Air Pollution and its Consequences on Human Health

Society, Ecology, and Natural Resources Education Collective – SEN

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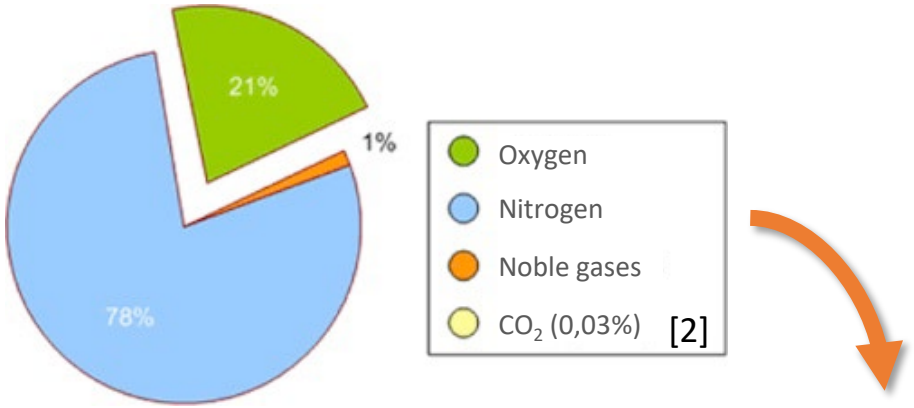
1. Air and its Characteristics



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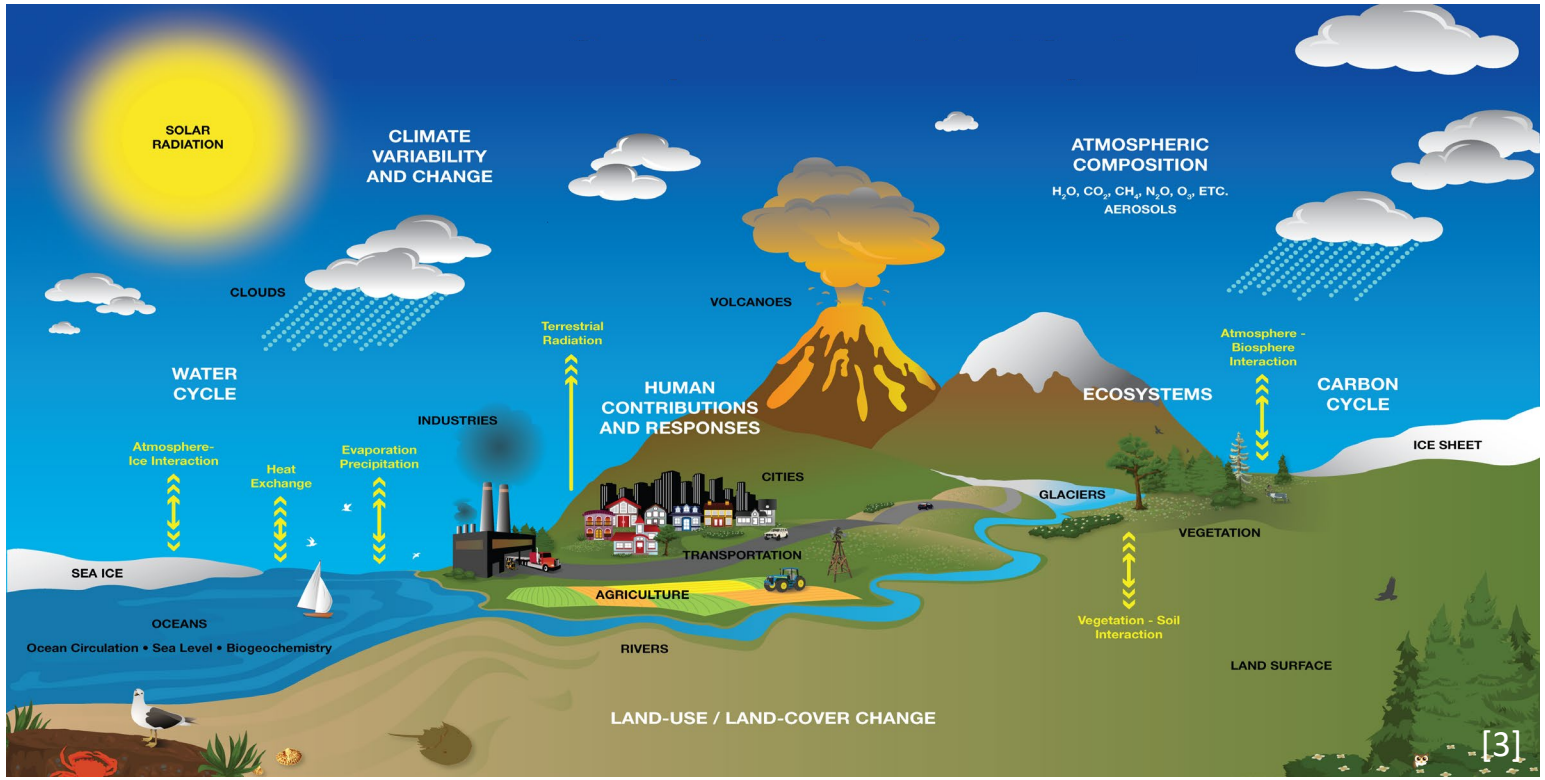

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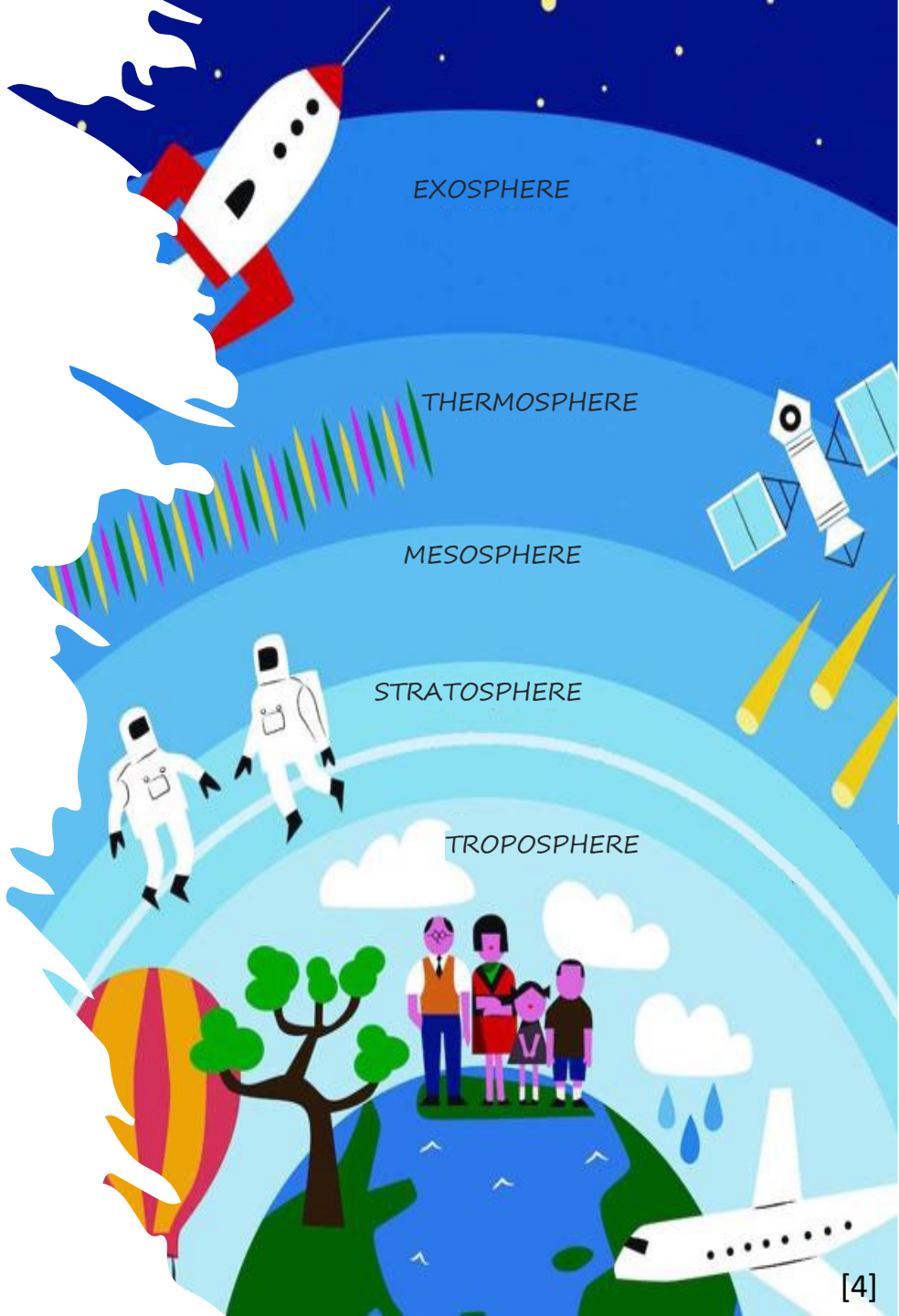

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2. Activity 1: Air is a Substance

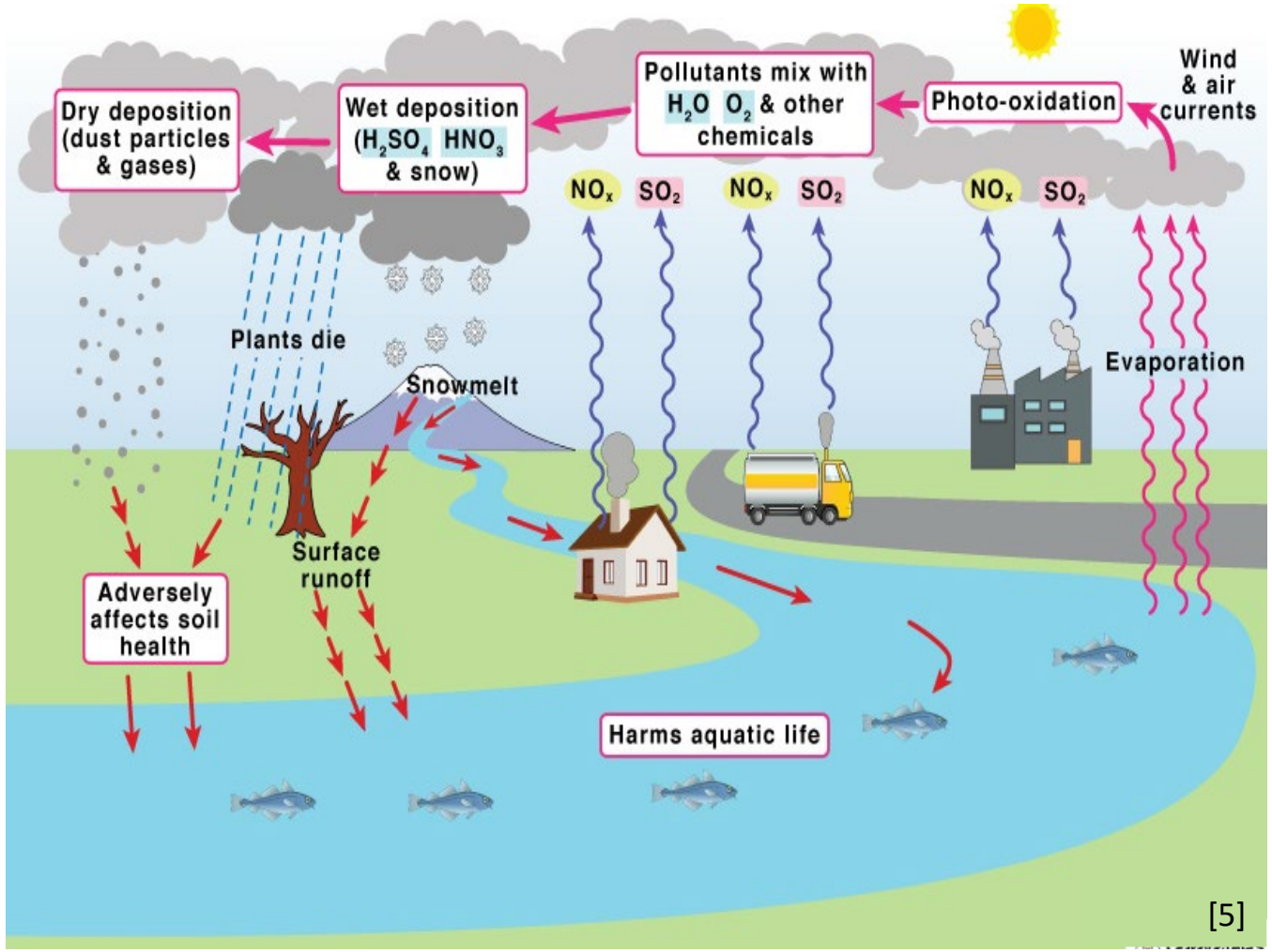
Objective

To demonstrate that air is a substance, even though we cannot see it.

	Part 1 – Teacher	Part 2 – Student
Materials	- 1 plastic bottle for the teacher - Paper	- 2 plastic cups per student - 1 straw per student - Water
Procedure	1. Place the bottle horizontally in front of the face 2. Put a small piece of paper in the bottle's mouth 3. Blow attempting to put the ball in the bottle	1. Fill one of the cups with water 2. Place your finger over one of the openings in the straw and place the other end in the water 3. Remove your finger from the opening. Put the straw back into the water and cover its end with your finger 4. Pick up the straw and place it on the empty glass
Questions	Will I be able to put the paper ball inside the bottle with one blow? Why doesn't the ball go into the bottle?	During step 2: Why doesn't the water go into the straw? At the end: Why does the water enter the straw? Why does the water flow once you lift your finger from the opening?

3. Air pollutants

Effects on the Environment



Air pollution is a mixture of dangerous substances of human (combustion vehicles) and natural (volcanic eruptions) origin.

Air pollution is the main cause of acid rain (rain that is more acidic than it should be, affecting soils and water).

When something is burned (e.g., fossil fuels like coal), chemicals and particles are released into the air, which combined with moisture form acid rain.

Effects on Human Health

Adverse effects in the respiratory system

Contaminant	Short term effect	Long term effect
"Respirable" particulate matter (PM_{10}) and fine ($PM_{2.5}$)	Increased respiratory morbidity and mortality Decrease in lung function Interference in lung defense mechanisms: phagocytosis and mucociliary clearance Obstructive bronchial syndrome	Decreased development of the structure and function of the respiratory system Increased risk of cancer in adulthood (PAHs)
Ultrafine particulate ($O_{0.1}$)	Greater inflammatory response (compared to PM_{10} and $PM_{2.5}$) Rapid passage to the circulation and other organs	
Ozone (O_3)	Decreased respiratory rate and decreased FVC and FEV_1 Neutrophilic alveolitis, increased permeability and bronchial hyperreactivity Alteration of the alveolar epithelium (type II cells)	Epithelial cell damage, alveolar "bronchiolization“ Decreased development of FVC and FEV_1
Sulfur dioxide (SO_2)	Bronchial obstruction Bronchial hypersecretion	Chronic bronchitis
Nitrogen dioxide (NO_3)	Bronchial hyperreactivity Increased respiratory symptoms and exacerbations Increases response to allergen challenge Decreased mucociliary activity	Possible decreased lung development
Carbon monoxide (CO)	Decreased exercise capacity	
Lead (Pb)	Alteration of the bronchiolar epithelium (Clara cells)	

Non-respiratory effects

Organs/Systems	Contaminants	Effects
Cardiovascular	Particulate matter	Decreased heart rate variability under stress
	Carbon monoxide	Interferes with O_2 transport by hemoglobin
	Lead/Vanadium	Increased frequency of arterial hypertension in the adult population
	Ozone (O_3)	Ventricular Septal Defect (Antenatal Administration in Rats)
Maternal-fetal unit	Carbon monoxide and $PM_{2.5}$ (Polycyclic Aromatic Hydrocarbons: PAHs)	Low birth weight Low height at birth
Central and autonomic nervous system	Carbon monoxide	Headache, irritability, decreased auditory and visual perception. Progressive and lethal compromise of consciousness in high concentrations
	Lead	Hyperkinesia, learning disorders; encephalopathy; intestinal colic
	Ozone (O_3)	Cerebellar Purkinje Cell Damage (prenatally administered to rats)
Renal	Cadmium and Vanadium	kidney toxicity
	Lead	Tubulopathy
Hematopoietic	Lead	Anemia
Osseous	Lead	Ca^{+2} replacement in the bones producing decalcification

FVC: forced vital capacity; FEV_1 : Forced expiratory volume in the first second. PAHs: polycyclic aromatic hydrocarbons.

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4. Activity 2: Breathe, Breathe


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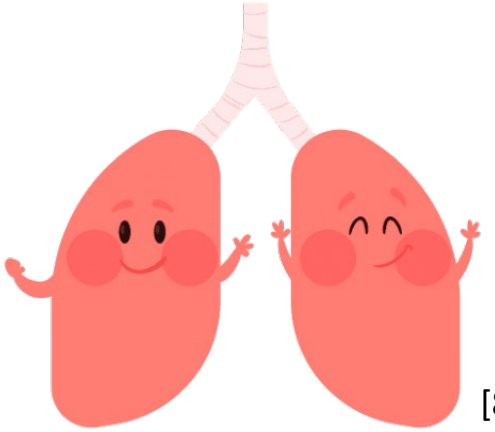
Objective

To teach students the effects that respiratory diseases such as asthma have on the human body.

Materials

1 straw per student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Process

1. Place the straw in the mouth and breathe through it for 30 seconds (discuss the experience).
2. Jump without the straw in the mouth for 1 minute
3. Quickly place the straw in your mouth and breathe through your mouth for 30 seconds (again, discuss and compare this situation with the original)
4. Repeat the physical activity for 1 minute, but with the straw in your mouth and breathing through your mouth
5. Breathe through the straw once the physical activity is finished. (Again, discuss what the experience was like and compare it to the original activity)

5. References

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Thematic content sources in the Documents Lesson Plan and Activity.