

## Starter Activity: What physics can't you see from the window?

**Introduction:** This activity is intended as a warm-up 'ice-breaker' exercise, to stimulate thinking about how pupils might relate the physics they are taught to the world outside the window, using the question sheet overleaf.

**Key Stage:** Physics KS4

**National Curriculum reference:** Sc4 3a, e, f, h, i, l, m, n, 4b, 5j, 6a,b,c.

**Time:** 20 minutes

**Pupil learning outcomes:** Pupils may well be astounded at just how much "physics" is going on around them, when they had probably thought of the subject as being confined to the laboratory. As a result of the discussion, they may treat their environment with more respect and understanding.

**Context:** Physical processes are going on all around us. At KS3 we considered the processes that can be seen through the window. At KS4, pupils are encouraged to state what physics they know is going on unseen in their immediate environment. The activity therefore depends on the background knowledge of the pupils to a greater extent than at KS3.

**Activity:** Participants simply look through a nearby window and attempt to answer the questions. This is best done in pairs to encourage discussion.



The view from the window (*Starter Activity*)

**Resource list:** Participant Card per group

**Follow-up:** Participants can continue to think of examples of unseen physics in action on their way home, or in the home.

The Participant Cards contain the question sheet: some possible answers are given below:

*All photographs can be found in colour on the Earth Science Education Unit website.*

## Some answers

Physics that is happening through the window – but I can't see it happening		Tick for 'it's happening', cross for 'it's not happening'	If it is happening, this physics could be detected/ measured by ...	This would vary across the area I can see from the window; tick for 'yes', cross for 'no'	If it does vary across the area I can see – it does so because ...
Electro-magnetic radiation is being transmitted as ...	... radio waves	✓	Radio telescope Radio receiver	✓	Whilst high frequency waves are likely to be constant over the area of your view, ultra-high frequency (UHF) coverage will vary since 'lines of sight' rules apply
	... microwaves	✓	Communications masts Mobile/cell phone	✓	These can be very variable over the area of your view, as patchy mobile phone reception can testify
	... infra-red waves	✓	Phototransistor Skin sensation IR proximity detector	✓	Local variation in energy received from the Sun depends on shading by clouds, buildings, etc.
	... visible light	✓	Eyes Photoelectric cell Photographic paper	✓	Local variation in energy received from the Sun depends on shading by clouds, buildings, etc.
	... ultra-violet waves	✓	Fluorescent paper UV detector Sun-tan	✓	Local variation in energy received from the Sun depends on shading by clouds, buildings, etc.
	... x-rays	✓	Photographic film Fluorescence Electronically using charge coupled devices	✓	The Earth is constantly bombarded by radiation of positively charged ions from outside our solar system. Collisions with atmospheric particles produce secondary radiation of many kinds of rays and particles, including x-rays
	... gamma waves (rays)	✓	Geiger-Muller tube	✓	Loss of radioactive radon gas from the Earth is patchy, depending on deep rock formations and conduits to the surface. When a radon atom decays, it emits an alpha particle and a gamma ray. Other materials, such as bricks, can also contain isotopes emitting gamma rays
Nuclear radiation is being transmitted	✓	Geiger-Muller tube	✓	Gamma waves, as above. Plus, rocks and soils can contain radioactive elements in trace amounts	
A magnetic field is acting	✓	Magnetic compass Dip needle Magnetometer	✓	Earth's magnetic field is steady (but does change slowly over time). Local variations are caused by buried metalliferous materials or rocks rich in metalliferous minerals	
Electricity is being transmitted (ignoring electrical wires)	✓	Resistance meter	✓	Natural electric currents pass through the Earth, affected locally by rock and soil conditions (if there is a thunderstorm outside, it is being transmitted by lightning too). Nerves use electrical impulses to transmit information in animals, including humans	
Heat energy is being dissipated (ignoring buildings)	✓	Temperature probe Heat haze	✓	The Earth's surface gains heat energy from the Sun, but then loses it. It also loses its own heat energy. Heat loss is determined by rock sequences at depth and by local ground conditions	
Shock waves are being transmitted	✓	Ears Noise meter Seismometer	✓	Sound amplitude increases towards sound sources and moving sources vary in pitch due to the Doppler effect. Seismic shock waves are being transmitted through ground (P and S waves) and water (P waves) all the time – varying in properties with the medium of transmission. (If there is a thunderstorm outside, sound is being transmitted as thunder too)	
Non-directional (confining) pressure is being imposed	✓	Barometer	X	Blanket cover – slight variations due to locally rising air over warm surfaces or sinking air over cold surfaces	
Gravitational forces are acting	✓	Gravimeter	✓	Gravity varies with distance from the centre of the Earth, so any variation of altitude (of more than 1 metre) could be detected by a gravimeter. Buried substructures would affect local gravity, but rock variations affect gravity on a regional rather than local scale	

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### **Activity:**

See table



The view from the window  
(*Starter Activity*)

## What physics can't you see from the window?

Look through the window and complete the sheet

	Physics that is happening through the window - but I can't see it happening	Tick for 'it's happening', cross for 'it's not happening'	If it is happening, this physics could be detected/ measured by ...	This would vary across the area I can see from the window; tick for 'yes', cross for 'no'	If it does vary across the area I can see - it does so because ...
Electro-magnetic radiation is being transmitted as ...	... radio waves				
	... microwaves				
	... infra-red waves				
	... visible light				
	... ultra-violet waves				
	... x-rays				
	... gamma waves				
	Nuclear radiation is present				
	A magnetic field is acting				
	Electric currents are flowing (ignoring electrical wires)				
	Heat energy is being dissipated (ignoring buildings)				
	Shock waves are being transmitted				
	Non-directional (confining) pressure is being imposed				
	Gravitational forces are acting				
	Others?				