuclear bombs to attack the other side. New technology developed during the space race (such as computers) could transform both military and civilian life. The first superpower to achieve these great technological feats would prove its superiority.
THE FIRST SATELLITE	<ul style="list-style-type: none"> On the 4th October 1957, the Soviets launched the world's first satellite, Sputnik. The US became concerned that there was now a 'missile gap' between them and the Soviets. In December 1957, the first US satellite, the Vanguard, exploded on the launch pad. The US eventually launched the Explorer satellite successfully on the 1st February 1958.
THE FIRST MAN IN SPACE	<ul style="list-style-type: none"> On the 12th April 1961, Yuri Gagarin of the Soviet Union was the first man in space after he orbited the Earth and returned safely. In February 1962, the US sent a man into orbit when John Glenn piloted the <i>Friendship 7</i>. US President John F Kennedy was determined that the US must succeed in landing a man on the moon by the end of the decade – but he would not live to see it.
THE MOON LANDINGS	<ul style="list-style-type: none"> The US National Aeronautics and Space Administration (NASA) launched the Gemini and Apollo missions. The Saturn V rocket was built to carry the Apollo spacecraft out of Earth's orbit. On the 16th July 1969, Apollo 11 launched from Florida carrying astronauts Neil Armstrong, Edwin 'Buzz' Aldrin and Michael Collins. On the 20th July 1969, Armstrong & Aldrin landed the lunar module, the Eagle, on the moon's surface. A camera in the Eagle provided live coverage. Over 500 million people around the world tuned in to make this the most watched event in television history up until that point.
Keywords	Summary
Rockets	
Nuclear bombs	
Computers	
Sputnik: Vanguard: Explorer	
Yuri Gagarin	
John F Kennedy	
NASA: Apollo; Gemini	
Apollo 11: Neil Armstrong	
Buzz Aldrin; Michael Collins	

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IMPACT AND CONTRIBUTION TO HISTORICAL CHANGE	<ul style="list-style-type: none">• By landing people on the moon, the US had 'won' the space race, and with it a propaganda victory over the Soviet Union and communism as a system.• The lunar landings continued until 1972, when they lost public support due to high costs.• Satellite, communication and computer technologies advanced greatly as a result of technological breakthroughs arising from the space race.
Keywords	Summary

Technology Keywords

Keywords	Definitions
Arms Race	A race between the USA and the USSR (Soviet Russia) and their allies to compete for superiority in military arms, often referred to during the Cold War.
Cold War	Period of hostility between the USA and its allies and the Soviet Union and its allies that lasted from the end of World War II to the collapse of Communism in the early 1990s.
Historical Change	Changes that happen in history; how differences occur in history through causes and effects (consequences).
Industrial Revolution	Rapid industrial growth or change that began in the middle of the 18th Century and brought about the factory system and the growth of cities.
Innovation	<ul style="list-style-type: none">• Any new idea, method or product that brings about change.
Navigation	<ul style="list-style-type: none">• Directing or guiding a ship from one place to another
Nuclear War	<ul style="list-style-type: none">• A war fought with atomic and hydrogen (nuclear) bombs
Standardisation	<ul style="list-style-type: none">• Developing the same basic features e.g. in the English language
Technological Developments	The practical use or application of methods and machines to produce goods and services in mass production.
Technology	<ul style="list-style-type: none">• The tools, devices or means to carry out tasks.