

Evaluation Rubric

	1	2	3	4
"The Cleansing Power of Fire"	The student's attitude and effort toward this project was poor and their score was below 10 on their presentation.	The student's attitude and effort were good and their score was between 10 and 20.	The student's attitude and effort were excellent and their score was above 20 but below 25.	The student's attitude and effort were excellent and his/her score was above 25.
"The Statistics of Fire"	The student struggled to create the graph and their final product was invalid. Their paragraph was poor.	The student's work on this project was satisfactory. The information was valid and well presented for the most part. The paragraph was satisfactory.	The student's work was good. The final product was both valid and well presented. The student's paragraph was well written.	The student did excellent work on this project, creating an outstanding graph and writing a great paragraph.
"Only YOU Can Prevent Forest Fires!"	The student's poster reflects little care and effort and does not adequately instill awareness in general public.	The student's poster reflects satisfactory care and effort. It was planned to be effective.	The student's poster was crafted with good care and effort. It was carefully planned and it effectively promotes public awareness.	The student's poster reflects exceptional care and effort. It is an outstanding finished product. Very effective!
"Grow A Class Tree"	The student showed little interest in this project, did not fully participate and wrote minimally in their journal.	The student showed some interest in this project. They participated, but did not write an effective journal entry.	The student participated fully in this project. They wrote an effective journal entry.	The student was clearly inspired by this project, participating eagerly in the assignment and writing an exceptional journal entry.
"Fireline Safety"	The student did not fully participate in the discussion and their paragraph did not reflect adequate understanding of the topic.	The student participated in the discussion and their paragraph drew some comparisons effectively.	The student fully participated in the discussion and their paragraph reflected a good understanding of the topic and good comparisons were made.	The student was a keen participant in the discussion. Their paragraph was meaningful and well constructed. The comparisons made were outstanding.
"The Fire Triangle"	The student's efforts and output in this assignment were below standard. Assistance was required and the product was insufficient.	The student took some pride in their work and the final product was mostly accurate.	The student took pride in their work and their finished product was creative and well done.	The student's work was outstanding. The finished product was both highly creative and informative.

The Cleansing Power of Fire

Persuasive Presentation Evaluation Criteria:

Your job is to research the topic of forest fires and to determine whether they are either good or bad for our environment. You may wish to take into account the following factors:

- Financial cost of forest fire suppression
- Potential danger to human life (both in suppression and allowing fires to burn)
- Air pollution and prescribed burning (intentionally lit and controlled fires)
- Ecological renewal and the rebirth of forests through fire cleansing
- Loss of wildlife habitat
- Timber valued and the forest industry
- Public perception

Your presentation (either oral or visual) will be graded on the following criteria:

10 points For demonstrating a firm grasp of the topic's concepts. Did you show that you understand the issues? Did you use valid and pertinent facts in your presentation?

10 points For care and effort. Did you demonstrate your best effort on this project? Was your presentation well-planned and laid out? Can you feel proud about how you performed or presented? Did you do all the work yourself?

10 points For the effectiveness of the project. Did your presentation serve to actually persuade the audience? Was it thought-provoking and meaningful?

Total: 30 points

From the CBC archives:

The aftermath of a forest fire looks devastating, with hectares of charred tree stumps and no sign of life. But just three months later, the forest is alive again. The heat of the fire melts the resin that seals pinecones and new seeds take root in a forest floor now clear of debris. CBC reporter Kelly Crowe learns that rangers are taking a more relaxed stance to forest fires than in the past, battling blazes only when they threaten people, property and valuable timber.

Fires naturally burn through a forest every five to 25 years. But when those fires are aggressively extinguished — or prevented from starting — the stage is set for a more devastating fire later on. Forest clutter piles up, creating a ladder of fuel that allows fire to climb higher, burn hotter and destroy virtually everything in its path. Cooler-burning natural fires, however, kill only less mature trees and clear the forest canopy, allowing sunlight through so that other plant species thrive on the forest floor.

- Fires have been part of the forest's life cycle ever since the glaciers retreated about 10,000 years ago.
- Several species, including lodgepole pine, jack pine and Douglas fir, have evolved to take advantage of fire's heat. Their pinecones release seeds onto a seed bed made rich in nutrients by ashes left behind by the fire.
- Forest animals can also benefit from fire. Beetles burrow into burned tree trunks and make excellent food for foraging woodpeckers.
- The practice of prescribed burning involves deliberately setting controlled fires in order to prevent future, more devastating forest fires.
- Prescribed fires have also been used to eliminate weeds, insects and fungi that damage vegetation, and to stimulate growth of wild blueberries.
- Grassland areas also use prescribed fires to improve the quality of grass for grazing animals and to control brush that can fuel a larger fire.
- Canada's aboriginal people used fire to clear grasslands and herd nomadic animals.
- Early settlers also used fire to clear land for homesteading. But these fires often got out of control, killing people and destroying homes.
- Canada's first laws against setting forest fires were passed in 1761 in Nova Scotia, in 1870 in Quebec and in 1878 in Ontario.
- Prescribed fires are typically planned up to a year in advance in places like Banff National Park. Crews wait until conditions are right — typically in late spring — and move through the area with torches. In more remote areas, helicopters drop small ball-sized igniters in key areas.
- Even urban forests can benefit from prescribed fires. The city of Windsor uses them regularly in its nature-preserve parks and Toronto city officials began regular prescribed burns in High Park in 1997.

Average Fires

The number of wildfires that occur on average every year in British Columbia is usually given as 2,500, with half caused by people and half caused by lightning. Because this is an average, it is different every year, and therefore the above generalization is never totally accurate.

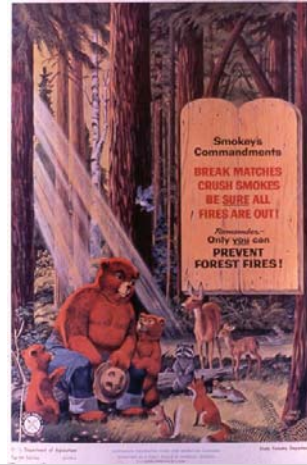
The current average, taken from 1993 to 2002 is 1,805 fires, 45.6% caused by people and 54.4% caused by lightning.

The following table shows the number and percentage of people- and lightning-caused fires for each of the past 10 years.

Year	# People	% People	# Lightning	% Lightning	Total
2002	911	51.2%	870	48.8%	1781
2001	787	62.2%	479	37.8%	1266
2000	697	45.3%	842	54.7%	1539
1999	608	50.4%	599	49.6%	1207
1998	910	34.1%	1755	65.9%	2665
1997	487	41.4%	688	58.6%	1175
1996	633	46.6%	725	53.4%	1358
1995	1130	76.7%	344	23.3%	1474
1994	1175	28.7%	2913	71.3%	4088
1993	886	59.2%	611	40.8%	1497
Average	822.4	45.6%	982.6	54.4%	1805



photo: Noel Hendrickson



“The Importance of Trees”

Trees are as important to human beings as food and water are. To keep city air cool and healthy, trees should cover at least 40% of city land. One tree can clean toxic emissions from the dirty air exhausted from an average car being driven 4,000 miles.

Trees produce most of the oxygen on Earth. Trees keep our air breathable by removing carbon dioxide and pollutants. They add moisture through transpiration.

Trees reduce costs of using our resources. For example, shade trees save money and energy. The trees lining city streets can save up to 50% on air-conditioning bills during the summer. In cold places, trees provide windbreaks that can reduce heating bills by as much as 30% in the winter.

Trees conserve other resources. Forests hold soil in place. They keep rainwater from running off the land so that it soaks through to the aquifer. Trees keep the water from running off the land too quickly and help control floods. Trees take care of our soil and water.

Trees provide shelter, food, recreation, beauty, and homes for birds, insects, and other animals and, we must always remember, chocolate. (The cocoa tree, the source of chocolate, is now on the endangered species list!)

As important as trees are, we are destroying them much faster than they can grow without our help. Imagine how many trees are used all over the world. People cut down trees to make room for new farms, housing developments, highways and cities. Trees are used to make newspapers, computer paper, furniture, houses and many other products. Whenever large parts of a forest are cut down, animals lose their homes and everything about the place where the trees grew changes.

It is up to us to take care of the tree in our world. If we work to prevent forest fires, take care of our environment and continue to recycle everything we use that is made from trees, like paper and cardboard, we can make all make a difference!

This information on trees is contained in the website:

<http://www.kidsecology.org/yourenvir.html>



Other useful tree links include:

Tree Canada Foundation: <http://www.treecanada.ca/programs/school/index.htm>

Trees for Life Adventures: http://www.treesforlife.org/sttfla/sttfla_new.htm

FIRE WEATHER – General Information

During forest fire season, weather is the controlling factor in the severity and frequency of fires. Dry, hot weather rapidly increases the danger of wildfires. In cool, damp weather there are fewer fires, and when one starts it can be brought under control more easily.

Up-to-date weather forecasts and information on the fuel and weather conditions in the forest are crucial for effective decision making in all aspects of fire management. Firefighters are trained to understand and interpret weather conditions so that they can assess the potential threat of a forest fire. Firefighters take the following four basic elements into consideration:

Temperature

Relative Humidity

Precipitation

Wind Speed and Direction

B.C.'s Ministry of Forests Protection Program operates 216 hourly weather stations. Temperature, relative humidity, precipitation, wind speed and wind direction are recorded hourly by these fully automated fire weather stations. This data is transmitted to Protection headquarters, every hour from April through October and less frequently during the winter months.



Temperature

Wildfires are greatly affected by temperature. In general, forest fires burn in British Columbia in the summer months (May to September). In large part, this is due to the higher summer temperatures. For this reason, wildland firefighting crews only come together to work on a seasonal basis. That is, firefighting in B.C. is not a year-round job. Can you think of some places in the world where forest firefighters might be needed all year long?

Additionally, forest fires tend to burn most actively after 10:00 in the morning. In fact, firefighters follow something called the "10am Concept": a guiding principle that urges firefighters to control a fire before 10 in the morning. If a fire is not controlled before 10 in the morning, then firefighters must be aware that the fire behaviour and the risk involved in fighting that will increase. The sun's energy after 10am is much stronger than in the early morning hours and as the heat of the day increases, so too does fire behaviour and the danger firefighters face in fighting it.

Firefighters can face extreme fire behaviour when a **30/30 crossover** condition occurs. This happens when the temperature rises above 30 degree Celsius and the relative humidity (moisture in the air) drops below 30%. When this occurs, the air is so hot (temperature) and so dry (relative humidity) that seemingly contained fires can quickly burn out of control. Firefighters are always alerted of these crossover conditions for their own safety. Sometimes, in a 30/30 crossover firefighters are required to pull back from the dangerous parts of the fire until more safe weather conditions prevail.

Temperature can also play a critical role in the safety of firefighters in another way. Hot temperatures combined with the strain of demanding physical labour put firefighters at risk of heat cramps, heat exhaustion and heat stroke.

Those who are unaccustomed to the heat, or who become **dehydrated** from excessive perspiration or inadequate consumption of liquids (or a combination), are most likely to experience **heat cramps**. Heat cramps are less likely when fluid intake is adequate and the diet includes bananas, oranges, fresh salads, and adequate table salt.

Prolonged exposure to heat in combination with dehydration can trigger **heat exhaustion**. Heat exhaustion is indicated by symptoms such as dizziness, sweating, dry mouth, headache, weakness, fatigue, clammy skin, and an unstable gait. Other indicators include muscle cramps and a weak and rapid pulse. Heat exhaustion can be treated with increased fluid and electrolyte intake, and by resting in a cool place.

While heat exhaustion takes time to develop, **heat stroke**, strikes suddenly with little warning. Heat stroke is a medical emergency which can be fatal if untreated. Medical assistance should be obtained as soon as possible in order to prevent brain damage or death. Signs of heat stroke include a very high temperature and skin that is hot, dry, and red. Sweating stops, and deep breathing with a fast pulse is followed by shallow breathing and a weak pulse. Pupils become dilated, speech may be incoherent, and confusion or delirium or even hallucinations and convulsions may occur.

Relative Humidity

Humidity is to blame for that muggy, steam-room feeling experienced by those who live in the Eastern parts of Canada. Luckily, in British Columbia we don't have very much weather that includes high humidity. If it were very humid here, summers would feel more like a tropical jungle – wet and sticky.

In fact, in this province we generally have low humidity in the summer. In areas like the Okanagan, the air is so dry that this part of B.C. is actually classified as a semi-arid desert. This dry air feels great if you are going to the beach, but it is a real problem for forest firefighters. Fires thrive in conditions of low humidity. Fuels dry out and the fire can quickly spread and burn out of control.

Firefighters speak of humidity in terms of **relative humidity**. Basically, relative humidity indicates how moist the air is. In fact:

The amount of water vapor in the air at any given time is usually less than that required to saturate the air. The relative humidity is the percent of saturation humidity, generally calculated in relation to saturated vapor density.

$$\text{Relative Humidity} = \frac{\text{actual vapor density}}{\text{saturation vapor density}} \times 100\%$$

Relative humidity is a very important measurement of weather for firefighters because it is a good indication of fire behaviour. Firefighters are alerted of a **30/30 crossover** condition when the temperature rises above 30 degrees and the relative humidity drops below 30%. During these conditions, firefighters must be extra alert and cautious. With conditions of low humidity, a seemingly quiet fire can grow and burn out of control in a hurry.

Humans are very sensitive to humidity, as the skin relies on the air to get rid of moisture. The process of **sweating** is your body's attempt to keep cool and maintain its current temperature. If the air is at 100-percent relative humidity, sweat will not evaporate into the air. As a result, we feel much hotter than the actual temperature when the relative humidity is high. The lower the humidity, the better able the body is to use sweat to cool itself effectively. For this reason, it is important for firefighters to continually intake adequate amounts of water to replenish their reserves of water. **Dehydration** is a real danger for firefighters working in hot, dry conditions.

Wind Speed and Direction

Wind is also an important factor when watching the movement and behavior of a forest fire. Wind is the ally of the fire. Wind blowing through the forest dries fuels, making them more flammable. Wind fans the fires already burning and carries sparks over vast areas. Wind is one of the reasons fires are generally worse during the day than at night -- by day, winds are stronger, temperatures are higher and there is less humidity. Wind is the primary factor that influences fire spread. This includes both the rate and direction of spread.

The **rate of spread** of a fire is related to how fast the wind is blowing. Strong winds with large gusts can blow smoke and ash kilometers ahead of the fire. The power of the wind will move the fire across the land at a greater rate than if the fire were to be burning under calm conditions. The direction of the fire's spread is also affected by the wind. While a fire may be consistently spreading in one direction, a sudden shift in wind direction and the fire can easily turn in an unpredictable way.

There are two types of winds which are relatively predictable for firefighters: These are anabatic and katabatic winds. A **katabatic wind** is also named a **mountain breeze**. These wind are most commonly noticed at night. It is during this time that evening air is cooling. Cool air is more dense than hot air and so falls. This falling air creates down slope winds. **Anabatic winds** are the opposite of katabatic winds. These winds flow up the slopes of mountains from the valleys due to daytime radiational warming of the lower slopes and valleys causing air to rise. An anabatic wind is also named a **valley breeze**.

These anabatic winds make firefighting difficult in the mountains of British Columbia.

Warm winds blowing up hill make fires move more rapidly up a mountain. Fires traveling uphill are dangerous for firefighters because they are nearly impossible to outrun. A well-trained firefighter would never allow him or herself to be caught in the path of a quickly moving fire with their only escape route being uphill.



KATABATIC WIND (MOUNTAIN BREEZE)



ANABATIC WIND (VALLEY BREEZE)

Precipitation

Precipitation is: "any or all forms of liquid or solid water particles that fall from the atmosphere and reach the Earth's surface. It includes drizzle, rain, snow, snow pellets, snow grains, ice crystals, ice pellets, and hail."

Precipitation plays a large role in the battle against forest fires in British Columbia. Large forest fires are often so difficult to contain that firefighters are only given a good chance of controlling them after a break in the hot summer weather provides them with much needed precipitation. When a few days of cooler, moist weather are forecast, firefighters will gather their resources to make a dramatic effort against the fire's advance. Allowing the moisture to **slow the fire** while they construct new fire guards around the blaze. Though this precipitation will give firefighters an opportunity to make some real advances in the battle against a forest fire, it is usually not enough to put the fire out itself.

Even when rain falls for days at a time on a forest fire, the fire can continue to smolder, unaffected in root systems and under logs. When warmer weather occurs, these quieted fires will snap back to life, regaining momentum and causing further destruction. Even winter snows have been known to allow fires to continue to burn. This precipitation is helpful, but sometimes just not enough to do the whole job. Firefighters must find these stubbornly burning hot spots, digging down under the top layers of dirt and debris to expose the fire's fuel and extinguish it completely.

Precipitation is also important in the months before and after the fire season. In Fall, Winter and Spring, British Columbia receives its heaviest amounts of precipitation. Whether falling as rain or snow, this precipitation builds up the land's **reserves of water**. Glaciers, lakes and rivers refill with water. Throughout the next fire season, wildland firefighters will rely on these natural water sources to draw water from to put out forest fires. When drought conditions occur, firefighters have difficulty finding available water sources in which to place their pumps. Without nearby water, helicopters and trucks must be used to bring water to the fireline. This is a time consuming and costly operation.



Name: _____

Fire Weather Quiz

Fill in the blanks:

- 1. _____ and _____ weather rapidly increases the danger of wildfires. In _____ and _____ weather there are fewer fires, and when one starts, it can be brought under control more easily.**
- 2. The four basic elements of weather that fire fighters are most concerned with are: _____
_____ and _____.**
- 3. The sun's energy grows more powerful as the day passes. Due to this fact, firefighters are guided by the "_____ concept" which promotes the control of fires before a certain time each day.**
- 4. When temperature rises above _____ and relative humidity drops below _____ a particularly dangerous condition known as "crossover" occurs.**
- 5. Firefighters face many dangers, including the effects of demanding physical labor in dangerously hot conditions. Drinking plenty of water helps to reduce a firefighter's chance of being effected by _____,
_____ or _____.**

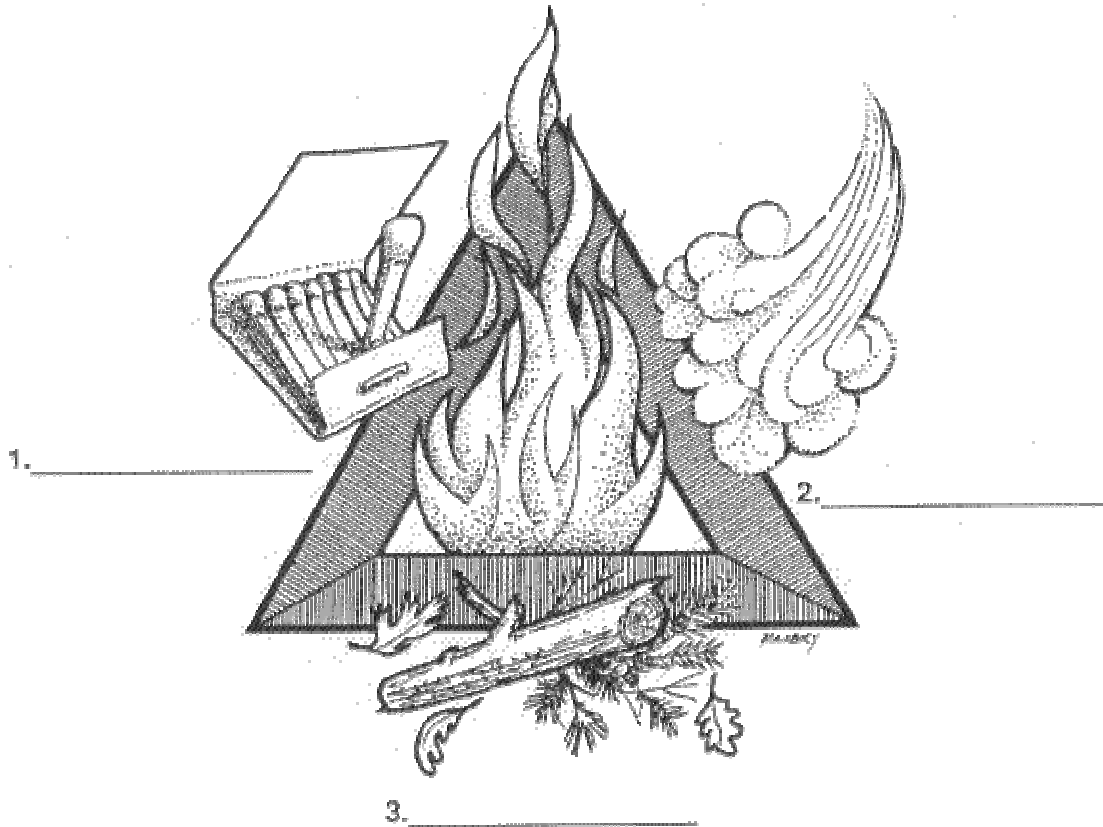
- 6. The Okanagan is a very dry place in the summer. The relative humidity of this area of the province is so _____ that we can actually classify it as a semi-arid desert.**
- 7. When firefighters are working in hot and dry conditions their bodies try to cool themselves by _____. Firefighters do so much of this, that they need to be very sure they are drinking enough water to avoid dehydration.**
- 8. Winds can powerfully affect forest fires. Two of the ways forest fires can be affected by winds are: rate of spread and _____ of spread.**
- 9. Warm, daytime winds are called anabatic winds. These winds blow _____. Cooler, nighttime winds are called katabatic. These winds blow _____.**
- 10. Firefighters sometimes have to wait for help from mother nature in the form of _____ to help cool a fire and allow them a chance to really contain it.**
- 11. Precipitation cannot be relied upon to put a fire out completely. Firefighters have to _____
_____ in order to ensure that a fire is really out.**

Name: _____

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THE FIRE TRIANGLE

Directions: Three "ingredients" are necessary if fire is to occur. Correctly label each side of the fire triangle. Then, briefly define each of the terms you have used in the space at the bottom of this worksheet



Describe each element in the space provided below.

1.

2.

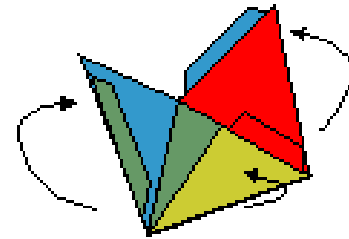
3.

The Fire Triangle

Fire needs three things to burn:
Fuel (wood, paper, gasoline, etc.),
Oxygen (the air we breathe) and
Heat (A flame or spark)

Here's a Fire Triangle that you can
put together to demonstrate that
If you take one of them away
the fire will go out.

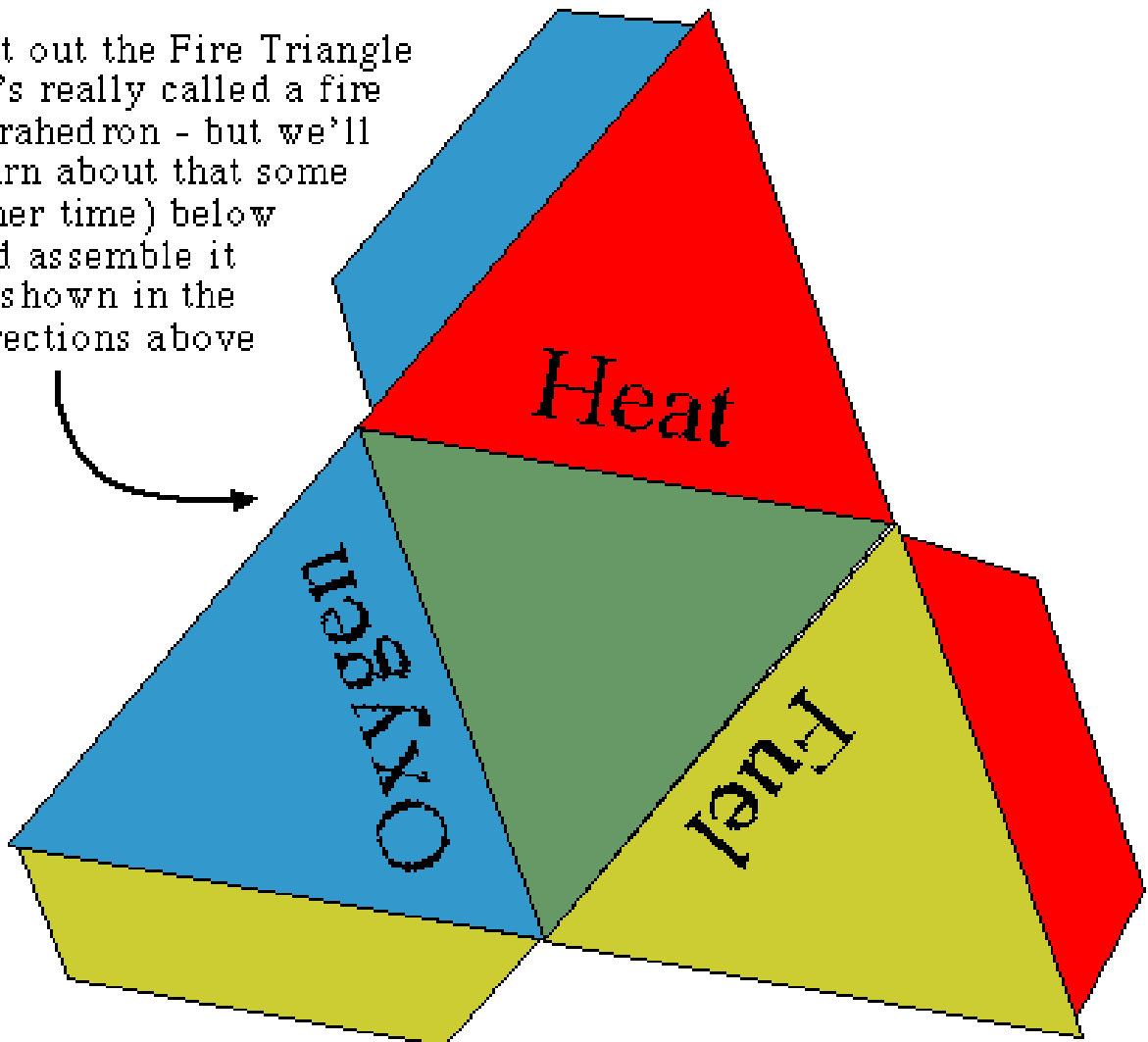
Cut out the Fire Triangle
(it's really called a fire
tetrahedron - but we'll
learn about that some
other time) below
and assemble it
as shown in the
directions above



Directions

Fold up the sides as shown

Glue or tape the tabs to
the side of the same color



Name: _____



Find the Hazards!

(Use the pictures in the poster to help you answer the following questions)

1. The use of aircraft (helicopters and planes) can present a number of potential hazards for forest firefighters. Can you think of four ways in which firefighters might be in danger around these machines?

2. Even if there wasn't a raging forest fire nearby, firefighters are often faced with a dangerous work environment. Can you think of five things that make working in the forests of British Columbia dangerous?

3. Firefighting is a very physically demanding job. Can you think of three reasons why being fit is so important for firefighters?

4. In British Columbia, firefighters work together to keep each other safe. If they didn't think and act safely, a lot could go wrong. Can you list 10 things that could possibly happen to harm our firefighters on the job?

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