

## Sustainable & Healthy Travel Workshop

### Teacher's Notes

#### Resources:

- Teacher Notes
- PowerPoint Slides
- Activity signs - Pollution, Healthy Travel
- Activity cards - London to Edinburgh Travel Game, Safety Game, What if?...
- Activity sheet - Stay Safe mind map

PowerPoint Slide	Activity
	<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• <b>TELL</b> pupils that these activities will help them decide the best forms of transport to use when they are travelling to school or to see friends etc.</li> <li>• <b>ASK</b> pupils 'what does sustainable' mean? <b>Answer:</b> sustainable is about not being harmful to the environment or using up natural resources. It means meeting the needs of the present without compromising the ability of future generations to meet their own needs.</li> </ul>
<p><b>Congestion</b></p> <p>Car?      Bus?      Bicycle?</p>	<p><b>86 people</b></p> <ul style="list-style-type: none"> <li>• <b>ASK</b> pupils 'what is traffic congestion?' <b>Answer:</b> it means slower speeds on our roads, longer trip times and an increase in queuing traffic.</li> <li>• <b>TELL</b> pupils these photos show the same street with 86 people and their 86 cars, 86 people and a bus that seats 86 people, and 86 people and their 86 bicycles (train = bus, as one train carriage will carry the same number of passengers).</li> <li>• <b>ASK</b> pupils 'which of these three takes up less space?' <b>Answer:</b> bus, which also means less congestion.</li> <li>• <b>ASK</b> pupils 'why is the bus better than the car for the environment (hint: emissions)?' Both have engines... <b>Answer:</b> better to have one engine carrying 86 passengers (the bus) than 86 people in 86 cars with 86 engines!</li> <li>• <b>ASK</b> pupils 'why is the train better than the bus?' <b>Answer:</b> because it doesn't use the roads!</li> </ul>

### Pollution

These are the main chemicals which are in car exhaust fumes. Which are toxic to us?



- Benzene (C<sub>6</sub>H<sub>6</sub>)
- Carbon Dioxide (CO<sub>2</sub>)
- Carbon Monoxide (CO)
- Hydrocarbons (HC)
- Nitrogen (N<sub>2</sub>)
- Nitrogen Oxides (NOx)
- Oxygen (O<sub>2</sub>)
- Particulate matter (PM) or 'soot'
- Sulphur Dioxide (SO<sub>2</sub>)
- Water (H<sub>2</sub>O)



### Pollution

#### Toxic

- Benzene (C<sub>6</sub>H<sub>6</sub>)
- Carbon Dioxide (CO<sub>2</sub>)
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#### Non Toxic

- Nitrogen (N<sub>2</sub>)
- Oxygen (O<sub>2</sub>)
- Water (H<sub>2</sub>O)



### Pollution

- **ASK** pupils 'what is pollution?' **Answer:** something introduced into the environment that is dirty, unclean or has a harmful effect.
- **TELL** pupils that particular matter in pollution gets into our heart and lungs. The carbon monoxide in pollution stops the red blood cells from receiving oxygen.
- **ASK** pupils 'what does toxic mean?' **Answer:** something that is poisonous, very harmful or bad.

**ACTIVITY** – divide the classroom into a 'toxic' side and 'non toxic' side, with 'not sure' in the middle of the classroom. Stick up 'toxic', 'non toxic' and 'not sure' signs. Call out each chemical and ask the pupils to move to the side of the room that they think is the correct answer. If they are 'not sure' they move to the middle of the classroom. Reveal the answer on the PowerPoint and call out the next chemical.

Additional notes about the chemicals are below:

These are the main exhaust products and their effects on the environment and our health.

**Nitrogen (N<sub>2</sub>)** – no adverse effects

**Oxygen (O<sub>2</sub>)** – no adverse effects

**Water (H<sub>2</sub>O)** – no adverse effects

**Carbon Dioxide (CO<sub>2</sub>)** – non-toxic but contributes towards acidification of our oceans and one of the most important greenhouse gases. Government policies around the world are aimed at reducing CO<sub>2</sub> emissions to combat global warming.

**Carbon Monoxide (CO)** – results from incomplete combustion of fuel. CO reduces the ability of blood to carry oxygen and can cause headaches, respiratory problems and, at high concentrations, even death.

**Nitrogen Oxides (NO<sub>x</sub>)** – produced in any combustion process, NO<sub>x</sub> emissions are oxidised in the atmosphere and contribute to acid rain. They react with hydrocarbons to produce low level ozone which can cause inflammation of the airways, reduced lung function and trigger asthma. They also contribute to the formation of particulate matter.

**Sulphur Dioxide (SO<sub>2</sub>)** – sulphur occurs naturally in the crude oil from which petrol and diesel are refined. It forms acids on combustion leading to acid rain and engine corrosion. It also

contributes to the formation of ozone and of particulate matter.

**Hydrocarbons (HC)** – HCs are emitted from vehicle exhausts as unburnt fuel and also through evaporation from the fuel tank, from the nozzle when you fill up and also at stages through the fuel supply chain. They react with NOx in sunlight to produce photochemical oxidants (including ozone), which cause breathing problems and increased symptoms in those with asthma.

**Benzene (C<sub>6</sub>H<sub>6</sub>)** – occurs naturally in small quantities (less than 2%) in petrol and diesel, Benzene is emitted from vehicle exhausts as unburnt fuel and also through evaporation from the fuel system although modern fuel systems are sealed and have carbon canisters to hold the vapours. Benzene is toxic and carcinogenic and long-term exposure has been linked with leukaemia.

**Particulate matter (PM) or soot** – particulate matter is partly burned fuel associated mainly with diesel engines and is also formed by the reaction between other pollutants. Smaller particles can pass deep into your lungs causing respiratory complaints and contributing to the risk of developing cardiovascular diseases. Modern diesel cars are fitted with Diesel Particulate Filters (DPF) to stop these particles passing into the atmosphere.

### London to Edinburgh



Who's the quickest?

- Bicycle
- Diesel Car
- Electric Car
- Petrol Car
- Plane
- Train



London to Edinburgh – who's the quickest?

Mode	Time	Miles
Plane	1 hour 25 mins*	336 miles
Train	4 hours 42 mins*	392 miles
Diesel Car	7 hours 25 mins*	405 miles
Petrol Car	7 hours 25 mins*	405 miles
Electric Car	11 hours 25 mins*	405 miles
Bicycle	38 hours*	481 miles

\* Not including transfers to and from city centre  
\* Direct from London King's Cross to Edinburgh  
\* Depending on traffic  
\* Opening on traffic  
\* Including one 4-hour charging session  
\* Uninterrupted cycling!  
\* Uninterrupted cycling time – according to Google

### London to Edinburgh Travel Game

**ACTIVITY** – hand each group a set of six Travel Game cards. **ASK** pupils to place these forms of transport in a list with the one with the quickest journey time at the top and slowest journey time at bottom on a journey between London and Edinburgh. Reveal the answers on the PowerPoint.

- Plane – 1 hr 25 mins / 336 miles
  - Train – 4 hrs 42 mins / 392 miles
  - Diesel car – 7 hrs 25 mins / 405 miles
  - Petrol car – 7 hrs 25 mins / 405 miles
  - Electric car – 11 hrs 25 mins (including charging time!) / 405 miles
  - Bicycle – 38 hrs (uninterrupted cycling!) / 481 miles
- ASK** pupils 'why does a cyclist cycle more miles?' Answer: they cannot use motorways.

**ACTIVITY** – **ASK** pupils to place these forms of transport in a list with the one with highest emissions at the top and lowest

### London to Edinburgh



Who emits the most carbon emissions?

- Bicycle
- Diesel Car
- Electric Car
- Petrol Car
- Plane
- Train



London to Edinburgh – who's emits the most carbon emissions?

<p><b>Plane</b> 144 kg Emission Factor: 0.204 kg CO<sub>2</sub>/km</p>	<p><b>Petrol Car</b> 120 kg Emission Factor: 0.189 kg CO<sub>2</sub>/km</p>	<p><b>Diesel Car</b> 115 kg Emission Factor: 0.177 kg CO<sub>2</sub>/km</p>
<p><b>Train</b> 29 kg Emission Factor: 0.046 kg CO<sub>2</sub>/km</p>	<p><b>Electric Car</b> 0 kg Emission Factor: 0.000 kg CO<sub>2</sub>/km</p>	<p><b>Bicycle</b> 0 kg Emission Factor: 0.000 kg CO<sub>2</sub>/km</p>



emissions at bottom on a journey between London and Edinburgh. Reveal the answers on the PowerPoint.

- Plane – 144 kg
- Petrol car – 120 kg
- Diesel car – 115 kg
- Train – 29 kg
- Electric car – 0 kg
- Bicycle – 0 kg

**ASK** pupils ‘why do you think the petrol car emitted more carbon emissions than the diesel car?’ **Answer:** this is only measuring CO<sub>2</sub> and petrol cars emit more CO<sub>2</sub> than diesel cars but less nitrogen and tiny particles.

**PUPIL DISCUSSION:** journey time vs CO<sub>2</sub> emissions, should they use the quick plane or the lower emission electric car?



### Buses and Biofuels: Sustainable Transportation From California Academy of Sciences – [click here](#) for video

**Suggested DISCUSS points are below:**

- What are carbon emissions?
- Why does transportation contribute to carbon emissions?
- What do you think is meant by ‘carbon footprint’? Why might you want to ‘reduce your carbon footprint’? Are there benefits to doing this?
- What is one of the biggest ways we can reduce our carbon footprint?
- Why do you think carsharing or riding with other people on a bus uses less energy than driving alone?
- What are some of the advantages of carsharing? What are some drawbacks?
- Are electric vehicles always more energy-efficient and environmentally friendly compared to gasoline-powered vehicles? Why or why not?
- How do electric vehicles work? Where do they get their energy from?
- What might be some advantages to electric vehicles? What might be some drawbacks?
- What do you think a ‘biofuel’ is? What types of materials can be made into biofuels?
- What do you think are some of the benefits of biofuels? What are some drawbacks?

• Where do you stand? Do you think we can convince more people to take public transportation? Are biofuels enough? Or should we focus on building a grid for electric vehicles?

**Suggested extension ACTIVITY:** What do you think would be the best solution for your city or town? What kind of information might you need to gather to find out?

### Healthy Travel

Sort these types of travel into two groups: 'good' and 'bad' for our health.

- Bicycle
- By foot
- Diesel Bus
- Diesel Car
- Diesel Train
- Electric Bus
- Electric Car
- Electric Train
- Fuel Cell Bus
- Petrol Car
- Plane
- Steam Train

### Healthy Travel

**Good**

- Bicycle
- By foot
- Diesel Bus
- Diesel Train
- Electric Bus
- Electric Car
- Electric Train
- Fuel Cell Bus
- Petrol Car
- Plane
- Steam Train

**Bad**

### Healthy Travel

**ACTIVITY** – divide the classroom into a ‘good’ side and ‘bad’ side, with ‘not sure’ in the middle of the classroom. Stick up ‘good’, ‘bad’ and ‘not sure’ signs. Call out each form of transport and ask the pupils to move to the side of the room that they think is the correct answer. If they are ‘not sure’ they move to the middle of the classroom. Reveal the answers on the PowerPoint and call out the next form of transport.

**Good** – includes diesel bus and train because they transport lots of people and reduce car usage.

**Bad** – includes steam train because it uses irreplaceable fossil fuels and is for non-essential leisure travel rather than essential travel to work.

**If you use the train or bus you are...**

- 44 % less likely to be overweight
- 27 % less likely to have high blood pressure
- 34 % less likely to have diabetes

### Bus / train = healthy you!

- **TELL** pupils that scientists are not sure why, but they know you're healthy if you use the bus / train.
- **ASK** pupils ‘why do you think this is?’ **Answer:** because they walk/cycle to the station and are not exposed to car fumes in a train whereas you are if you walk by traffic or sit in your car.
- **ASK** pupils ‘why are scientists concerned about cycling?’ **Answer:** cycling on road = breathing in car exhausts.

### Safety

Sort these types of travel into a list with the most dangerous at the top and least dangerous at the bottom.

- Bicycle
- Boat
- Bus / Coach
- Car
- Motorcycle
- Plane
- Train
- Van
- Walking

### Safety Game

**ACTIVITY** – hand each group a set of nine Safety Game cards. **ASK** the pupils what we mean by ‘most dangerous’? **Answer:** most dangerous means most people are killed by this form of transport. **ASK** pupils to sort these different types of transport into a list with most dangerous at the top and least dangerous at the bottom.

- Motorcycle - 83
- Walking - 26
- Bicycle - 24
- Car - 1.6

## Safety

	Most dangerous	
Bicycle	↓	Motorcycle = 83
Boat		Walking = 26
Bus / Coach		Bicycle = 24
Car		Car = 1.6
Motorcycle		Boat = 0.6
Plane		Van = 0.4
Train		Bus / Coach = 0.2
Van		Plane = 0.01
Walking		Train = 0
		Least dangerous



Figures are number of people killed per billion passenger kilometres between 2006 – 2015







- Boat - 0.6
- Van - 0.4
- Bus / Coach - 0.2
- Plane - 0.01
- Train - 0

**TELL** pupils that this shows that trains are a very safe form of transport.

*(Figures are number of people killed per billion passenger kilometres between 2006 – 2015)*

**TELL** the pupils about the Information from the Royal Society for the prevention of accidents below:

- 10% of cyclists injured are children.
- Hospital data shows that over 40% of cyclists, and 45% of child cyclists, suffer head injuries
- Cycling accidents increase as children grow older, with 10 to 15 year old riders being more at risk than other age groups. This reflects increased cycling as children grow older. It also coincides with the age when children attend Secondary school and may start to indicate riskier behaviour.
- Almost two thirds of cyclists killed or seriously injured were involved in collisions at, or near, a road junction, with T-junctions being the most commonly involved. Roundabouts are particularly dangerous junctions for cyclists.
- Accidents involving child cyclists are often the result of the child playing, doing tricks, riding too fast or losing control.
- For teenage and adult cyclists, accidents are more likely to involve collisions with motor vehicles, but about 16% of fatal or serious cyclist accidents reported to the police do not involve a collision with another vehicle, but are caused by the rider losing control of their bicycle.
- In collisions involving a bicycle and another vehicle, the most common key contributory factor recorded by the police is 'failed to look properly' by either the driver or rider, especially at junctions.
- Another common contributory factor attributed to cyclists was 'cyclist entering the road from the pavement' (including when a cyclist crosses the road at a pedestrian crossing), which was recorded in about 20% serious collisions (and over one third of serious collisions involving child cyclists).

<p><b>Stay safe</b></p> <p>How can YOU stay safe when you walk by the road?</p>  <p>How can YOU stay safe when you cycle on the road?</p>  	<p><b>Stay Safe</b></p> <p><b>ACTIVITY</b> – hand out the Mind Maps sheets (or ask pupils to make notes in their workbooks). <b>ASK</b> pupils what they can do to stay safe when walking or cycling? <b>Answers</b> may include:</p> <ul style="list-style-type: none"> <li>• wear a helmet</li> <li>• complete your cycling proficiency course</li> <li>• never cycle / walk whilst wearing headphones</li> <li>• cycle sensibly and do not do tricks or cycle too fast on the road</li> <li>• take time to look properly at road junctions</li> <li>• do not enter the road from the pavement e.g. at a pedestrian crossing</li> </ul>
<p>What if?...</p> 	<p><b>What if?...</b></p> <p><b>ACTIVITY</b> – pupils work in pairs and are given a ‘What if?...’ card. Each card has a different scenario for something they may encounter on train journeys e.g. What if... you fall asleep on the train and wake up at the wrong station? Pupils decide how they would handle each scenario and feedback back to the class. <b>TELL</b> pupils that they are very unlikely to experience many of these scenarios!</p> <p><b>Please note that one of these scenarios is about suicide on the railways. Please remove this card (last one in the pack) from this activity if you do not think it is appropriate for your class.</b></p> <p><b>REMEMBER</b> – the different ways their can get help are:</p> <ul style="list-style-type: none"> <li>• At the ticket office</li> <li>• From a Help Point (using either the Information or Emergency buttons)</li> <li>• From a member of staff on the platform</li> <li>• From a member of staff on the train</li> <li>• Social media (e.g. the Twitter feeds of the rail operators give regular updates on delays etc.)</li> <li>• The British Transport Police text number 61016</li> <li>• Or by calling 999</li> </ul>

**Additional activities:**

Design a poster to encourage people to travel by train to cut pollution and minimize their carbon footprint.