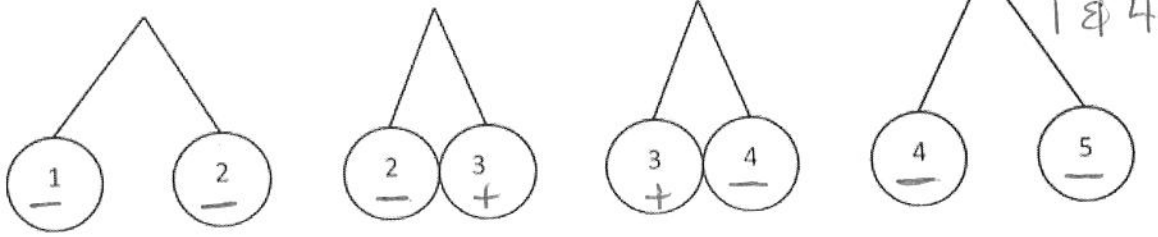
Topic 1- Static electricity

1. You have five spheres which are each electrically charged. Determine what will occur when sphere 1 and sphere 4 come into contact and when sphere 2 and 5 come into contact.

2 & 5 repel
1 & 4 repel



2. If two substances like cotton and acetate are rubbed together, what will be their reaction and explain why this occurs? They would attract because during friction two opposite charges are created.

3. In the laboratory, a student was given the following substances :

1. ebonite
2. cotton
3. silk
4. glass

The student was told that when two substances from the above list are rubbed together, the one higher up in the list becomes negatively charged and the other becomes positively charged.

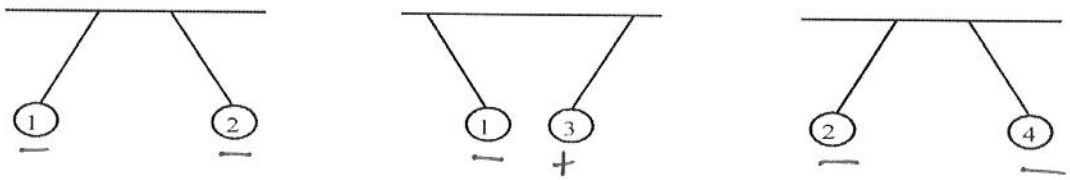
The student did the following :

- Rubbed the ebonite (−) and the silk (+) together.
- Rubbed the glass (+) and the cotton (−) together.
- Brought the cotton (−) close to the ebonite (−). = Repulsion.
- Brought the cotton (−) close to the silk (+). = Attraction.

Which one of the following statements is TRUE?

A) Ebonite and cotton repel each other; silk and cotton repel each other.
B) Ebonite and cotton repel each other; silk and cotton attract each other.
C) Ebonite and cotton attract each other; silk and cotton repel each other.
D) Ebonite and cotton attract each other; silk and cotton attract each other.

4. A student was given four electrically charged spheres.
The following diagrams show what happened when these spheres were suspended in pairs close to each other.

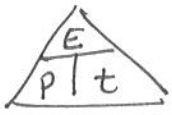


Which of the following statements is true?

A) Spheres 1, 2, 3 and 4 have the same charge.
B) Spheres 2, 3 and 4 have the same charge.
C) Spheres 1, 2 and 4 have the same charge.
D) Spheres 1 and 3 have the same charge.

Topic 2- Electricity formulas and circuits

1. Define current intensity, resistance and potential difference. What are their symbols and units? Current = charges passing per second. Potential difference = Amount of energy per charge from one point to another in a circuit. Resistance = Ability to slow down/hinder flow.
2. In the table below fill in the formula in the top box, then give the appropriate triangle used for each unknown. Include units for each.

Resistance	Power	Energy
$V = IR$	$P = VI$	$E = P\Delta t$ (x)
		

3. How would you convert the following time units:

Minutes to seconds X 60 — Seconds to minutes ÷ 60

Hours to seconds X60 X 60 — Seconds to hours ÷60 ÷ 60

Minutes to hours ÷60 — Hours to minutes X 60

W to kW ÷1000 — J to kWh ÷ 3 600 000 J

* This is on your formula sheet, but I suggest using formula $E = Pxt$.

4. How much power did an electric lawn mower use if it used 45 000 J of energy in the 50 minutes it took to mow the lawn? $P = \frac{E}{t} = \frac{45000J}{(50min \times 60)} = 15W$
5. How much time was a fish tank on when it needed 0.5 A, 100 V and 45 000 J of energy?
$P = V \times I$ $P = 0.5A(100V) = 50W$ / $P = 50W$, $E = 45000J$ $t = x$
$50W = \frac{45000J}{x}$ $x = 900s$
6. A man used the computer for 7 hours and used 500 W of power. How much energy (in Wh) did it take to use the computer for seven hours? $E = P \times t$
$500W \times 7h$ $E = 3500 W \cdot h$
7. What is the potential difference of a light bulb when it uses a 200 Ω resistor and 0.4 A?
$V = IR$ $V = 0.4A(200\Omega)$ $V = 80V$
8. A radio is on for 150 minutes and has 450 W of power. What is the energy in kWh?
$P = 450W = 0.45kW$
$t = 150min \div 60 = 2.5h$
$E = 0.45kW \cdot 2.5h = 1.13kWh$

9. A toaster takes 300 seconds to toast a piece of bread. If it uses 400 W of power how much energy will be used in J? $E = P \times t$ $E = 400W \times 300s = 120\,000\,J$

10. What is the current intensity of a clock radio when it uses a 150 Ω resistor and 200 V?
$V = IR$, $I = \frac{V}{R}$ $I = \frac{200V}{150\Omega}$, $I = 1.33\,A$

11. An oven is used for 35 minutes to bake cookies. Its voltage is 150 V and its intensity is 4 A. How much energy was used in J to bake the cake? $P = 150V \cdot 4A = 600W$ $P = 600W$ $t = 35min \times 60 = 2100s$ $E = 600W \times 2100s = 1\,260\,000\,J$

12. How much time passed in minutes when a computer did 50 000 J of work and had 550 W of power? $t = \frac{E}{P}$ $t = \frac{50\,000J}{550W}$ $t = 90.9s \div 60 = 1.52\,min$

13. How much energy was used when a radio was on for 90 minutes and had 220 V and a current intensity of 2 A? $P = 220V(2A) = 440W$ $E = P \times t$ $= 440W \cdot 1.5h$ $t = 90min \div 60 = 1.5h$ $= 660W$

3 steps * 14. What is the resistance of a resistor if a circuit is on for 2 hours, used 50 000 J of energy and 220 V?
① $P = \frac{E}{t}$ $t = 2h \times 60 \times 60 = 7200s$ $P = \frac{50\,000J}{7200s} = 6.94W$ ② $P = VI$, $I = \frac{6.94W}{220V}$ $I = 0.03A$ ③ $R = \frac{V}{I} = \frac{220V}{0.03A}$ $R = 7333\,\Omega$

15. What is the power of an appliance if it works on 5 A and has a 3.5 Ω resistor?
① $V = IR$, $V = 5A(3.5\Omega) = 17.5V$ ② $P = VI$, $P = 17.5V(5A) = 87.5W$

16. What was the current intensity of a clock radio that used 20 000 J of energy when it was on for 2 hours and had 110 V?
① $P = \frac{E}{t}$, $P = \frac{20\,000J}{(2h \times 60 \times 60)s} = 2.78W$ ② $P = VI$, $2.78W = 110V(x)$ $I = 0.03A$

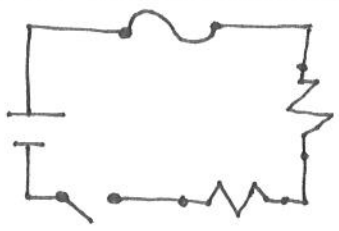
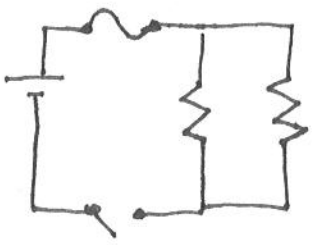
17. Draw the symbols for the following:

Resistor	Voltmeter	Total voltage	Current	Total current	Light	Wire	Switch	Power supply
		V_T	I	I_t				

18. Fill in the table

	Series circuit	Parallel circuit
Give the definition	A single loop of current	A circuit containing more than one pathway for current.

19. Draw a series and parallel circuit, each with two resistors. Include a switch and a fuse for the controlling the whole circuit.

Series	Parallel
	

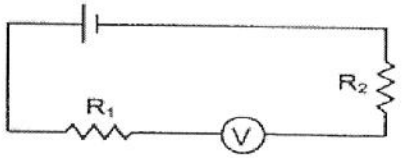
20. Draw a circuit where current intensity has 4 possible pathways. Use the specifics below when drawing the circuit

- ✓ Place a voltmeter that measures the potential difference coming from the power source, use Vt as your symbol.
- ✓ Place a voltmeter that measures the potential difference across resistor R_2, use V_2 as your symbol.
- ✓ Place an ammeter that measures the current intensity from the power source, use At as your symbol.
- ✓ Place an ammeter that measures the current intensity through resistor R_3, use A_3 as your symbol.
- ✓ Place an ammeter that measures the current intensity through resistor R_3 and resistor R_4, use A_4 as your symbol.
- ✓ Place a switch that will cause the whole circuit to stop working when it is open.
- ✓ Place a switch that will cause resistor R_1 to stop working when it is opened.
- ✓ Place a switch that will cause resistors R_2, R_3, and R_4 to stop working when it is opened.
- ✓ Place a fuse to control the whole circuit
- ✓ Place a switch to control resistor 3

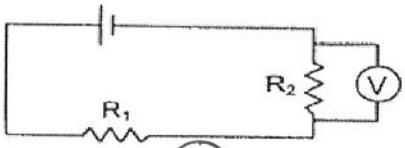
A See attached

21. Four electric circuit diagrams are given below.
You wish to measure the potential difference across the terminals of resistor R2.
Which diagrams show a correctly connected voltmeter?

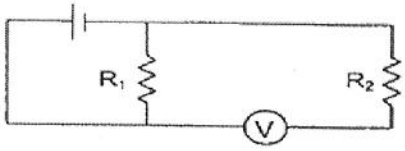
1)



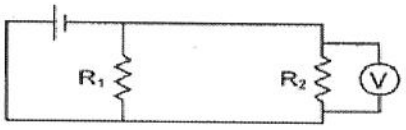
2)



3)



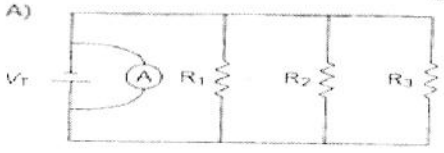
4)



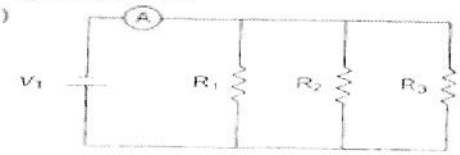
A) 1 and 3 B) 2 and 4 C) 1 and 2 D) 2 and 3

22. The following electric circuit consists of a power supply, V_T, connected to three resistors (R1, R2 andR3). Which of the following circuit diagrams shows the correct connection for an ammeter A that measures the current flowing through resistor R1?

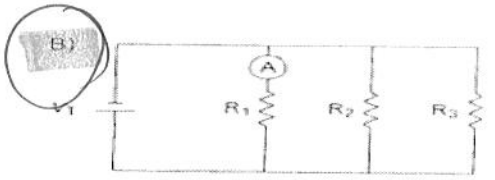
A)



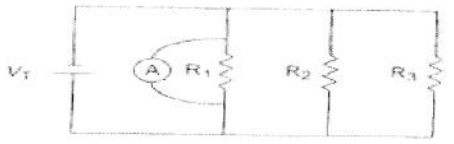
C)



B)



D)

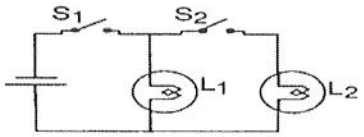


23. An electrical circuit consists of a power source, two switches (S_1 and S_2) and two light bulbs (L_1 and L_2). The following table shows what happens to both light bulbs:

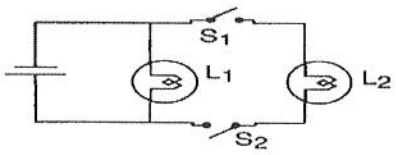
Switch		Light Bulb	
S_1	S_2	L_1	L_2
open	open	out	out
closed	open	bright	out

Which of the following circuit diagrams illustrates the results shown in the table above?

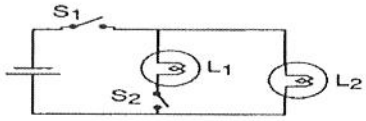
A)



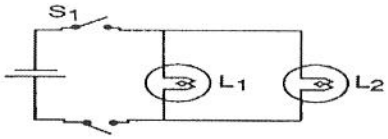
C)



B)



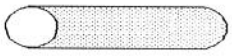
D)



24. A circuit consists of a power supply, a light bulb and two terminals that can be connected to a rod.

The copper rods illustrated below are inserted into the circuit one at a time. The rods are the same temperature, but they have different dimensions.

1.



3.

2.

shortest + fattest.

4.

Which rod will offer the least resistance to the flow of electric current?

A) rod 1 B) rod 2 C) rod 3 D) rod 4

25. The following table shows measurements related to four different resistors.
Which of the resistors below has the most conductance (i.e. lowest resistance)?

$R = \frac{V}{I}$

Resistor	Potential Difference (V)	Current Intensity (A)
1	10	10
2	10	1
3	1	10
4	4	2

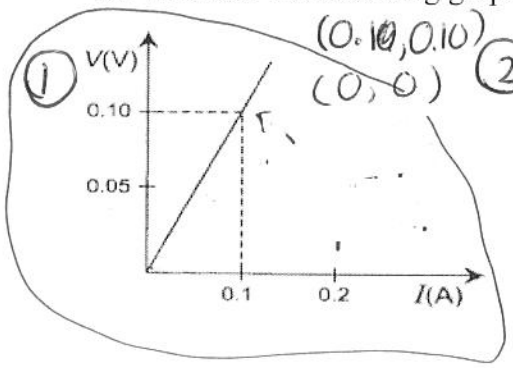
$\frac{10V}{10A} = 1\Omega$

$\frac{10V}{1A} = 10\Omega$

$\frac{4V}{2A} = 2\Omega$

$\frac{1V}{10A} = 0.1\Omega$

26. Which of the following graphs represents the conductor with the highest resistance?



① $\frac{V_2 - V_1}{I_2 - I_1} = \frac{0.10V - 0V}{0.1A - 0A} = 1\Omega$

② $\frac{V_2 - V_1}{I_2 - I_1} = \frac{0.5V - 0V}{0.1A - 0A} = 5\Omega$

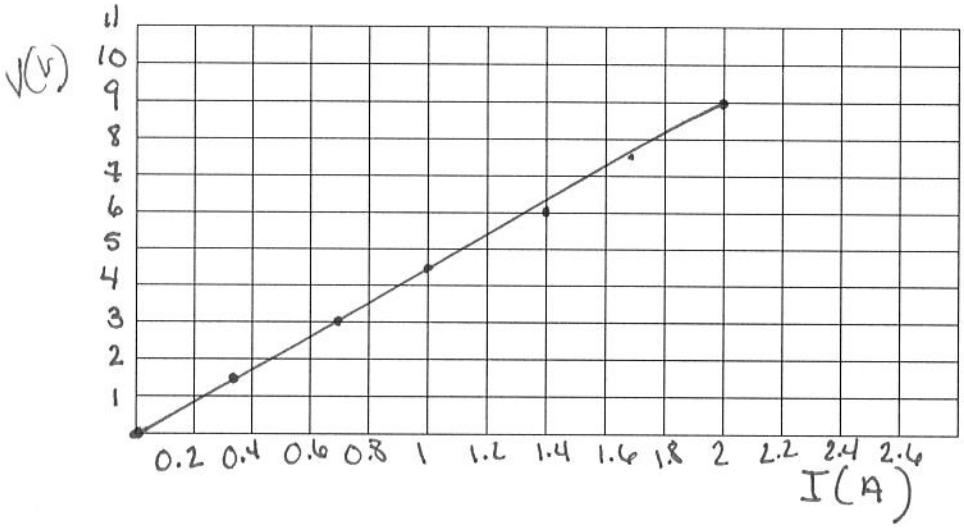
∴ Second Graph has highest Resistance

27. Use the results to answer the questions.

Voltage (V)	0	1.5	3.0	4.5	6	7.5	9
Current (A)	0	0.35	0.70	1.0	1.4	1.7	2.0

P_1 P_2

Draw a resistance graph



Find the resistance

$R = \text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4.5 - 0}{1.0 - 0} = 4.5\Omega$

Topic 3 Energy efficiency and heat

1. What is the energy efficiency formula?

$$\%\,\text{eff} = \frac{\text{Useful Energy}}{\text{Consumed Energy (total in)}} \times 100$$

2. An elevator has an energy efficiency of 64%. What amount of energy must the elevator consume in order to provide 95 kWh of useful energy?

$64\% = \frac{95\,\text{kWh}}{x} 100$, $0.64 = \frac{95\,\text{kWh}}{x}$ $x = 148.44\,\text{kWh}$

3. A microwave consumes 27 000 J of energy in order to provide 21 500 J of useful energy. What is its energy efficiency?

$\% = \frac{21\,500\,\text{J}}{27\,000\,\text{J}} \times 100 = 79.6\%$

4. A computer that is 87% efficient consumes 375 kWh of energy. How much useful energy does it provide?

$87\% = \frac{x}{375\,\text{kWh}} \times 100$, $0.87 = \frac{x}{375\,\text{kWh}} = 326.25\,\text{kWh}$

5. A television that is 83% efficient provides 4 600 J of useful energy. How much energy does it consume? $83\% = \frac{4600J}{x} \times 100$, $0.83 = \frac{4600J}{x} = 5542J$

6. An oven consumes 425 kWh of energy in order to provide 386 kWh of useful energy. What is its percent efficiency?

$\% = \frac{386\,KWh}{425\,KWh} \times 100 = 90.8\%$.

~~7. What are the 2 variables for heat?~~
Ignore this question.

Topic 4- Populations and ecosystems

1. Define the term population.
A group of individuals of the same species.
2. In a forest, 24 new blue jays were born, 17 flew in for the summer, 12 died because of the harsh winter and 7 emigrated because of the lack of resources. Was there a population increase or decrease during the year?
Individuals added = 27 + 17 = 44, Ind. Removed = 12 + 7 = 19 The population increased. (More added than removed)
3. Explain what population density is.
# of individuals per given unit of space (area or volume)
4. You counted 150 dandelions in a 6 m^2 area. What is their population density?
$150/6m^2 = 25$ dandelions$/m^2$
5. Give 2 examples of biotic and abiotic factors.
Biotic: predators in the area, bacteria. Abiotic: Amount of sunlight & water.
6. Draw what each type of population distribution would look like.

Clumped	Uniform	Random
		

7. Explain what a limiting factor is.
When there is too much or not enough of this factor the survival of the species is at risk.

ex: Water for plants.

8. The X's, O's, W's and T's represent diffferent populations in a community.

X T T TTO O X T T T T TO O X TT T TO O W

3 - X
13 - T
6 - O
1 - W
} Poor Relative abundance

A- Explain if this is a diverse community. NO

B- Calculate the ~~biodiversity~~ relative abundance of each species

$\frac{3}{23} = 13\%$, $\frac{13}{23} = 56.5\%$, $\frac{6}{23} = 26\%$, $\frac{1}{23} = 0.04\%$

9. Use the graph to answer the questions.

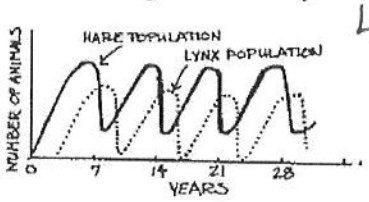
A-What causes the lynx population to increase? ← Increased food (hares)

B- What causes the hare population to decrease?
Increased predation by the lynx.

C- What causes the lynx population to decrease?
LESS food available.

D- What causes the hare population to increase?
The lynx die off due to lack of food, giving the hares a chance to repopulate.

E- How long does this cycle last?
↳ It repeats season after season.

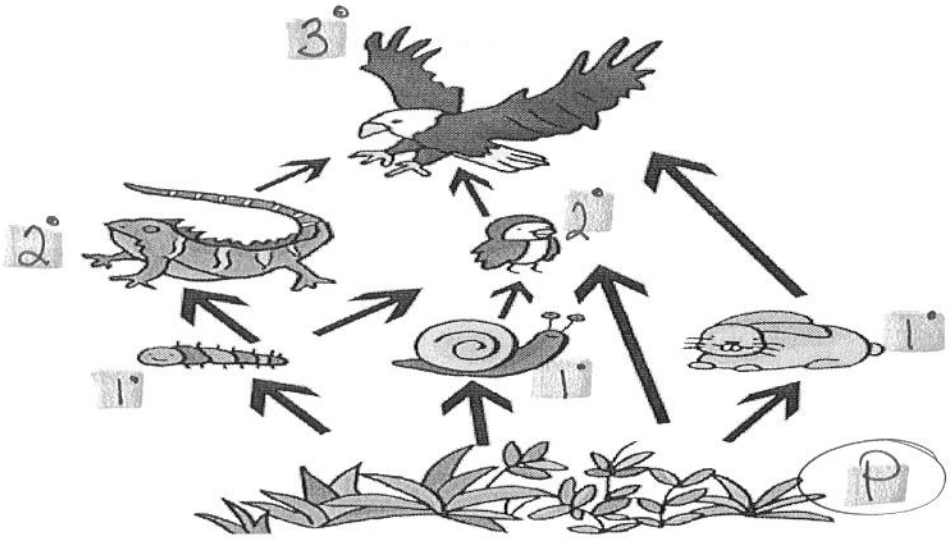


10. Define and give examples of the following words.

	Definition	Example
Mutualism	Both living organisms benefit.	Bees + flowers.
Predation	A living thing that feeds on another.	Wolf + Elk.
Parasitism	Parasite feeds on a host. (No immediate death)	Flees on a dog.
Commensalism	One living organism benefits and the other is not affected.	Nest in a tree.
Competition	Living things compete for the same resources. (negative effect on both competitors)	Seagulls competing for a piece of bread.

11. Define the following terms and give an example of each.

	Ecosystem	Producer	Consumer	Decomposer
Definition	Interactions between all living/non living elements.	→ 1st level of any food web. → Produce own food.	→ Must eat other organisms	→ Decompose dead organic matter.
Example	→ A forest.	Plants.	Rabbits.	Bacteria.



12. Using the picture above, answer the following questions:

a- Name a secondary producer?

see diagram

b- Can the bird be a primary and secondary consumer? Yes, we call it 2° (eats both)

c- Make a food chain with 3 consumers

Your answers may vary.

d- Give a consequence of the lizard being taken out of the food web.

- The caterpillar population will increase
- The bird will have more food. - The eagle will lose a source of food.

13. Explain why the sun is necessary for the energy flow between trophic levels.

The sun provides energy for the entire food web.

14. Explain what biomass is.

All living matter in the ecosystem.

15. What is primary productivity and what is it influenced by?

All new biomass in the ecosystem (plant materials + producers)

Topic 5: Renewable and Non-renewable Energy

1. Create a table listing each of the energy sources from the lithosphere, hydrosphere and atmosphere.
   a. Your table should include:

*See attached at the end!

i. The name of the energy source
ii. Whether it is renewable or nonrenewable
iii. How it works (What turns the turbines connected to the generator?)
iv. Advantages of using this source
v. Disadvantages of using this source

Topic 6: Estimating Population Size

1. Scientists want to determine the size of a population of brook trout in a lake. First, they catch 50 trout, tag them and release them. A few days later, they catch 55 trout, including 11 tagged fish.
   a) Which method for measuring population size did the scientists use?
   b) What is the estimated population of brook trout in this lake? Show your calculations.

2. There is an average of seven clovers per 0.5 m^2 in Cedar Park; the area of the park is 2500 m^2.

a) Mark + Recapture

1. Estimated pop^n size = $\frac{\#\text{ marked} \times \#\text{ recaptured}}{\#\text{ marked + recaptured.}}$

b) $= \frac{50 \times 55}{11} =$ 250 trout.

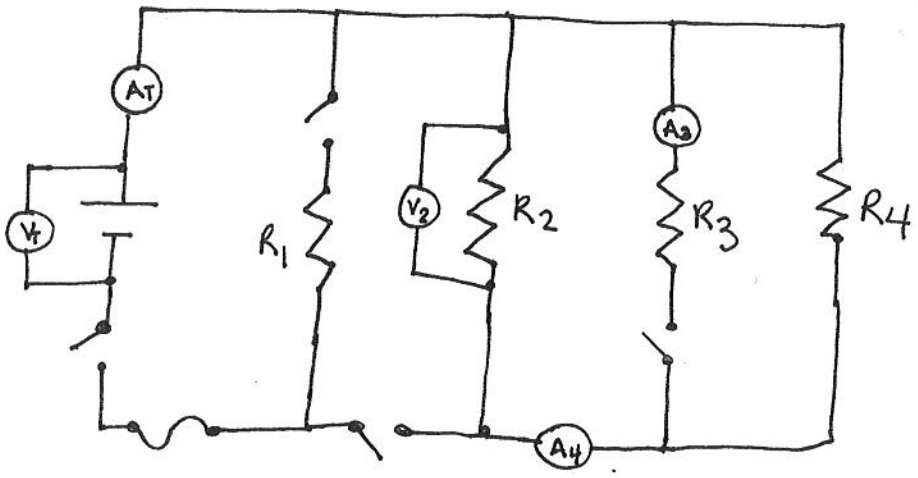
2. Use Quadrats!

$\frac{\text{Estimated pop}^n\text{ (big)}}{\text{Total area (big)}} = \frac{\text{Average \# /section (small)}}{\text{Area of quadrat (small)}}$

$\frac{x}{2500m^2} \cancel{=} \frac{7}{0.5m^2}$

$x =$ 35 000 clovers.

#20



*Your diagram may look slightly different.

Lithosphere

Energy Source	Description
Fossil Fuels	• Produced when animal and plant residues accumulate on the sea floor and gradually get covered by layers of sand and rock. Over millions of years, they are transformed into oil and natural gas. • Humans mine fossil fuels and burn them to produce thermal energy, which can also be converted into mechanical and electrical energy. • The burning of fossil fuels releases pollutants such as carbon dioxide (CO_2) and methane (CH_4). Other gases, such as sulfur dioxide (SO_2) and nitrogen oxides (NO_X) are also released.
Uranium (Nuclear)	• Uranium is a radioactive element and exists naturally in the lithosphere. • Nuclear power plants use mined uranium to transform thermal energy into mechanical and electrical energy. • A small amount of radioactive material produces a lot of energy • Nuclear waste is another by-product and needs to be buried since it continues to release radioactivity for hundreds of years
Geothermal	• Below the lithosphere lies hot magma which releases thermal energy. Harnessing this energy is called geothermics. • A fluid is circulated into the ground; it is heated naturally, then brought up to the surface. The hot liquid can be used to heat homes or its thermal energy can be transformed into electrical energy. • It can be difficult to access geothermal energy. It can also be very expensive.