

1001 Inventions



1001 INVENTIONS TEACHERS PACK

Supplementary notes for teachers in Scotland



Introduction

This supplement links the '1001 Inventions Teachers' Pack' activities to science lessons in Scottish schools, particularly the S1/S2 science course in Glasgow.

The '1001 Inventions Teachers' Pack' was specifically written for the English National Science Curriculum. It consists of nine activities - seeing in the dark, coffee, perfume, raising water, puzzling plants, pharmacy, build it strong, figuring out phenomena, and bird man. Each activity highlights the contributions to science and technology from the Muslim World.

Each of the nine activities have specific learning outcomes and curricular links to (1) the Glasgow Science Scheme (2) the draft science learning outcomes for a Curriculum for Excellence, published September 2007 and (3) other parts of the curriculum (eg standard grade and intermediate 1). One activity – Activity 7 'Build it strong' - does not match the Glasgow S1/S2 science course, but it can be useful for Standard Grade Science.

The quick guide sets out the S1/S2 Glasgow Science Course and possible linked specific activities in the 1001 Inventions Teachers Pack.

The '1001 Inventions Teachers' Pack' and this supplement complements the exhibition '1001 Inventions: Discover the Muslim Heritage in our World' currently on show at the Glasgow Science Centre from 24th October 2007 to 8th January 2008.

This 'hands-on' exhibition brings to life an often overlooked golden age of discovery and innovation. It uncovers one thousand years of scientific and technological innovation by Muslim scholars and inventors across the globe from southern Europe to Asia... the first flying machine, the first university, our numbers 1 – 9, astronomy, algebra and day-to-day necessities like coffee, soap, clocks, surgical instruments and the camera. The exhibition is arranged in seven zones – home, school, market, hospital, town, world and universe. For each of the exhibition's seven zones, curriculum content and objectives are set out.

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Activities

1001 Inventions Teachers' Pack	Curricular link to Glasgow Science scheme	Curricular link to curriculum for excellence learning outcomes (draft)	Links to other parts of curriculum (e.g. standard grade, intermediate 1)
Activity 1: Seeing in the dark	Topic: optics & acoustics Learning outcome: State that light travels in straight lines	Life & cells: using my senses SCN321S Communication: communication systems SCN230U	
Activity 2: Coffee	Topic: cell processes Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine & raw materials		Intermediate 1 chemistry Unit 3: Drugs
Activity 3: Perfume	Topic: matter Learning outcome: State that solids, liquids & gases are made up of particles. Explain diffusion in terms of particle theory. Use particle theory of matter to explain the changes from solid to liquid to gas, e.g. in the water cycle	Planet earth: SCN304D particulate nature of matter, effect when heated & cooled	
Activity 4: Raising water	Topic: matter Learning outcome: Predict the effect of gas pressure using the particulate theory Topic: forces Learning outcome: Pressure=force/area Give some practical applications of pneumatics & hydraulics		

Activities

1001 Inventions Teachers' Pack	Curricular link to Glasgow Science scheme	Curricular link to curriculum for excellence learning outcomes (draft)	Links to other parts of curriculum (e.g. standard grade, intermediate 1)
<p>Activity 5: Puzzling plants</p>	<p>Topic: variation & genetics Learning outcome: Devise criteria for decision points in a classification key. Create a branch key using easily observed characteristics of living things Topic: cell processes Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine and raw materials Topic: microbiology Learning outcome: Identify the types of micro-organism that cause disease. Outline the principles of modern biotechnology and explain its significance now and for the future</p>	<p>Planet Earth: biodiversity SCN205B identify and classify living things & SCN 209B how plants have benefited society</p>	<p>Intermediate 1 chemistry Unit 3: Food & diet</p>
<p>Activity 6: Pharmacy</p>	<p>Topic: acids & metals Learning outcome: Measure the pH of common solutions Identify acids, alkalis and neutral solutions from the pH values. State that acids & alkalis combine to form a neutral solution.</p>	<p>Materials: chemical reactions SCN233Z Everyday reactions SCN329U</p>	<p>Intermediate 1 chemistry Unit 3: Drugs Unit 1: acids & alkalis Standard Grade chemistry reactions of acids</p>
<p>Activity 7: Build it strong</p>	<p>Nothing in Glasgow S1/2 science course matching this activity.</p>		

Activities

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<p>Activity 8: Figuring out phenomena</p>	<p>Topic: cosmos Learning outcome: Explain the phases of the moon in terms of the relative motion of the earth and the moon Topic: optics & acoustics Learning outcome: State that light travels in straight lines Use in context the terms normal, angle of incidence, angle of reflection, refraction and angle of refraction. State that a spectrum is produced when white light is passed through a prism. Identify the colours of the spectrum produced and the order in which they appear. State the effect of coloured filters on white light</p>	<p>Planet Earth: astronomy SCN213E use simple models to communicate understanding of size, scale and relative motion in our solar system</p>	
<p>Activity 9: Bird man</p>	<p>Topic: forces Learning outcome: Describe the effect of balanced forces Pressure=force/area. State that weight is the force of gravity on an object. Give some practical applications of high and low pressure ... Topic: matter Learning outcome: Explain the different masses of materials of materials with the same volume in terms of particle spacing and relate this to density</p>	<p>Forces & motion: SCN313L I have carried out activities to investigate the effect of gravity on objects ...</p>	
<p>Possible extra activity: Perforated Bowl Clock investigation</p>	<p>Topic: Matter, density Topic: Storing energy, potential energy changes to kinetic energy</p>		

Glasgow S1/2 course comparison

Glasgow S1/2 Science Course	1001 Inventions Teachers' Pack
Variation and Genetics	Activity 5: Puzzling plants
Matter	Activity 3: Perfume Activity 4: Raising water Activity 9: Bird man
Acids & Metals	Activity 6: Pharmacy
The Cosmos	Activity 8: Figuring out phenomena
Optics & Acoustics	Activity 1: Seeing in the dark Activity 8: Figuring out phenomena
Microbiology	Activity 5: Puzzling plants
Cell processes	Activity 2: Coffee Activity 5: Puzzling plants
Forces	Activity 4: Raising water Activity 9: Bird man

1001 Inventions - zones

The 1001 Inventions Exhibition at the Glasgow Science Centre and the accompanying book "1001 Inventions: Muslim Heritage in our World" 2nd Edition, 2007 (Editor Salim Al-Hassani, ISBN 13:978-0-9552426-1-8, published by Foundation for Science, Technology and Civilisation) contains dozens of interesting stories for enriching class science lessons.

home

Article	Content	Curriculum link/objective
On the coffee trail	How was coffee discovered? Over 1200 years ago, an Arab goatherd wondered why his goats became lively after eating some berries.	Topic: cell processes Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine & raw materials
Cleanliness	How did Muslims protect their teeth 100 years ago? They used a twig, which scientists have now discovered contains an antibiotic. Making soap from oil and "alkali"	Topic: microbiology Learning outcome: identify the types of micro-organisms that cause disease Topic: cell processes Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine and raw materials Topic: acids & metals Learning outcome: State that when an acid neutralises an alkali a salt & water is formed
Vision & cameras	Children today still struggle with the idea that light comes from the object, not the eye, but this was known as early as the 10th century.	Topic: optics & acoustics Learning outcome: State that light travels in straight lines
Trick devices	The original 'executive toy' was based on pressure – a drinking bull that made a noise of contentment when it was finished.	Topic: matter Learning outcome: Predict the effect of gas pressure using the particulate theory

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School

Article	Content	Curriculum link/objective
Chemistry	1300 years ago, Muslim chemists were developing a whole host of separating techniques we now teach to 11 year olds.	<p>Topic: matter Learning outcome: State that solids, liquids & gases are made up of particles Use particle theory of matter to explain the changes from solid to liquid to gas, e.g. in the water cycle</p> <p>Topic: chemical reactions Learning outcome: Explain the difference between a mixture and a compound State that energy is needed to break up a chemical compound. Explain the difference between a chemical and a physical change</p> <p>Topic: acids & metals Learning outcome: Measure the pH of common solutions. Identify acids, alkalis and neutral solutions from the pH values State that acids & alkalis combine to form a neutral solution. State that when an acid neutralises an alkali a salt & water is formed. Give examples of how reactivity relates to uses and sources of metals Give some examples of how some metals are extracted</p>
Vision & Cameras	Children today still struggle with the idea that light comes from the object, not the eye, but this was known as early as the 10th century.	<p>Topic: optics & acoustics Learning outcome: State that light travels in straight lines</p>
Trick Devices	The original “executive toy” was based on pressure – a drinking bull that made a noise of contentment when it was finished.	<p>Topic: matter Learning outcome: Predict the effect of gas pressure using the particulate theory</p>

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Market 1 of 2

Article	Content	Curriculum link/objective
Raising Water	The James Dyson of the 12th century was Al-Jazari who invented a brilliant way to haul up river water to irrigate fields automatically.	<p>Topic: matter</p> <p>Learning outcome: Predict the effect of gas pressure using the particulate theory</p> <p>Topic: forces</p> <p>Learning outcome: Pressure=force/area</p> <p>Give some practical applications of pneumatics & hydraulics</p>
Irrigation & Water Management	Muslims were experts in raising water by several metres, guaranteeing a constant flow by using both pumps & water wheels or norias	<p>Topic: matter</p> <p>Learning outcome: Predict the effect of gas pressure using the particulate theory</p> <p>Use particle theory of matter to explain the changes from solid to liquid to gas, e.g. in the water cycle</p> <p>Topic: forces</p> <p>Learning outcome: Pressure=force/area</p> <p>Give some practical applications of pneumatics & hydraulics</p>
Farming Manuals & Ecological Balance	Muslim agricultural scientists experimented to find the best organic fertiliser. Their conclusion? Pigeon manure.	<p>Topic: food webs & competition</p> <p>Learning outcome: State that plants compete with each other for light, moisture & space. State that the organisms most suited to their environment are the ones to survive</p> <p>Topic: acids & metals</p> <p>Learning outcome: State that when an acid neutralises an alkali a salt & water is formed</p>
Windmill	Wind turbines are becoming a common feature of the countryside. But how was the power of the wind first harnessed?	<p>Topic: storing energy</p> <p>Learning outcome: Describe some differences between renewable & non-renewable energy resources</p>

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Market 2 of 2

Article	Content	Curriculum link/objective
Commercial Chemistry	What use is crude oil without being able to separate liquids of different boiling points. Muslim chemists did this in the 8th century.	<p>Topic: matter Learning outcome: State that solids, liquids & gases are made up of particles Use particle theory of matter to explain the changes from solid to liquid to gas, e.g. in the water cycle</p> <p>Topic: chemical reactions Learning outcome: Explain the difference between a mixture and a compound State that energy is needed to break up a chemical compound Explain the difference between a chemical and a physical change</p> <p>Topic: acids & metals Learning outcome: Measure the pH of common solutions. Identify acids, alkalis and neutral solutions from the pH values State that acids & alkalis combine to form a neutral solution. State that when an acid neutralises an alkali a salt & water is formed. Give examples of how reactivity relates to uses and sources of metals. Give some examples of how some metals are extracted</p>
Paper	Paper seems like such an ordinary product today, but it's fundamental to modern civilisation. Think of all the pieces of paper you use everyday, from magazines, tv guides and newspapers to kitchen roll and greetings cards.	<p>Topic: cell processes Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine & raw materials</p>

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Hospital

Article	Content	Curriculum link/objective
Pharmacy	Muslim pharmacists a thousand years ago were dishing out drugs for everything from aches to acne. How did they make them?	<p>Topic: acids & metals</p> <p>Learning outcome: Measure the pH of common solutions. Identify acids, alkalis and neutral solutions from the pH values. State that acids & alkalis combine to form a neutral solution</p>
Herbal Medicines	Centuries before Linnaeus's classification system, a Muslim scientist compiled an encyclopaedia of plants and their uses.	<p>Topic: variation & genetics</p> <p>Learning outcome: Devise criteria for decision points in a classification key. Create a branch key using easily observed characteristics of living things</p> <p>Topic: cell processes</p> <p>Learning outcome: Describe the importance of green plants to humans, to include gas balance, food supply, medicine and raw materials</p> <p>Topic: microbiology</p> <p>Learning outcome: Identify the types of micro-organism that cause disease. Outline the principles of modern biotechnology and explain its significance now and for the future</p>
Vaccination	Vaccination is generally credited to Edward Jenner, but was first carried out by the Turks/	<p>Topic: microbiology</p> <p>Learning outcome: Identify the types of micro-organism that cause disease. Outline the principles of modern biotechnology and explain its significance now and for the future</p>

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Town

Article	Content	Curriculum link/objective
Arches	The arch was a big step forward in building. Muslim architects were partly inspired by the way palm tree branches curved.	
Tents	Bedouin and Muslims realised that a common shape held the key to building strong tents?	
Windmill	Wind turbines are becoming a common feature of the countryside. But how was the power of the wind first harnessed?	Topic: storing energy Learning outcome: Describe some differences between renewable & non-renewable energy resources
Vaults	Muslim architects wanted to create ever bigger buildings. How did they solve the problem of supporting heavy roofs?	

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World

Article	Content	Curriculum link/objective
Natural Phenomena	Muslim scientists grappled with questions that baffle us today like: why does the moon look bigger near the horizon?	<p>Topic: cosmos</p> <p>Learning outcome: Explain the phases of the moon in terms of the relative motion of the earth and the moon</p> <p>Topic: optics & acoustics</p> <p>Learning outcome: State that light</p>
		travels in straight lines. Use in context the terms normal, angle of incidence, angle of reflection, refraction and angle of refraction. State that a spectrum is produced when white light is passed through a prism. Identify the colours of the spectrum produced and the order in which they appear. State the effect of coloured filters on white light
Planet Earth	Unlike in Europe, many educated Muslims in the 11th century took it for granted that the earth is round, not flat.	<p>Topic: The Cosmos</p> <p>Learning Outcome: State that a day is the time taken for the earth to rotate about its axis (24hours)</p>
Earth Science	The writings of Ibn-Sina on earthquakes influenced the pioneering Scottish geologist James Hutton seven centuries later.	<p>Topic: acids & metals</p> <p>Learning outcome: Give examples of how reactivity relates to uses and sources of metals. Give examples of how some metals are extracted</p>
Weaponry	Muslim chemists learned to purify explosive potassium nitrate and made rockets in the 13th century.	<p>Topic: acids & metals</p> <p>Learning outcome: State that when an acid neutralises an alkali, a salt and water are formed</p> <p>Topic: chemical reactions</p> <p>Learning outcome: Explain the difference between a mixture and a compound. Explain the difference between a chemical and a physical change</p>

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Universe

Article	Content	Curriculum link/objective
Flight	<p>Abbas ibn Firnas made a successful take off a thousand years before the Wright brothers, in his flying glider.</p> <p>Lagari Hasan Celebi made a successful take off using a rocket propelled by gun powder mixture, nearly 500 years ago.</p>	<p>Topic: forces Learning outcome: Describe the effect of balanced forces. Pressure=force/area. State that weight is the force of gravity on an object. Give some practical applications of high and low pressure ...</p> <p>Topic: matter Learning outcome: Explain the different masses of materials of materials with the same volume in terms of particle spacing and relate this to density</p>
Astronomy	<p>Muslim astronomers were the first to build observatories, make highly accurate measurements with sophisticated instruments.</p>	<p>Topic: the cosmos Learning outcome: State that a month is the time taken for the moon to complete one orbit around the earth. State that a year is the time taken for the earth to complete one orbit around the sun. Explain the phases of the moon in terms of the relative motion of the earth and the moon. Explain how the tilt of the earth produces the seasons of the year.</p>
Astrolabe	<p>Until the computer came along, the astrolabe was the most important calculating device for astronomers.</p>	
The Moon	<p>As Muslims base their calendar on the lunar cycle, their astronomers knew incredible amounts about it a thousand years ago.</p>	<p>Topic: the cosmos Learning outcome: State that a month is the time taken for the moon to complete one orbit around the earth</p>
Lunar Formations	<p>Many craters on the moon are named after Muslim astronomers who made great contributions to knowledge.</p>	
Stars	<p>The idea of there being a galaxy beyond the Milky way was unknown until Abd al-Rahman al-Sufi in the 10th century.</p>	<p>Topic: the cosmos Learning outcome: Describe the universe in terms of galaxies and black holes</p>