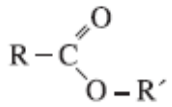
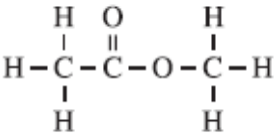
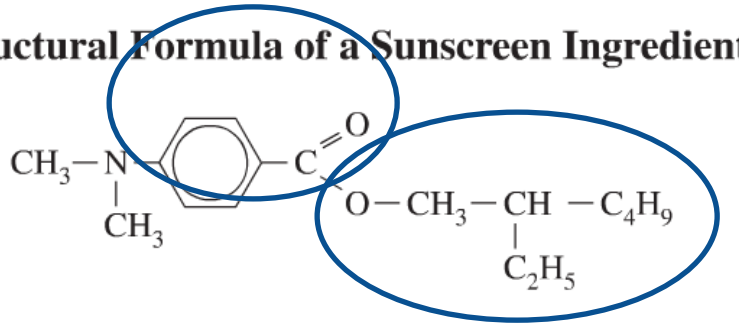
	ester		methyl ethanoate

Sample Diploma Problems

Use the following information to answer the question 13.

Structural Formula of a Sunscreen Ingredient

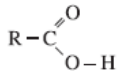
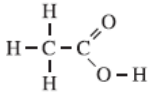
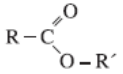
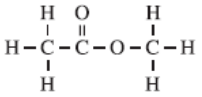
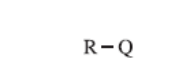
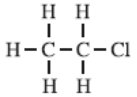


2 "R" groups

13. The structural formula above shows that the ingredient can be classified as

A. an ester
B. an alcohol
C. a carboxylic acid
D. a halogenated hydrocarbon

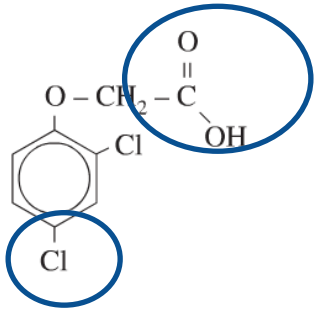
Sample

	carboxylic acid		ethanoic acid
	ester		methyl ethanoate
	halogenated hydrocarbon		chloroethane

Use the following information to answer question 14.

Pesticides can be complex organic compounds that contain a variety of functional groups.

Phenoxy Herbicide



Carboxylic acid

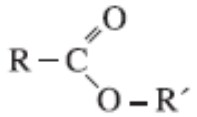
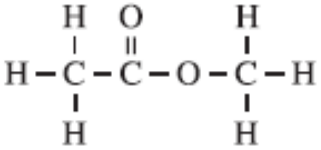
14. Phenoxy herbicide has the same functional groups as

A. an ester and an alcohol

B. an ester and a carboxylic acid

C. a halogenated organic compound and an alcohol

D. a halogenated organic compound and a carboxylic acid

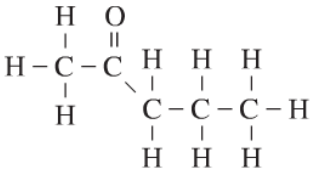
	ester		methyl ethanoate

Sample Diploma Problems

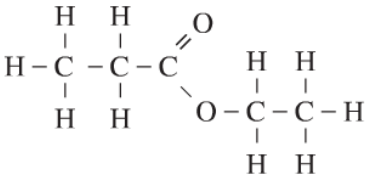
Two Possible Esterification Reactants

15. The ester that would be produced by the reactants represented above is

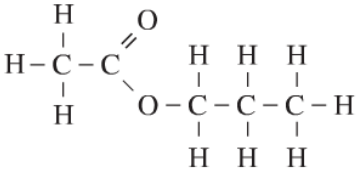
A.



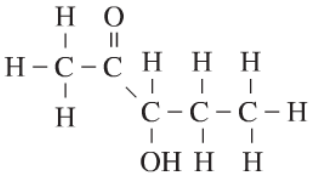
B.



C.

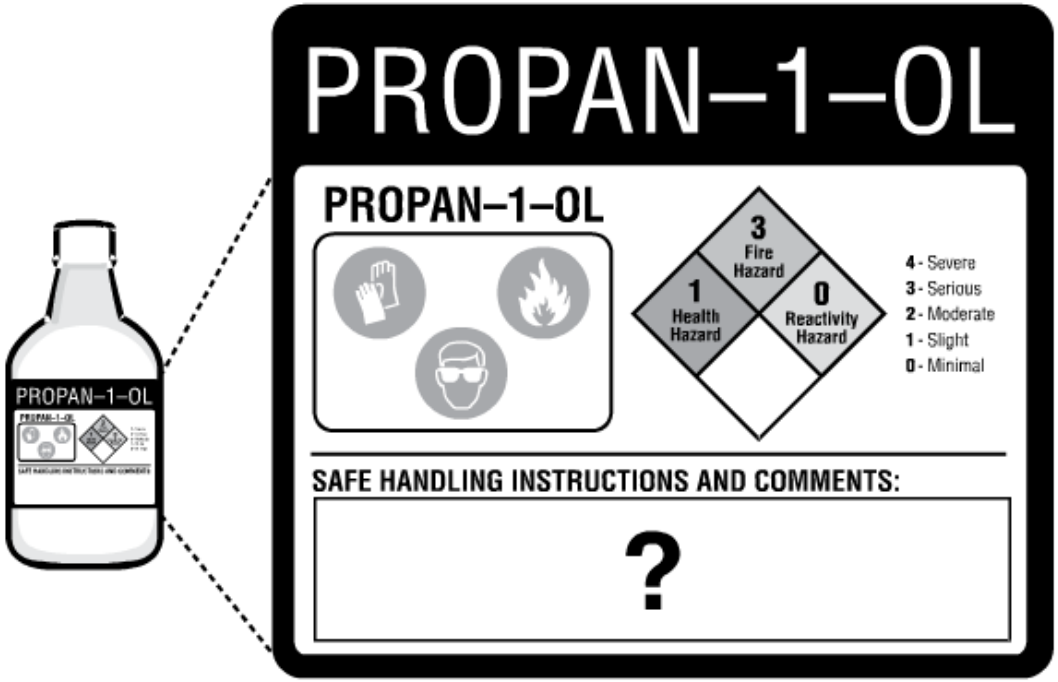


D.



Use the following information to answer question 24.

While handling a container of propan-1-ol, a student read the following label on the container.



24. Which of the following boxes correctly identifies the safe-handling instructions and comments **most likely** found on a container of propan-1-ol?

A.

- Highly corrosive
- May cause skin irritation

B.

- Highly flammable
- May cause skin irritation

C.

- Highly corrosive
- Dangerously reactive and unstable chemical

D.

- Highly flammable
- Dangerously reactive and unstable chemical

Understanding Exposure

Curriculum

- identify organic compounds commonly considered to be environmental pollutants; i.e., hydrocarbons, organic waste, CFCs, polychlorinated biphenyls (PCBs), dioxins and furans
- list the sources of, and analyze the hazards posed by, halogenated hydrocarbons and benzene derivatives
- identify and explain how human activities and natural events contribute to the production of photochemical smog, the depletion of the ozone layer and increased concentrations of organic compounds in the environment;

Curriculum

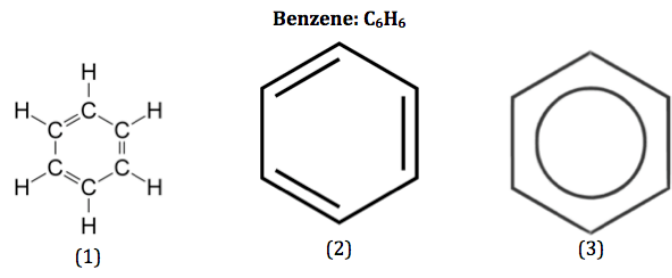
- explain how the introduction of environmental contaminants, i.e., herbicides, pesticides, dichlorodiphenyltrichloroethane (DDT), CFCs, $SO_2(g)$, $CO_2(g)$, particularly persistent organic pollutants (POPs), affects living systems globally
- describe the risks and benefits of using chemical processes that may produce products and/or by-products that have the potential to harm the environment
- describe alternatives to the use of chemical technologies;

Review

	Source	Environmental Effect
CO_2	combustion	Enhanced green house gas
SO_2	Burning coal	Acid rain
NOx	Car exhaust	Acid rain Photochemical fog

Persistent Organic Pollutants

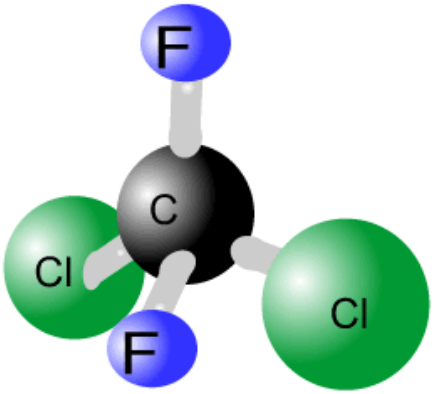
- **POPs (persistent organic pollutants)** are a category of organic substances that are not easily broken down
- They remain in the environment for a long period of time and cause adverse affects on humans and animals



Benzene

- Benzene used to be a common organic compound in gasoline
- It was later found to be a **carcinogen**, a cancer causing agent, and so government took action to reduce its concentrations
- If gasoline leaks from an underground storage tank, it can leach into water and can seriously threaten the health of humans and animals
- Because benzene is so stable, they have a harder time being broken down and are labeled as **POPs (persistent organic pollutants)**

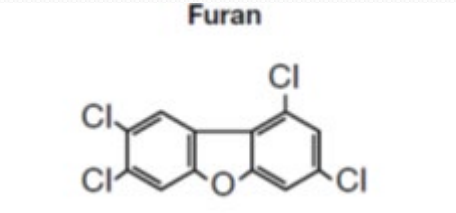
CFCs (Chlorofluorocarbon)

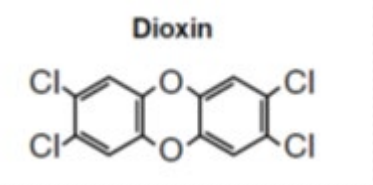


- **CFCs** are halogenated hydrocarbons
- **The ozone layer** ($O_{3(g)}$) is a layer in the stratosphere that protects us against dangerous UV radiation
- CFCs were a common substance found in aerosols and refrigerants since the 1930s
- CFCs disrupt the natural ozone cycle which then exposes organisms on the surface to higher levels of dangerous UV radiation

Dioxins and furans

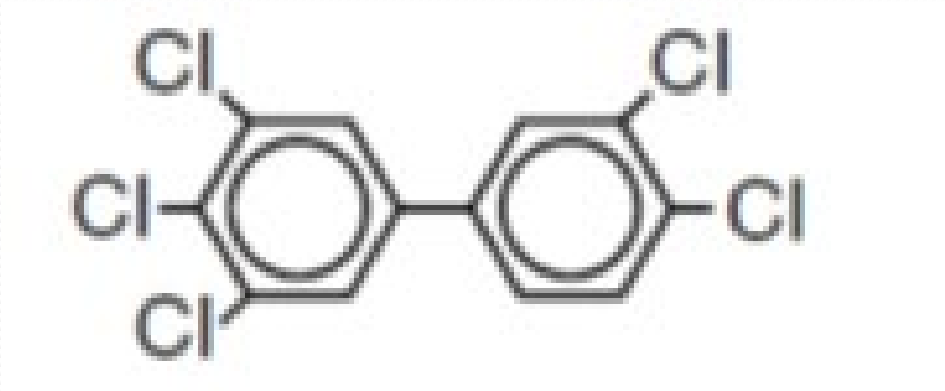
- **Dioxins and furans** are a byproduct of manufacturing things like PVC pipe, bleaching paper, manufacturing pesticides
- If humans are exposed short term it can cause lesions
- Long term it can cause cancer





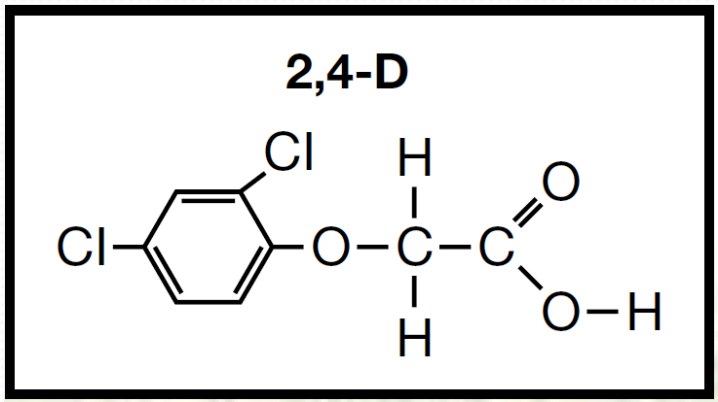
Polychlorinated Biphenyls

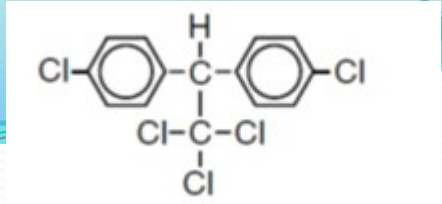
- **Polychlorinated Biphenyls or PCBs** are man made organic compounds used in *electrical equipment*
- Their non flammable and very stable which makes them great insulators
- They can cause cancer and affect immune systems and nervous systems



Pesticides

- Different pesticides have different **target specificity**, meaning how specific the thing they have to kill is
- Some will be very broad and kill everything (roundup) and some have a very specific type of species they kill
- 2,4-D is a herbicide used on lawns to kill dandelions and clover, but leave your grass unaffected





Dichlorodiphenyltrichoroethane

- Dichlorodiphenyltrichoroethane or **DDT** is used for mosquito control
- Banned in 2001
- Can cause cancer and infertility

Fertilizers

- Fertilizers give crops nitrogen, phosphorus, and potassium they need to grow and thrive
- Overuse of fertilizers leads them to run off into streams and bodies of water
- This can lead to **algae blooms**
- How do algae blooms kill a lake?

- **Biochemical oxygen demand (BOD)** is a test that shows effects of organic matter sample will have on dissolved oxygen content

LD50 and LC50

- Toxins such as pesticides can end up in lakes and rivers
- Scientists measure how toxic a substance is by using **LD50**
- LD stands for lethal dose and 50 is for 50% of test animals die
- **LC50** stands to lethal concentration

Material	What the heck is it?	LD50 (mg/kg)*	toxic category**
water	You know this one.	90000	practically non-toxic
sucrose	...and this one. Refined from sugar cane or sugar beets	30000	practically non-toxic
citric acid	A chemical in citrus fruits (lemons, oranges, etc)	12000	slightly toxic
ethanol (component in many bevvies)	Hic!	7000	slightly toxic
sodium bicarbonate (baking soda)	One word: Biscuits	4220	moderately toxic
sodium chloride (table salt)	Not too much now...	3000	moderately toxic
caffeine	Gasp. See *italicized* comment on chocolate^	192	very toxic
DDT	Tasteless and almost odorless chemical known for its insecticidal properties. Was used in WWII to control malaria and typhus.	113-800	very toxic
Nicotine	A potent alkaloid found in the nightshade family of plants (Solanaceae) and a stimulant drug and a major contributing factor to the dependence-forming properties of tobacco smoking.	50	extremely toxic
cyanide	Cyanides are produced by certain bacteria, fungi, and algae and are found in a number of plants - used in mining, industrial organic chemistry and for pest control.	10	extremely toxic
vitamin D	Vitamin D toxicity can occur when you have excessive amounts of vitamin D in your body by megadoses of of vitamin D supplements (not by diet or exposure to the sun).	10	extremely toxic

Heavy Metals

- Heavy metals are a metal with a density greater than 5 g/cm^3
- Copper, lead, zinc, mercury, cadmium, nickel
- Heavy metals can be toxic
- Heavy metals are most harmful to children because they affect normal brain development

Sample Diploma Problem

Use the following information to answer question 16.

Polyphenylethene can be produced from a component of natural gas to make disposable foam coffee cups. A label is used on the product packaging to advertise that an environmentally friendly method was used to manufacture the cups.

Label on a Package of Foam Coffee Cups

Things that hurt the Ozone: CFC

16. The missing statement, labelled I in the diagram above, could be

A. Low pH

B. No CFCs Used

C. No PCBs Used

D. Low Sulfur Content

Cause cancer, affect immune system and nervous system

Sample Diploma Problem

Use the following information to answer numerical-question 6.

Pollutant		Source		Environmental Concern	
1	Organic waste, such as fertilizer or manure	**4**	Automobile exhaust	**7**	Increase in biological oxygen demand (BOD)
2	Polychlorinated biphenyls (PCBs)	**5**	Agriculture	**8**	Biomagnification
3	Nitrogen oxides, $NO_x(g)$	**6**	Old electrical transformers	**9**	Formation of smog

Numerical Response

6. Using the numbers above, choose **one pollutant** and match it with that pollutant's source and with an environmental concern associated with that pollutant. (There is more than one correct answer.)

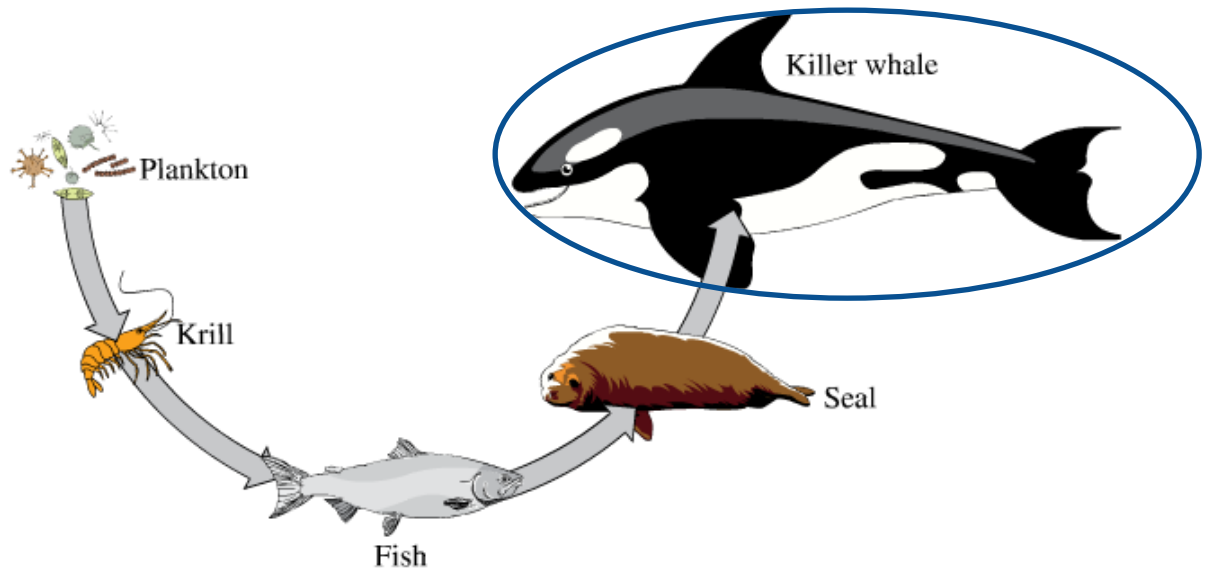
1,5,7 or 2,6,8 or 3,4,9

Number:	_____	_____	_____
Description:	**Pollutant**	**Source**	**Environmental concern**

(Record all **three digits** of your answer in the response boxes at the bottom of the screen.)

Use the following information to answer question 21.

An Ocean Food Chain



21. *The organism in the food chain shown above that is **most likely** to have the highest concentration of persistent organic pollutants (POPs) in its tissues is the* ___***i***___ *. Some examples of POPs are* ___***ii***___ *.*

The statements above are completed by the information in row

Pops = DDT, PCB, dioxins

Row	*i*	*ii*
A.	plankton	DDT, PCBs, and dioxins
B.	plankton	SO_x, NO_x, and CO_2
C.	killer whale	DDT, PCBs, and dioxins
D.	killer whale	SO_x, NO_x, and CO_2