

Sustainable Transport

Teaching Pack (Lower Secondary)

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LESSON OUTLINE (Lower Secondary)

Topic: Sustainable Transport in Hong Kong

Target: Lower Secondary (S1 – S3)

Period: Two 40-minute lessons

Subject: Science, Geography, EPA

Links to the following areas of the Hong Kong curriculum for **Science**

Age Group	Unit	Sub- Unit
Secondary 1	Unit 4 Energy	4.3 Fuels
Secondary 1	Unit 4 Energy	4.4 Generating Electricity
Secondary 1	Unit 4 Energy	4.5 Energy Sources and We

Links to the following areas of the Hong Kong syllabus for **Geography**

Age Group	Content Area	Topic
Secondary 1	Living in the Urban Environment	Fixing our Cities' Problems
Secondary 3	Resources and Development	How Clean is our Atmosphere
Secondary 3	Resources and Development	Struggle for Power Resources

Links to the following areas of the Hong Kong curriculum for **EPA**

Age Group	Component	Topic
Secondary 1	The Society	Transportation
Secondary 3	The Society	Pollution

Cross-curricular Links: English Language, Maths.

Learning Objectives:

Knowledge (K)

After the lesson students should be able to:

1. Identify internal and external costs of transport
2. Understand links between transport choices, the environment and our health
3. Understand links between transport and energy use
4. Propose solutions to transport problems
5. Recognise the potential of alternative energy sources
6. Recognise the effects of human activities on the environment

Skills (S)

After the lesson students should develop the following skills:

1. Comparing Advantages and Disadvantages
2. Creativity
3. Critical Thinking
4. Problem Solving
5. Collaboration
6. Civil rights and responsibility

Personal and Social Values/Attitudes (PV)

After the lesson students should be able to develop the following values/attitudes:

1. Caring and Concern
2. Responsibility
3. Respect for the Environment
4. Self reflection
5. Participation
6. Creativity and inventiveness

Advance Preparation – First 40 minute lesson

For a class of 40 students you will need:

1. 40 pamphlets on Sustainable Transport (available for collection from Civic Exchange)
2. A Copy of the CD-ROM PowerPoint presentation (available from Civic Exchange)
3. A computer or laptop computer which is able to run PowerPoint

4. A projector on which to project the PowerPoint presentation.
5. 40 photocopies of worksheets A and B.

Advance Preparation – Second 40 minute lesson; Creation of Solar Cars

In the week prior to the class the children will need to work in teams of 3 to collect various recycled materials with which to create the solar car.

1. For the chassis or car body: milk carton, cardboard, cardboard box, polystyrene lunch box, plastic bottle, aluminium can, kitchen roll holder etc.
2. For the wheels: cardboard, foam, aluminium can, cotton reels, old toy wheels
3. For the axle: satay sticks, pencil
4. To create traction on the wheels: rubber bands, elastoplast
5. For bearings: straws, bolts

The school will need to purchase one solar car kit per group of three students who will work as a team.

Vocabulary

congestion	contribute	convenience	emissions
energy efficient	external	internal	journey
licensing	maintain	pedestrians	pollution
renewable energy	sustainable	tax	transport

Note to ESL Teachers:

To facilitate understanding of vocabulary a 'pre-lesson' tagged on to the end of an earlier class may be helpful. In the 'pre-lesson' give a quick explanation of the topic for the next lesson, then split the class into groups of four. Have each student in the group take responsibility for finding out the meaning of four of the words and explaining these to the rest of the group.

LESSON PLAN (LOWER SECONDARY) FIRST 40 MINUTE LESSON

Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
<p>Motivation</p> <p>15 minutes</p>	<p>Active listening:</p> <ul style="list-style-type: none"> Listen to the presentation and be prepared to answer questions on each section. Ask questions for greater clarity. 	<p>Hand out one pamphlet to each student.</p> <p>Conduct the PowerPoint Presentation</p> <p>Ask students to think about the following issues while watching the PowerPoint presentation:</p> <ul style="list-style-type: none"> What factors affect people's transport choices? What are Internal Costs? What are External Costs? Why should I be concerned about transport? <p>Stop the PowerPoint presentation at appropriate intervals and ask the students questions to enable them to verbally summarise the information given.</p>	<p>Pamphlet</p> <p>PowerPoint presentation</p>	<p>K: 1,2,3,6 S: 3, 6 PV: 1,3,4</p>

Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
<p>Reducing Pollution</p> <p>5 minutes</p>	<p>Students discuss with their partner which vehicles make the most/least roadside air pollution.</p> <p>Students discuss with their partner which vehicles make the most/least noise pollution.</p> <p>Students Complete Worksheet A.</p>	<p>Split class into pairs</p> <p>Hand out worksheet A</p>	<p>40 photocopies of Worksheet A</p>	<p>K: 1,2,6 S: 3,5 PV: 1,4,5</p>
<p>Summary of findings</p> <p>5 minutes</p>	<p>Feedback results</p> <p>The following website containing a research report may be useful as an insight into children's attitudes to sustainable transport:</p> <p>www.scotland.gov.uk/library5/transport/cast-00.asp</p>	<p>Ask students to briefly report back findings.</p> <p>Record separately for both air and noise pollution:</p> <p>How many students had an 8 for cars? How many had an 8 for taxis? How many had an 8 for Buses? And so on.</p> <p>Which is the most polluting vehicle, which is the noisiest vehicle according to the class?</p> <p>Why do these vehicles produce more pollution?</p> <p>Why are they noisier?</p>	<p>Note: The object of the worksheets is to stimulate discussion on which vehicles are perceived to be more polluting. Making an exact assessment of the most polluting vehicle is difficult as it depends on type of fuel used for the vehicle, size of vehicle etc.</p>	<p>K: 1,2,6 S: 3,5 PV: 1,4,5</p>

Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
<p>Making transport systems less polluting.</p> <p>10 minutes</p>	<p>Active listening.</p> <p>Complete worksheet on hub and spoke system.</p>	<p>Explain that electric vehicles produce the least roadside pollution as they receive their energy from electric cables.</p> <p>Electricity generation does produce pollution at power stations (especially CO₂). We will look at ways to reduce this pollution in the next lesson.</p> <p>How can we encourage people to take more environmentally friendly transport?</p> <p>A Hub and Spoke transport network makes it easy for people to access the least polluting (in terms of roadside emissions) form of transport – the train.</p> <p>Have students look at the hub-and-spoke diagram in the centre page.</p> <p>Hand out worksheets on the hub-and-spoke transport network.</p> <p>Ask students to make their own hub-and-spoke diagram using the most eco-friendly transport.</p>	<p>40 photocopies of Worksheet B</p>	<p>K: 2,3,4 S: 1,2,4 PV: 6</p>
<p>Summary</p> <p>5 minutes</p>	<p>Feedback ideas to encourage people to use environmentally friendlier transport.</p>	<p>Ask the class for suggestions as to how we can encourage people to walk, cycle or take the train or tram.</p>		<p>K: 4 S: 3,4 PV: 1,2,5</p>

LESSON PLAN (LOWER SECONDARY) CREATION OF SOLAR POWER CAR SECOND 40 MINUTE LESSON

Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
<p>Creating a vehicle that uses an alternative energy source</p> <p>15 Minutes</p>	<p>Active Listening</p>	<p>Divide students into groups of 3.</p> <p>Explain how solar car kits work. Explain that they are delicate systems and the students must take care of them.</p> <p>Explain the main components of their car:</p> <ul style="list-style-type: none"> • The chassis or body of the car • The wheels • The axis or pole to support the wheels • Bearings to make the wheels move more smoothly <p>Demonstrate the construction of a solar car (using guidelines attached).</p>	<ul style="list-style-type: none"> • Recycled materials to form parts of the car • Solar Car Kit • Sticky tape • Glue • Scissors 	<p>K: 3,5 S: 2,4,5 PV: 5,6</p>
<p>Building a Model Solar Car</p> <p>25 minutes</p>	<p>Work in groups to assemble solar car from the solar car kit provided and the recycled materials they have collected.</p>	<p>Hand out guidelines on the construction of a solar car.</p> <p>Hand out solar kits – one per group of 3 students.</p> <p>Working in their groups of 3, students assemble a solar car.</p>	<ul style="list-style-type: none"> • Recycled materials to form parts of the car • Solar Car Kit • Sticky tape • Glue • Scissors 	<p>K: 3,5,6 S: 2,4,5 PV: 5,6</p>

Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
Enter Inter-School Solar Car Competition 2004	<p>OPTIONAL:</p> <p>Students can work on their car after lesson time and prepare it for entry into the Inter-School Solar Car Competition co-organised by Civic Exchange to take place in November 2004</p>		<ul style="list-style-type: none"> • Solar Car 	<p>K: 3,5,6 S: 2,4,5 PV: 5,6</p>

FOLLOW-UP ACTIVITIES








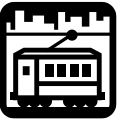
Teaching Point Timing	Student's Activity	Teacher's Activity	Resources	Objectives Check
Design Skills	<p>Refine the design of their group solar car so that it moves as fast as possible.</p> <p>Race your car!</p>	<p>Arrange an in-school solar car race.</p> <p>Select a site paying careful attention to the passage of the sun on the site and the evenness of the surface.</p>	<p>A hard surface for the race Consistent sunlight (no shade) Chalk to draw lanes Stopwatches</p>	
Transport Survey	<p>Design a questionnaire to assess modes of transport used by students within the school and why those modes of transport are used.</p> <p>Conduct the questionnaire amongst students from different classes.</p> <p>Participate in class discussion on encouraging students to take environmentally friendlier forms of transport to school.</p> <p>Design a sustainable transport action plan for the school.</p>	<p>Have the students design a questionnaire to assess modes of transport used by students within the school and why those modes of transport are used.</p> <p>Use the results of the survey as a discussion point for students to discuss how we can encourage people to take environmentally friendlier forms of transport to school.</p> <p>Have the students design a sustainable transport action plan for the school.</p>		<p>K: 1,4 S: 1,2,5,6 PV: 1,2,3</p>

Name: _____

Worksheet A - Secondary

Which forms of transport generate the most roadside pollution?

1. Number the vehicles 1 to 8 (with 8 the greatest) to show which creates the most air pollution. Fill out the statement at the bottom of the worksheet.
2. Number the vehicles 1 to 8 (with 8 the greatest) to show which creates the most noise pollution. Fill out the statement at the bottom of the worksheet.

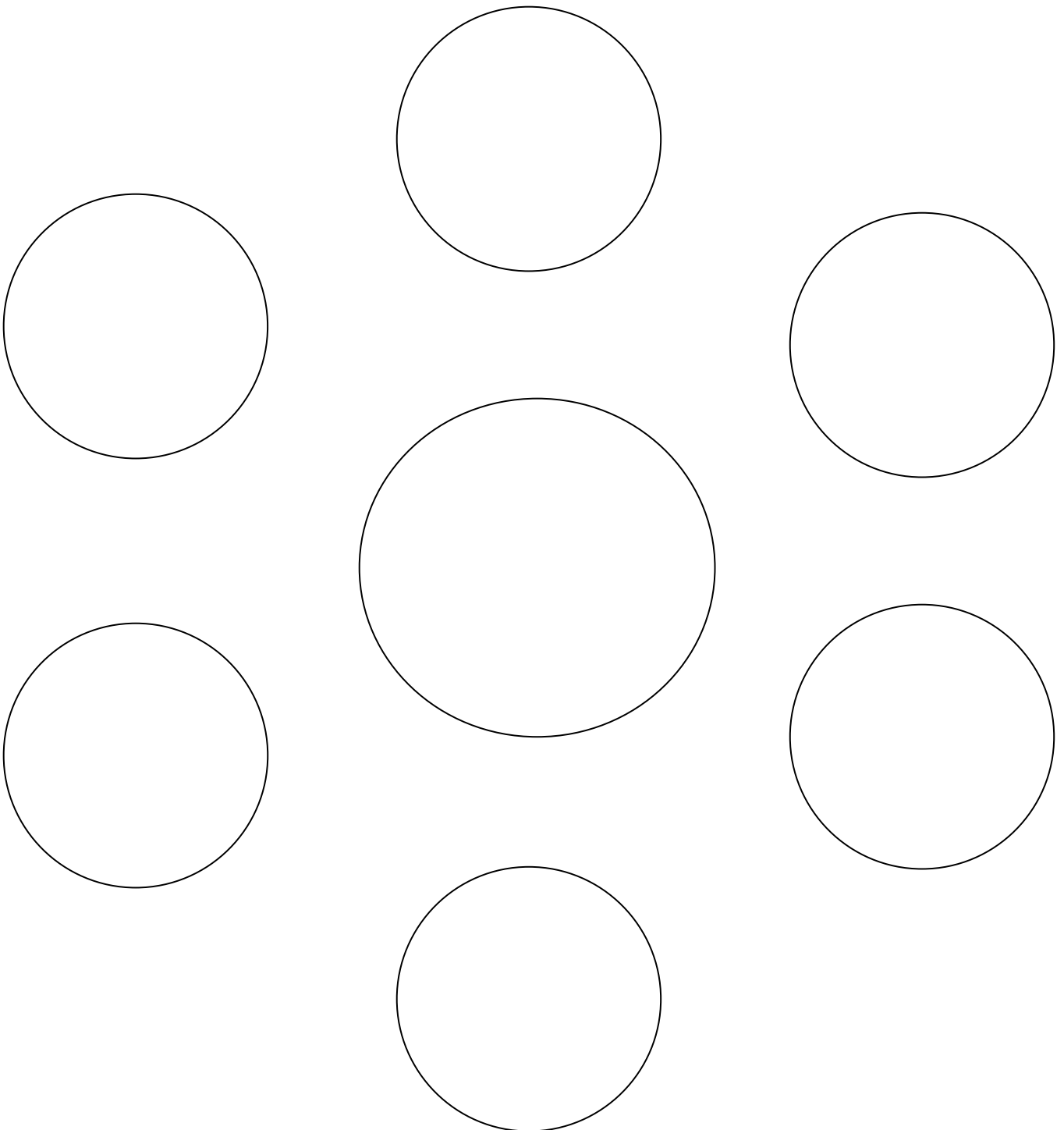
<p>Car</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>	<p>Taxi</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>
<p>Double-Decker Bus</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>	<p>Mini Bus</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>
<p>Lorry</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>	<p>Van</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>
<p>MTR and KCR</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>	<p>Tram</p>  <p>Air Pollution <input type="text"/></p> <p>Noise Pollution <input type="text"/></p>

_____ produces the most air pollution because _____

_____ produces the most noise pollution because _____

Name: _____

Worksheet B - Secondary



Guidelines for Creating a Solar Car

1. Attach the axle bearings (axle holders) to the chassis (main body of the car) You want the holders to be parallel and running straight ahead
2. Select an axle and two wheels. Insert the axle into the bearings. Add the tubing (in-line shaft retainers that keep the wheel from rubbing against the body) onto each end of the axle.
3. Add the wheels to the axle
4. Take the other axle and two wheels and repeat step 2 and 3.
5. Create traction on the back wheels by wrapping Elastoplast or cloth around them.
6. Use the elastic band as a drive band and loop this around one of the back wheels and the motor pulley. Position the motor on the chassis so that the elastic band is not too tight and not too loose and attach with glue or tape.
7. Attach the solar panel.

Useful Website Addresses

Hong Kong

Hong Kong Government

Education & Manpower Bureau:	http://resources.emb.gov.hk/envir-ed/e_index.htm
Environmental Protection Department:	www.epd.gov.hk
Transport Department	www.info.gov.hk/td/
Environmental Campaign Committee	www.ecc.org.hk/ebody.htm

Hong Kong NGOs

Civic Exchange	www.civic-exchange.org
Business Environment Council	www.bec.org.hk
The Conservancy Association	www.conservancy.org.hk
Friends of the Earth Hong Kong	www.foe.org.hk/
Greenpeace China	www.gpchina.org/
Green Power	www.greenpower.org.hk
Hong Kong Marine Conservation Society	www.hkmcs.org
Hong Kong Sustainable Communications Assoc	www.hksca.org
Worldwide Fund for Nature	www.wwf.org.hk

Solar and Wind Power in Hong Kong

Hong Kong Photovoltaic Consortium	http://thegreenroom.arch.hku.hk/index.htm
Wind Sun Limited	www.windsun.com.hk

International

Sustainable Transport

Young Transnet	www.youngtransnet.org.uk/main/home.htm
Sustrans	www.saferoutestoschools.org.uk/index.php
Department of Energy National Junior Solar Sprint	www.nrel.gov/education/student/natjss.html

Sustainable Energy

Centre for Sustainable Energy	www.cse.org.uk/
Energy Sources	www.darvill.clara.net/altenerg/index.htm
Energy Resources	www.energex.com.au/switched_on/index.asp
Planet Energy	www.dti.gov.uk/energy/renewables/ed_pack/index.html

Hydro Power

www.fwee.org/education.html

Solar Power

www.sunwindsolar.com/a_scripts/n_lessons.php
www.energyquest.ca.gov/projects/#solar
www.energex.com.au/switched_on/activities/photovoltaic/photovoltaic.html



Environmental

Taiwan Environmental Protection Agency
EPA Office of Transportation and Air Quality
US Dept of Energy
US Environmental Protection Agency
Natural Resources Defense Council
Explorer's Club

www.epa.gov.tw
www.epa.gov/OMSWWW/
www.eren.doe.gov/buildings/highperformance/
www.epa.gov
www.nrdc.org/air/pollution/default.asp
www.epa.gov/kids/ask.htm

If students have an environmental question, they can visit this Web site--sponsored by the Environmental Protection Agency--and have their questions answered within 15 days.

Research

Children's Attitudes to Sustainable Transport:

www.scotland.gov.uk/library5/transport/cast-00.asp