Adapting to Climate Change

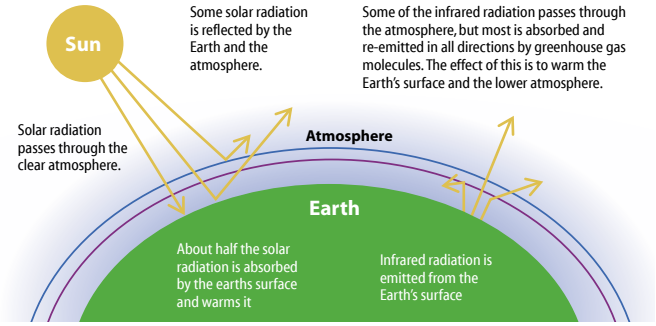
Level 6 Activities – SOLUTIONS

L6A1 Understanding Climate Change

1. This starter activity is aimed at identifying what students already know about the concept of climate change. With a five minute time frame they will really need to focus to get as much down as possible. Expect a range of terms and ideas, eg. greenhouse gases, carbon dioxide, global warming as well as potential consequences. At the end of the activity students take it in turns sharing their team's responses. This will set a backdrop of knowledge and understanding upon which this topic will be further developed.

2. The greenhouse effect refers to particles such as greenhouse gases, in the atmosphere absorbing solar radiation and retaining heat energy. Some of the solar radiation is reflected back to space, but some particles re-emit the sun's radiation, further warming the atmosphere. These gases act a like a blanket keeping the atmosphere warm.

3a. Current carbon dioxide concentrations in our atmosphere are at far greater concentrations than occur naturally. This is mostly due to human activity such as burning fossil fuels. It is a problem because higher carbon dioxide levels are linked to higher atmospheric temperatures, which in turn alter the global climatic patterns. Changes in climate will change the conditions for living things.



b. The 'natural greenhouse effect' refers to the absorption and retention of solar radiation by particles naturally present in the atmosphere (greenhouse gases) that keep the atmosphere warm. The 'enhanced greenhouse effect' refers to the further increase in atmospheric warming due to the increased concentration of greenhouse gases caused by human activity.

c. Current carbon dioxide concentrations in our atmosphere are at far greater concentrations than occur naturally. This is mostly due to human activity such as burning fossil fuels. It is a problem because higher carbon dioxide levels are linked to higher atmospheric temperatures, which in turn alter global climatic patterns. Changes in climate will change the conditions for living things.

d. A variety of responses will be acceptable. Some examples are set out in the table.

Human Activity	Impact of factor
1. Burning fossil fuels for industry, transport, electricity	Burning fossil fuels increases the concentration of greenhouse gases such as carbon dioxide into the atmosphere. These gases absorb and retain solar radiation contributing to an increase in global atmospheric temperatures.
2. Use of chlorofluorcarbons as propellants	Chlorofluorocarbons are greenhouse gases that absorb and retain solar radiation. The higher their concentration in the atmosphere, the greater the contribution to global warming.
3. Use of fertilizers in agriculture	Nitrogen-based fertilizers can release nitrous oxide gas which is a greenhouse gas. The higher its concentration in the atmosphere, the greater the contribution to global warming.

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L6A2 Climate Change – The Movie

1. Evidence that climate change is occurring includes global warming over past century and data that shows the past decade as the warmest on record since 1850.

2. Dr. Pearman attributes the climate to change to the activity of humans.

3. Increased greenhouse gas levels caused by human activities including

- Land use change
- Agriculture
- Burning fossil fuels

4.

Human activity	**a. Contribution to increased greenhouse effect**	**b. Alternatives**
Burning fossil fuels to generate electricity	When fossil fuels are burned they release carbon dioxide gas into the atmosphere. Carbon dioxide is a greenhouse gas, absorbing and retaining solar radiation. The higher the concentration of this gas in the atmosphere the greater the contribution to global warming.	Electricity can be generated using · Wind power · Solar energy · Tidal energy
Farming cattle	Cattle produce methane gas (flatulence). Methane is a greenhouse gas. The more cattle, the greater the methane output and the greater the contribution to global warming.	Alter dietary balance to include more vegetables & less meat Farm animals that are less likely to produce methane gas, eg. more chickens, more fish
Clearing forests	Through photosynthesis green plants, including trees, recycle carbon dioxide and return oxygen to the air. When we clear large areas of forest we reduce the number of trees available for this recycling. The less trees the more carbon dioxide remains in the atmosphere.	Plan cities that require less land, eg. buildings with smaller footprint but multiple storeys. Increase reforestation programs.

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L6A3 Climate Change – The Movie Part II

1.

Factor affected	Impact of climate change
• Less resilient species of plants & animals	Less likely to survive, increased risk of extinction – reduced biodiversity.
• More resilient species of plants & animals	Increased chance of surviving, perhaps in alternative environments, so less likely to become extinct.
• Agriculture/livestock	Crops more susceptible to presence of new weeds and pests so less successful; farmers may need to change what they grow.
• Farming of livestock	Increased risk of animal diseases; farmers may need to change from one kind of livestock to another or change to crop farming or farming may not be viable.
• Coastal cities, towns, communities	Increased global temperatures means icecaps will melt and sea-levels will rise. Significant impact on coastal communities as land will be claimed by the sea and communities will have to retreat – less land for more people.
• Older people & people with disabilities & chronic illnesses	Higher risk of increased ill health and/or lack of ability to cope with higher temperatures – increased risk of overheating. Often these are the disadvantaged in the community, living in poor quality housing that is not equipped to keep them cool.

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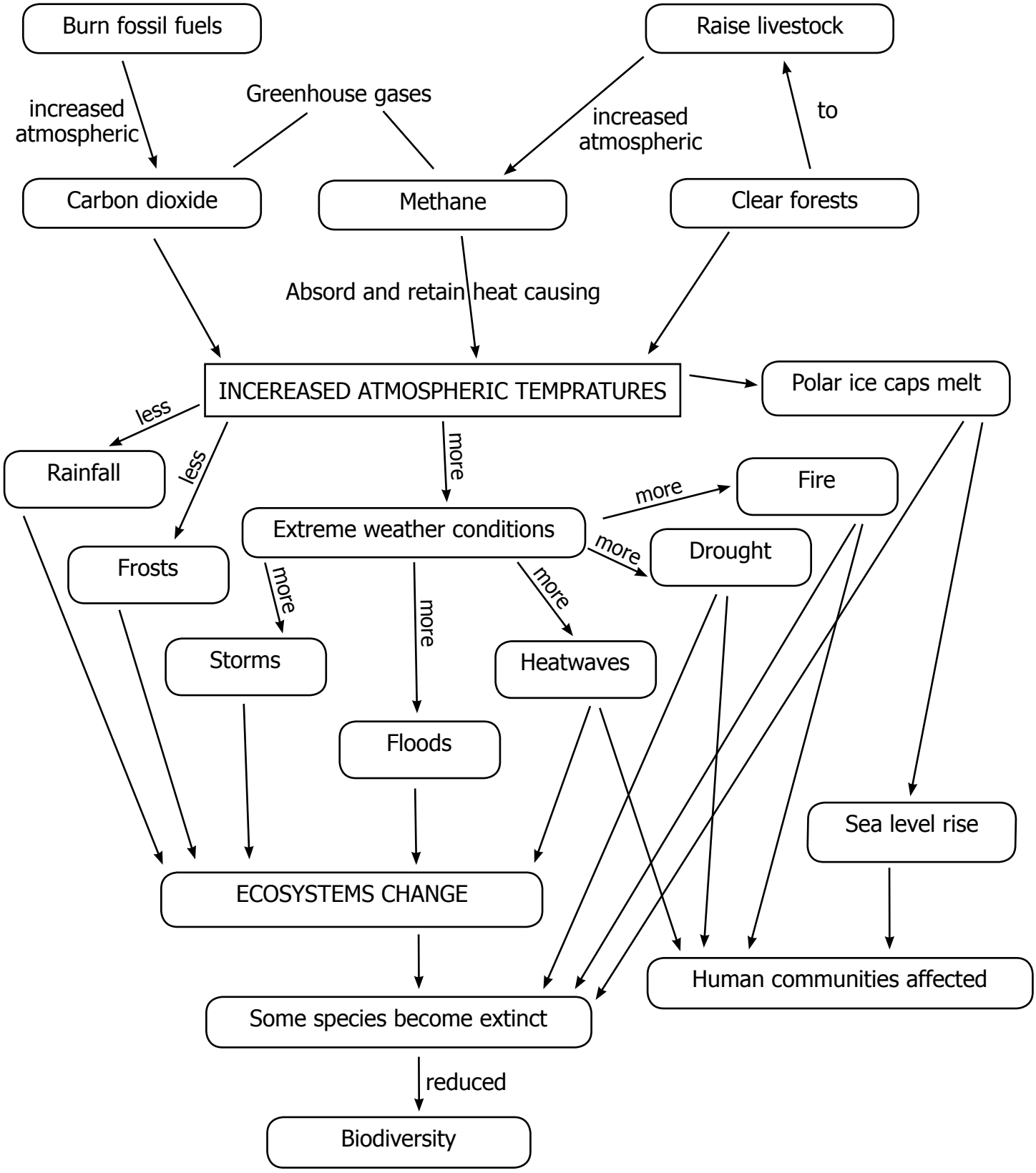
2.



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3. Students will select from a wide range of options identified in the concept maps. Any logical responses are acceptable. Examples might include:

Burning of fossil fuels – we could reduce this cause by using alternative sources of fuel for example to heat our homes, eg. solar power; would reduce the impact of the initial cause and make little/no difference to our lifestyle/comfort because we're still able to heat our homes; there are initial set up costs, but these would be offset by future savings on power bills.

Fire – people in high bushfire risk areas will be on high alert in summer but can be prepared by building homes using fire-resistant materials, installing water tanks, power generators and possibly even fire shelters/bunkers. Clearing the areas close to their homes will also reduce their fire risk. In these ways people can maintain a country lifestyle with relative safety.

L6A4 A Scientific Stock Take

1. **Sources:** refers to sources of greenhouse gas emissions.

Examples: burning fossil fuels, methane produced by livestock

Sinks: refers to repositories for greenhouse gases when removed from the atmosphere

Examples: fixed by trees/plants during photosynthesis

2. There has been an overall significant increase in greenhouse gas emissions for Victoria, with a small decrease between 2006 & 2007.

3. Victoria's greenhouse gas emissions increased by around 22 megatonnes per year between 1994 and 2004.

4a. Net greenhouse emissions between 1990 and 2007 is about 13 megatonnes (119Mt – 106Mt).

b. Reasonable responses acceptable here. Could include changes to land use, less land cleared (actual principal reason); more efficient transport or changes to transport use; changes in agriculture.

5a. Energy industries have had a sharp and significant rise in greenhouse gas emissions over the period, with emissions leveling off from about 2004. Overall increase of about 19Mt per year.

b. Transport industries rose steadily over the same period, peaking in 2004 and then declining. Net greenhouse emissions 3Mt per year.

(note scale difference for these two graphs)

6. While student responses will vary, expected answers will reflect a lack of sustainability into the future at this rate of greenhouse emissions with clear need to change the way we generate energy and transport people and goods.

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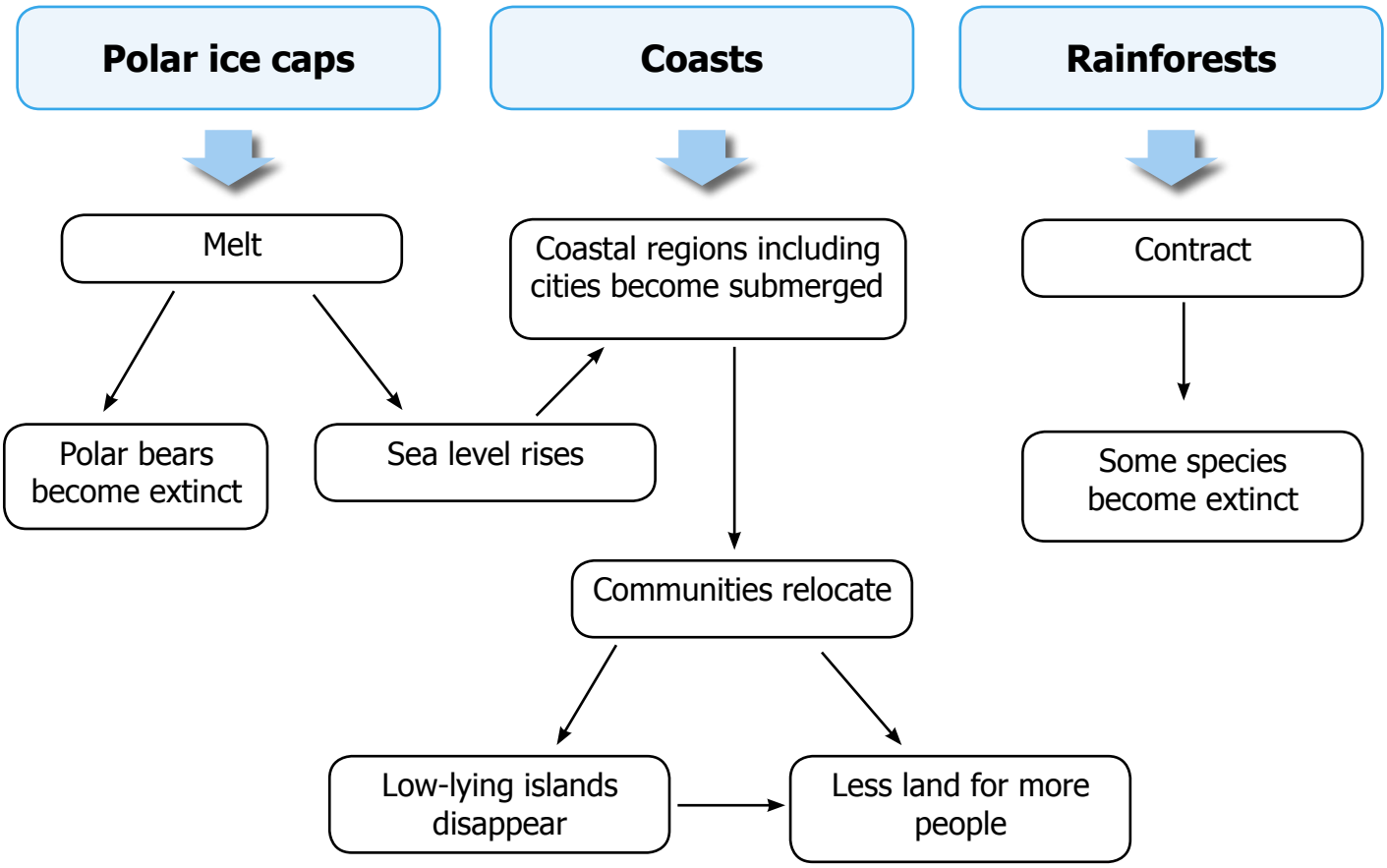
L6A5 No room for complacency!

1. Individual student responses will vary for all parts of this item.

2.



3. Individual responses will vary. Students should be guided by their responses to **1c**, where they have identified key activities contributing to greenhouse gas emissions – this will provide direction about changing behavior aimed at reducing emissions.

Other benefits for families might include lower electricity bills related to reduced usage, lower water bills if having shorter showers due to less power used to heat.

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L6A6 Taking stock!

1. Students can select from a wide range of actions available directly from the website. Some suggestions include:

Action	Cost	Benefit
Have shorter showers Wash clothing in cold water	Small inconvenience None	Conserve water Lower water bill Reduce greenhouse gas emissions
Buy a fuel-efficient car Comparisons available on Green Vehicle Guide	Usually the cost of cheaper car	Smaller cars cost less to purchase, fuel and maintain Reduced greenhouse gas emissions
Check the temperature of your home by setting the central heating at 18 – 20°C in winter & no less than 25°C in summer	None	Reduced energy usage & reduce electricity bill Reduced greenhouse emissions
Draught-proof your home - make sure your home is insulated Keep doors closed	Cost of insulation	Home more effective at keeping constant temperature Reduces need for heaters & air conditioners so reduced running costs Reduced greenhouse emissions
Stop losing stand-by power by turning off appliances when not in use	None	Reduced running costs Reduced greenhouse emissions
Switch to Green Power by registering with your electricity provider to use wind, solar, hydro for electricity generation	Small additional cost	Significant reduction in greenhouse gas emissions
Use compact fluorescent light bulbs Turn lights off when not in use	Increased cost for light bulbs	Light bulbs last much longer & are more energy efficient Reduced cost electricity bill Reduced greenhouse emissions
Choose energy efficient appliances - buy electrical appliances that display energy star rating labels	May cost a little more	Cheaper running costs so lower electricity bill Reduced greenhouse emissions
Reduce waste by composting, recycling, bulk buying	None	Reduce household waste Reduce landfill Buying in bulk offers long term savings
Take public transport, car-pool, walk or cycle to school	Cost of a ticket Shared running costs for car-pooling	Reduced costs for running/maintaining car Reduced greenhouse emissions from less cars on the road Get fitter

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2a. The more stars an appliance displays the more energy-efficient it is.

b. Because appliances with higher star ratings are more energy-efficient they cost less to run, so the electricity bill be less when these appliances are used compared to items with less or no stars. The environment benefits when we use these appliances above others because less electricity is used to run them. This in turn means less greenhouse gases are produced.

L6A7 Conferring on Climate Change

1. A range of reasonable responses will be acceptable so long as they are focused on the topic. Some examples of issues that might be raised are listed below.

- Previous generations have made the greatest contributions to climate change but this generation will have to live with its consequences. What will the government do to help?
- What changes can we make to slow down/stop global warming?
- Who pays for climate change? How?
- Can we stop or reverse climate change?
- Can we expect a climate change tax? How would it be used?
- What will happen to coastal communities when sea levels rise?
- What impact will this have on other communities? Can we expect greater population density?
- How are increases in population density likely to affect communities? Eg. increase in crime rate?
- How can this be managed/deterred?
- How can we slow down/stop the extinction of animals such as the polar bear while polar ice caps are melting?
- Elderly and chronically ill people are at greater risk – what will the government be doing to accommodate their needs? Who will pay for this?
- What affect is climate change likely to have on Australian species of plants and animals already endangered if ecosystems undergo significant change?
- Extreme weather events are likely to be more frequent as a result of climate change. Will the government foot the bill or help communities devastated by fire, flood and storm?
- What impact will climate change have on government regulations related to building homes and planning cities?
- Will the government mandate electricity providers to use only renewable energy? When?

L6A8 The future is in your hands!

1. A range of answers will be acceptable here as there are many different facts that students can record. It will be useful to share student responses at the conclusion of the exercise.

2. A range of responses is acceptable here as well. This is an important item to finish off with sharing of responses as it consolidates the big and small ways in which students, their families, their communities and the school can change the way we do things for a more sustainable future.

3. This final activity gives students an opportunity to reflect on the many themes encountered in this unit and how it is likely to affect each student in their daily lives. Time to think and write will be important to help students identify some ways in which they can change the way they do things for a better future for our planet, and to act on it.

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