Checkpoint Science Scheme of Work

Physics – Year 1

Topic: Measurement

Aims
That pupils should be able to:

- choose the appropriate apparatus for measurement
- use the apparatus carefully and accurately
- express and record measurements in their correct units
- give a rough estimate of some quantities when this is useful

Links
Checkpoint curriculum – Pp 1
IGCSE Physics 1.1, 2.2, IGCSE Combined Sciences Physics Topic One, IGCSE Physical Science 1.1, 1.3

Words
scale, unit, area, volume

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
measure length and calculate area	Students learn to use rulers accurately, lining up the eye with the measurement. Finding the height of a pack of paper and dividing by the number of pages (use easy numbers) gives the thickness of one sheet. Irregular areas can be found by counting squares on graph paper, e.g. of a leaf or base of a beaker. Estimation is an important skill. Students can estimate such quantities as the height of the room or the length from their elbow to finger tip and then check with a ruler.	Record in mm. Record in cm^2

measure volume	The volume of liquid in measuring cylinder must be read at the bottom of the meniscus. The cylinder can then be used to find the volume of an irregular solid such as a stone or spoon.	Record in ml.
measure temperature	Students heat water in a beaker for 10 minutes and record the temperature every minute. A table, with correctly headed columns, is needed to record the results. This can be continued turning off the heater.	Record in degrees Celsius, ^{o}C.
measure mass and weight	Students should be shown that care is needed with top-pan or lever balances if accuracy is to be maintained. They should find the lightest object whose mass can be read. They should find the weight of e.g. a seed or a pin by weighing a known number.	Record in g or kg.
measure time	Students can use a stop-watch to measure their reaction time with a partner, for example, by dropping a ruler. Accuracy for timing a swinging pendulum is improved by timing 10 swings and dividing the time measured by ten. A challenge to achieve a given time interval measured by stop clock improves involvement.	Record in s. Keep angles of swing small.
use a computer data-logging package	If a computer and sensor are available they can be used as appropriate. A temperature sensor can continuously monitor, overnight if required. A motion sensor can measure speed and convert quickly to a graph giving a very clear picture of distance travelled and speed.	
take a range of readings and record them appropriately	Students use a range of instruments to compile a record of measurements using the techniques they have learned. Examples include hand span, area of feet, volume of fist, temperature of armpit, body weight, pulse rate.	

Resources

http://www.acorns.k12.tn.us/staffdev/curricu/lp_k12_m_svwh.htm

Topic: Forces and their effects

Aims
That pupils should be able to:

- calculate average speeds
- describe the effect of forces on the motion of objects
- describe the effects of forces on the shape of objects

Links
Checkpoint curriculum – Pf 1, Pf 2
IGCSE Physics 1.5, IGCSE Co-ordinated Sciences P 4 IGCSE Combined Science Physics Topic One, IGCSE Physical Science 1.5

Words
Force, motion

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
understand that forces change the speed and direction of objects	Students should try activities to show the effect on speed of pushing and pulling forces. Examples include kicking a squashy football and pulling a raft across water.	
measure forces	The forces students themselves can apply can be measured using various force meters. Use bathroom scales for pushing against a wall or squeezing with the hands. Use a strong spring for stretching (it can be calibrated against known weights).	Emphasise the need for recording all forces in newtons.
investigate the effect of forces on the shape of objects	Students can investigate the extension of an expendable spring with added weights. They like to make their own springs with copper wire and this avoids the need to use heavy weights. Rubber bands can be used but need quite a few heavy weights.	Safety goggles should be worn for this activity as springs can flick back or break. A bin, cushioned with a coat inside, should be placed underneath the weights.

Topic: Fuels and Energy

Aims
That pupils should be able to:

- explain that energy is needed for action to happen
- explain that energy is transferred during action
- name major sources of energy including fuels
- describe alternative sources of energy such as solar and wind

Links
Checkpoint curriculum – Pe 1,Pe2
IGCSE Physics 1.6, IGCSE Co-ordinated Sciences P 18, IGCSE Combined Sciences Chemistry Topic Two, IGCSE Physical Science 1.6

Words
energy, fuel, fossil fuel, alternative energy source

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
consider what is meant by energy	Students can brainstorm their own ideas about what 'energy' means. A guided discussion suggests that it is something needed to bring about changes such as heating water, running upstairs, switching on the light etc. It has to be 'paid for'.	
consider examples of energy transfer	Students can inspect or try a range of simple activities such as clockwork toys, lamps, releasing a blown up balloon, burning a match, looking at a photographic negative, rattling a tin, etc. They should suggest how energy is being input and what outcome is being achieved.	The forms of energy can be given after the activity and include, at this stage: heat (thermal) light sound electrical chemical kinetic(movement) potential (stored)

understand that energy is wasted	Students can compare the transfer of energy from several different examples such as a burner, an electric light, lifting weights for 5 minutes, to find that energy is wasted in the form of heat and dispersed in the atmosphere.	The weights lifted should be 'safe', i.e.10 or 20N sandbags or similar, to prevent injury.
provide examples of fuels	Fuels are energy sources which release their energy through burning. Students can compare two fuels e.g. wax (or, cleaner, metafuel) and wood and by burning a known mass to heat equal masses of water. Their experimental design should include ways of reducing heat loss. A research project on the history of the formation of one of the fossil fuels can produce good display material.	Safety goggles should be worn.
consider other energy sources	There are many different alternative sources which can be researched. They can include solar power, wind power, geothermal energy, hydroelectricity, wave power, tidal power and biomass. Use any local sites where these can be seen.	
choose appropriate energy sources	A challenge can be set to choose energy sources to supply a group of people living on an island. Drawings of an island can be provided to include various geographical features such as hills, lakes, rivers, wind direction and strength etc	See also topic 15

Resources

www.energyquest.ca.gov/story/index.html

Topic: Electrical Circuits

Aims
That pupils should be able to:

- distinguish conductors and insulators
- be able to set up simple circuits safely
- know the effects of some components on currents

Links
Checkpoint curriculum – Pc 1, Pc 3, Pc 4
IGCSE Syllabus – 4.2, 4.3, 4.4

Words
Conductor, insulator, current, series, circuit, cell, battery, switch, lamp

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
understand that a circuit must be complete for energy to flow	Challenge pupils to light a lamp given lamp, cell and wire. Discuss what is happening and encourage the idea of flow of electricity.	Warn that no connection should be made directly across the cell. Mains electricity should never be used directly for any of these types of investigation. Avoid the idea that current sets out from the cell and gets smaller as it moves around the circuit. Teachers may prefer to introduce ammeters at this point rather than later in the course.
understand the function of a switch	Pupils can design a switch using aluminium foil.	Always include a push switch in future to avoid battery drain. The current stops everywhere in the circuit.
distinguish between conductors and insulators	Pupils can put other materials in the circuit with the lamp to test for conduction. It should be ensured that conductors have sufficiently low resistance to allow the lamp to light.	Use crocodile clips to connect in series.
investigate the effects of other components	Pupils should try the effects on the lamp of adding one or more lamp in series, also a variable resistor (long resistance wire will do). Other components such as buzzers, different sized lamps, additional	Warn that thin wires will get hot. Cells facing will produce no current but cells in the same direction make up a battery. Link the voltage written on the cell with the energy

	cells, thin wires / fuses can be tried.	available – brightness of bulb.
Understand the value of circuits diagrams	Pupils should try to draw a simple circuit to appreciate the difficulty. Then they can be introduced to circuit diagrams as a simple solution. They should set up some circuits from diagrams drawn by friends, first predicting the result.	It should be stressed that, like any diagram, it must be accurate to be useful.

Resources

http://youth.net/cec/cecsci/cecsci.72.txt

Topic: Particle Model

Aims
That pupils should be able to:

- explain the way that particles are arranged in solids, liquids and gases
- explain the expansion of solids, liquids and gases

Links
Checkpoint curriculum – Pp 2, Pp 3
IGCSE Physics 2.1, 2.2, IGCSE Co-ordinated Sciences P 2, IGCSE Combined Sciences Physics Topic Four, IGCSE Physical Science 2.1

Words
particle, expansion

Activities

Objectives Students should be able to:	Possible Activities	Health and safety/notes
distinguish between solids, liquids and gases.	A demonstration showing the effect of shaking a fizzy drink and then opening it, gives the opportunity for students to explore the meaning of the terms solid, liquid and gas. They should identify the differences between them and also look for similarities.	Solids are hard, keep their shape, dense. Liquids can be dense but are generally less hard and take the shape of the bottom of their container. Gases are light, have the shape of their container and can be compressed.
recognise how particles are arranged in each of the three states.	Students can be given models of the three states and asked to explain which represents each state. They should be able to suggest the similarities and differences between the model and the state of matter.	All three models are made up of particles. The particles have energy so continually move. Differences between the model and the 'reality' include size, actual speed and the 'hard sphere' nature of the particles.
investigate the expansion of solids	There are a number of special pieces of equipment to demonstrate expansion of solids (metals) but students enjoy doing it for themselves. This can be done by heating a piece of horizontal wire, supported at both ends, with a small weight hanging on it.	Safety goggles should be worn for any experiments with heating. Students should be advised to allow for cooling before touching apparatus. Consider the explanation in terms of particles.

investigate the expansion of liquids	This can be seen by students if they heat a boiling tube, fitted with a glass tube and bung, full of coloured water. They should be able to **design** a way that this could be used to find the temperature of e.g. melting wax.	Safety goggles should be worn for any experiments with heating. Students should be advised to allow for cooling before touching apparatus. Consider the explanation in terms of particles.
investigate the expansion of gases	A boiling tube fitted with a bung and glass tube can be heated **gently** e.g. by holding in the hand. If the end of the tube is dipping into some water, bubbles can be seen showing that gas is escaping. As the tube then cools, water is sucked back into the tube.	Safety goggles should be worn for any experiments with heating. Cold water moving into the hot tube can cause cracking so the initial heating must be very gentle. Consider the explanation in terms of particles.
describe what happens when water freezes	A sealed plastic bottle can be filled with water and frozen showing expansion. Students can observe, or recall from experience, that the density of ice is less than that of water.	Students should try to use the idea of particles to explain why.
know how salt affects the freezing point of water	Students should set up two filter funnels supported in measuring cylinders containing crushed ice, adding some salt to one. The temperatures (and volumes of melted ice) of both tubes can be compared over several minutes. Students can suggest why salt is put on roads in countries where the temperature falls below $0^{o}C$.	

Resources

http://brainpop.com/science/matter/statesofmatter/index.weml