Can you help Alex conduct some *Chemistree* this advent season?

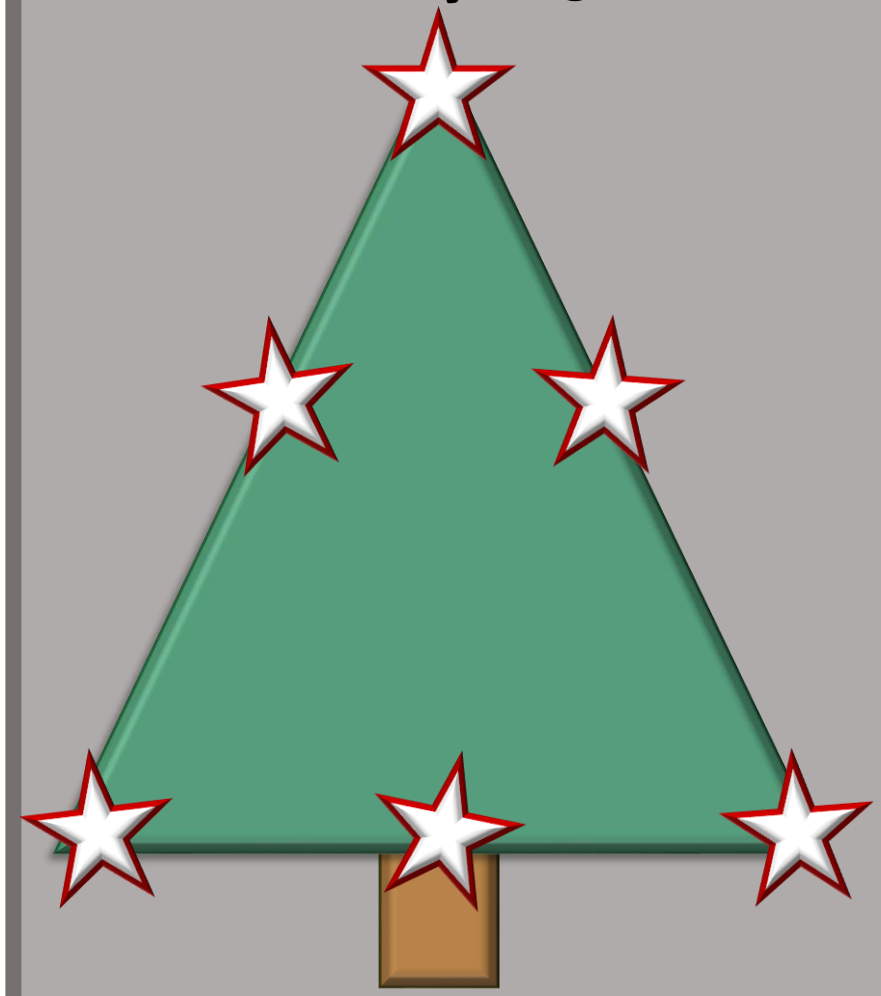
1

Can you use the the following items to create some festive eruptions?

Add about half a tablespoon of baking soda to the shot glass and then sprinkle glitter on top.

Next add either red or green food colouring to white vinegar and use a baster or eye dropper to add some drops to the glass. Watch as your creation erupts!

Hannah needs to use her math's knowledge to help decorate her tree. Can you give her a little myrrh help to get it finished?



Only using the numbers 1 through 9 place them in the star decorations so that each side of the tree total the same amount

Oh *deer*, Mark is having a difficult time solving this festive riddle.
Do you think you can give him a helping hand?

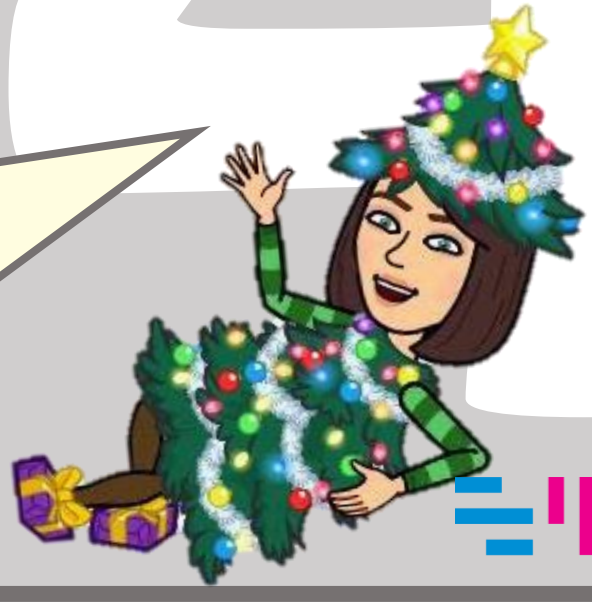
I know that if we work together we can sleigh this riddle before the end of the day!

When Santa Claus sets off from the North Pole on Christmas Eve, in which direction does he travel?

Alex is looking into the sounds of Christmas today and is wondering if you can conduct some experiments that will help her Jingle all the way into the festive season?

For this investigation you need an empty plastic cup, a jingle bell, tinsel, pom poms, bows and tissue paper.

One by one put the material in the cup with the bell and see what muffles the sound best.



Can I ent-ice you to help Hannah with this winter weather query? She wants to know the weather for the STEM Christmas night out next week. Can you help her Decode the message below?

101 0011 – 100 1110 – 100 1111 – 101 0111 – 101 1001
101 0011 – 100 1000 – 100 1111 – 101 0111 – 100 0101 – 101 1010 – 101 0011
101 0111 – 100 1001 – 101 0100 – 100 1000
101 0011 – 100 1111 – 100 1101 – 100 0101
100 1100 – 100 1001 – 100 0111 – 100 1000 – 101 0100
101 0111 – 100 1001 – 100 1110 – 100 0100

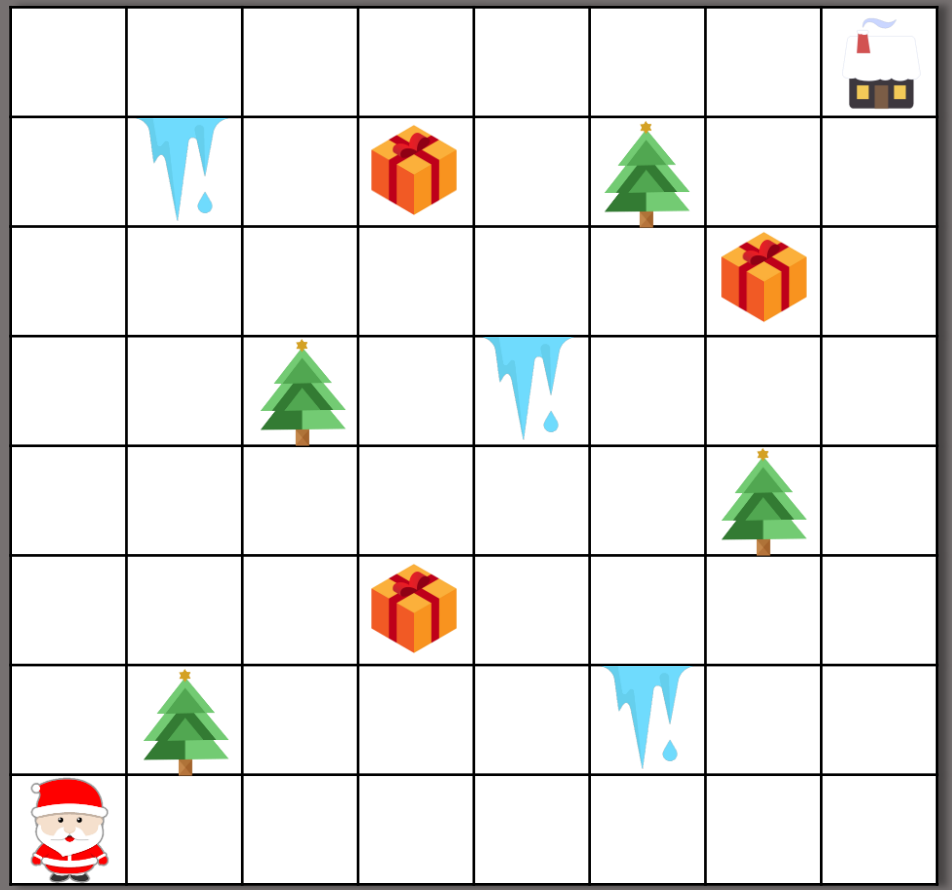
A	100 0001	H	100 1000	O	100 1111	V	101 0110
B	100 0010	I	100 1001	P	101 0000	W	101 0111
C	100 0011	J	100 1010	Q	101 0001	X	101 1000
D	100 0100	K	100 1011	R	101 1010	Y	101 1001
E	100 0101	L	100 1100	S	101 0011	Z	101 1010
F	100 0110	M	100 1101	T	101 0100	a	110 0001
G	100 0111	N	100 1110	U	101 0101	b	110 0010

Mark is helping Santa plot his flying course for Christmas eve... but he's having issues getting him there safely. Can you plot a course and save Christmas?

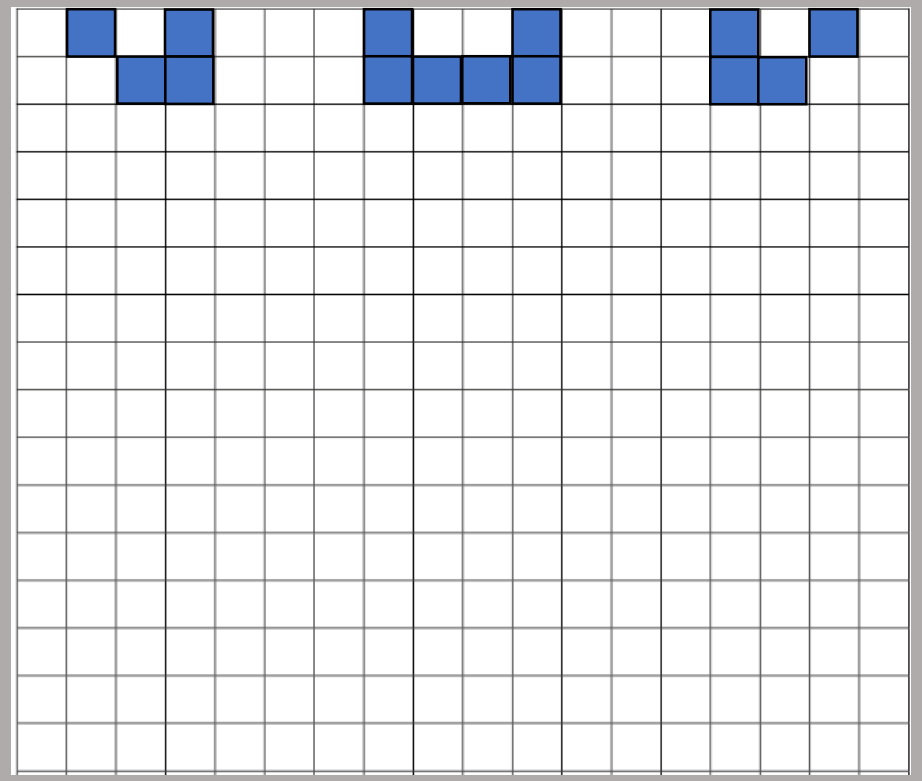
I'm trying to help Mr. Claus pick up all the presents and deliver them to the house without crashing into a tree or slipping on ice. Can you help me?

We can use these moves:

- **One box up**
- **One box down**
- **One box left**
- **One box right**



Alex is having a go at some festive image representation. A couple of lines have been done for you. Can you complete the rest?



1, 1, 1, 1, 3, 1, 2, 1, 3, 1, 1, 1
2, 2, 3, 4, 3, 2
1, 4, 3, 2, 3, 4
3, 3, 2, 2, 2, 3
4, 3, 1, 2, 1, 3
5, 8
1, 2, 3, 2, 2, 2, 3, 2
2, 6, 1, 2, 1, 6
2, 6, 1, 2, 1, 6
1, 2, 3, 2, 2, 2, 3, 2
5, 8
4, 3, 1, 2, 1, 3
3, 3, 2, 2, 2, 3
1, 4, 3, 2, 3, 4
2, 2, 3, 4, 3, 2
1, 1, 1, 1, 3, 1, 2, 1, 3, 1, 1, 1

Fill in the rows based on the numbers at the side and see what image it creates. The first number tells you how many blank spaces to leave, the next is how many to colour in.

Hannah has been learning some Scratch and decided to code herself a sandwich. She's got the commands but doesn't know the order... can you help her?

if Got ingredients then

go to Fridge

switch costume to Apron

go to Counter and make sandwich

if Hungry then

go to Kitchen

play sound Yummmmm...

say This tastes great

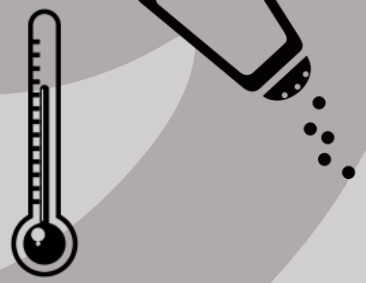
think Am I hungry?

when At fridge Take ingredients

when clicked

I'm a bit hungry and could sleigh a sandwich... but I'm not sure what order to put my scratch commands in.

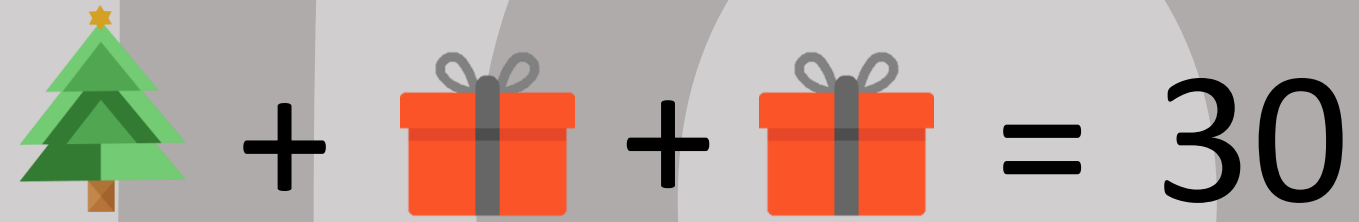
Mark has a great *seasonal* science experiment for you to try.
Instantly create your own ice!



Follow the instructions below to amaze your friends by turning water to ice instantly!

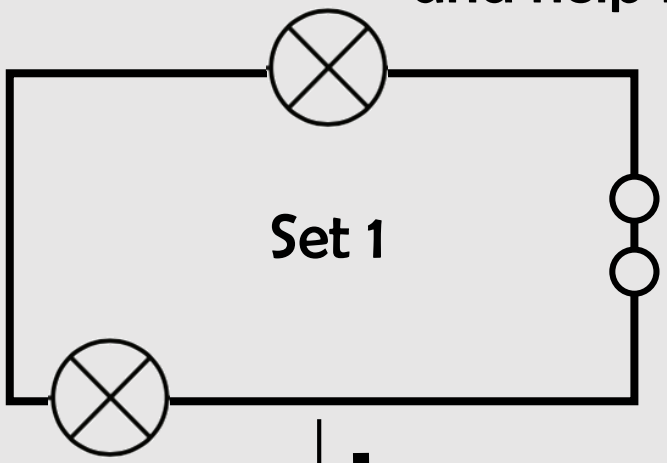
1. Fill large bowl to the brim with ice
2. Submerge two (already refrigerated) plastic bottles into the bowl
3. Pour generous amounts of rock salt into the bowl
4. Using a thermometer get the temperature in the bowl to -8°C
5. Take the bottle out the bowl and strike it against the table

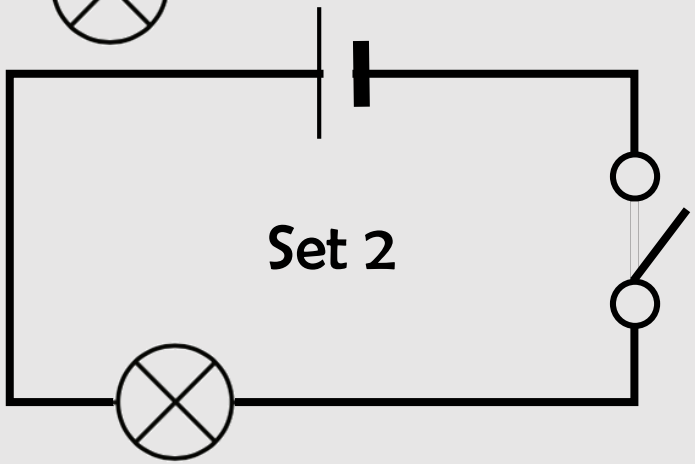
Alex is having a go at some seasonal maths puzzles. She's struggling a bit with the one below. Can you work it out?

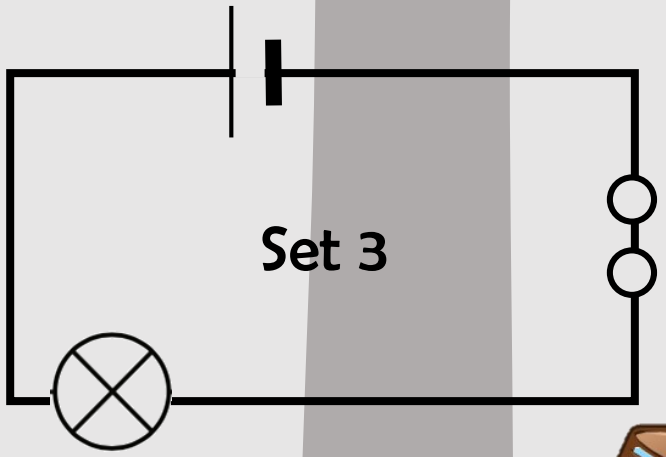


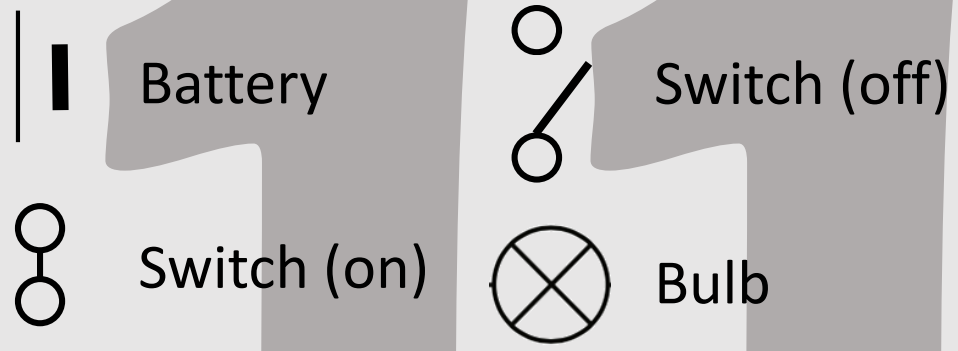
I know that I have all the information I need… I just can't work it out?

Hannah is about to buy a new set of fairy lights for her Christmas tree but only one of the sets in the shop works. Can you look at the 3 and help her choose the best option?







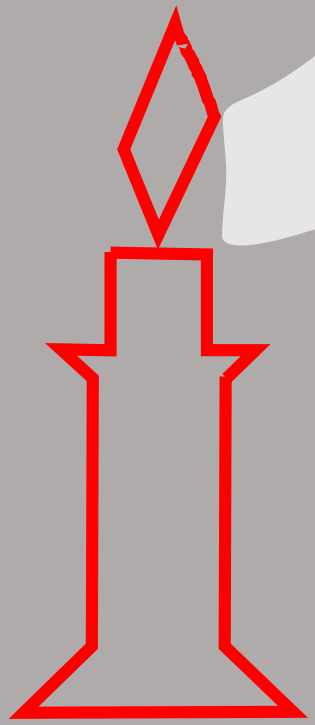


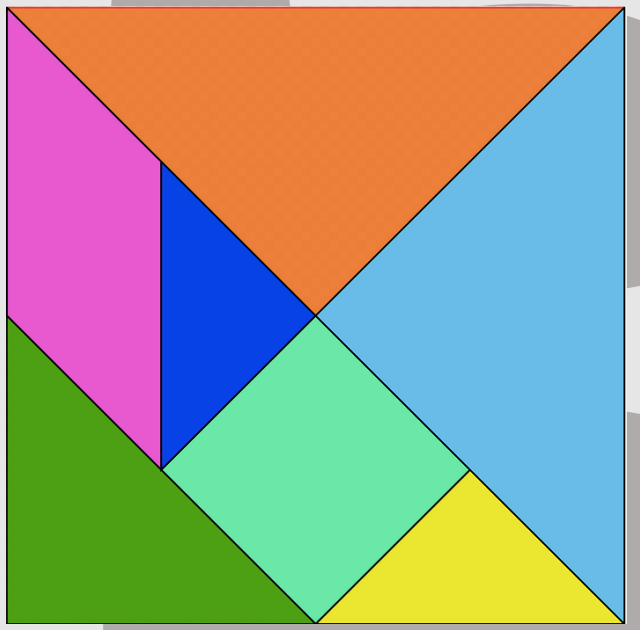
I can't make a mistake here because I can only afford one set... I've even supplied the symbols to help you!

At Christmas time Mark always loves a chocolate coin. He's been using them to work on his maths and spatial awareness. Can you change the direction by only moving 3 coins?

I've made the arrow point at the present but I'd like you to make the arrow point at the tree. You can only move 3 of the coins so no cheating!

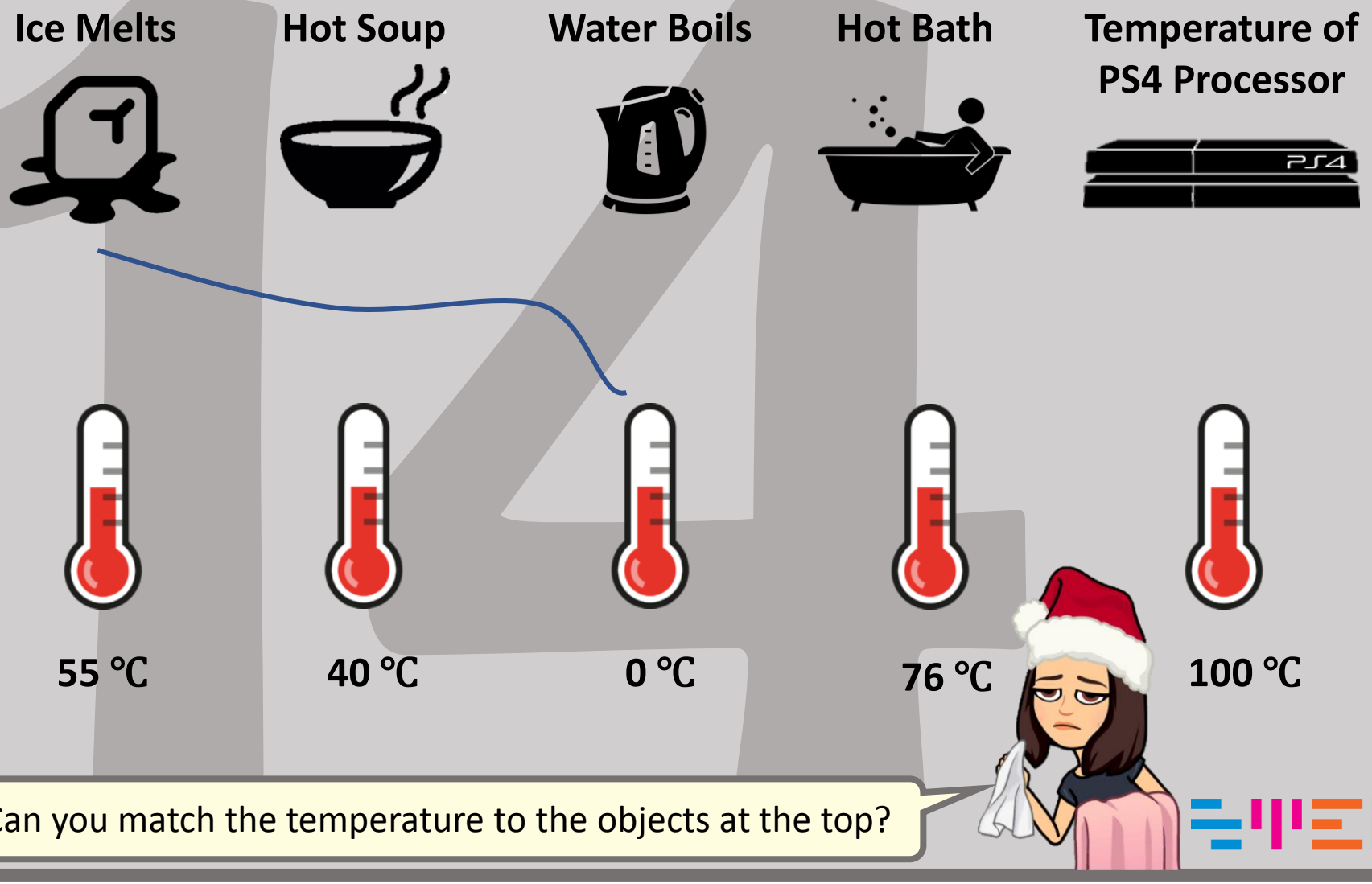
Alex is enjoying making some Christmas crafts this week. She's been working with coloured card to make tangrams of different shapes.



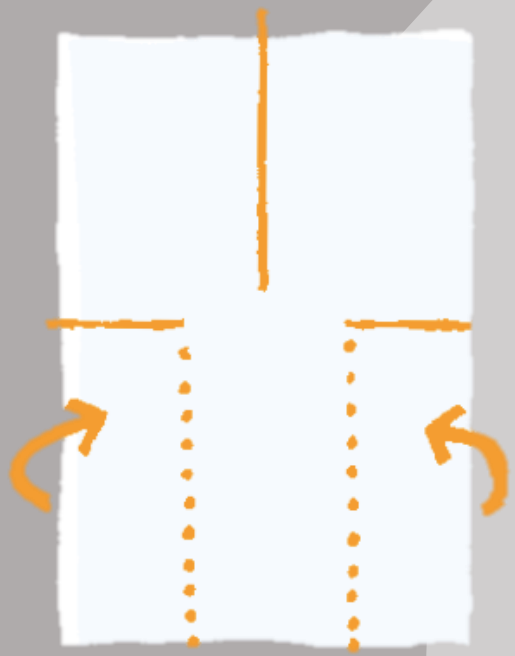


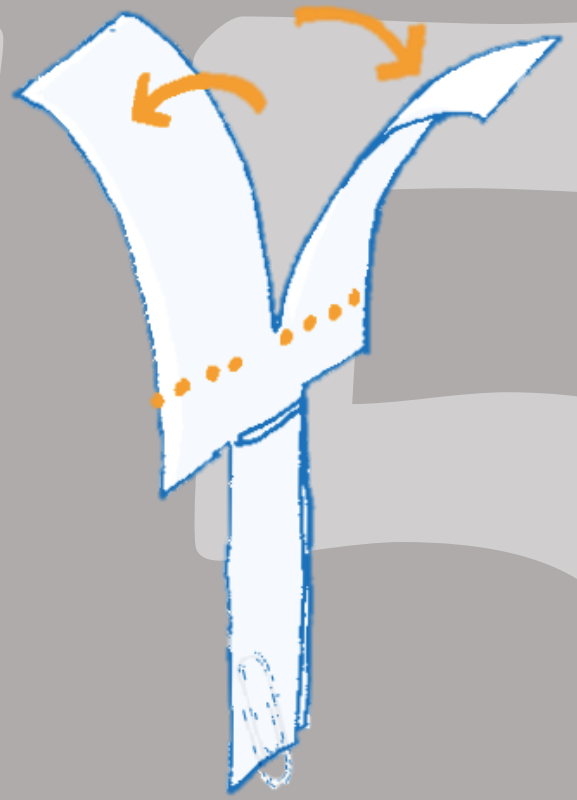
Can you rearrange the all 7 shapes inside the square to make a Christmas candle? I've even given you a template as a hint if you're struggling.

It's been so frosty this week Hannah's been putting the heating up to keep warm. It's got her thinking about temperature. Can you match the temp to the objects?



With all this cold weather it makes Mark want to jet set to a hotter climate. Today he's asking you to create your own helicopter using just paper, scissors and a paper clip.

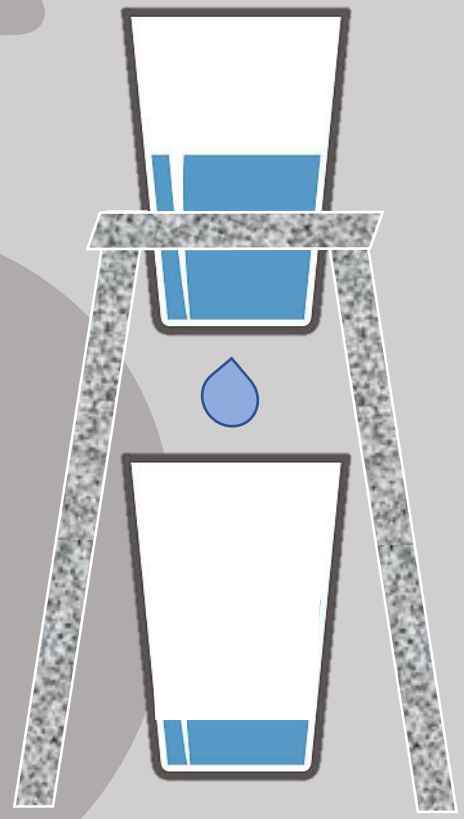




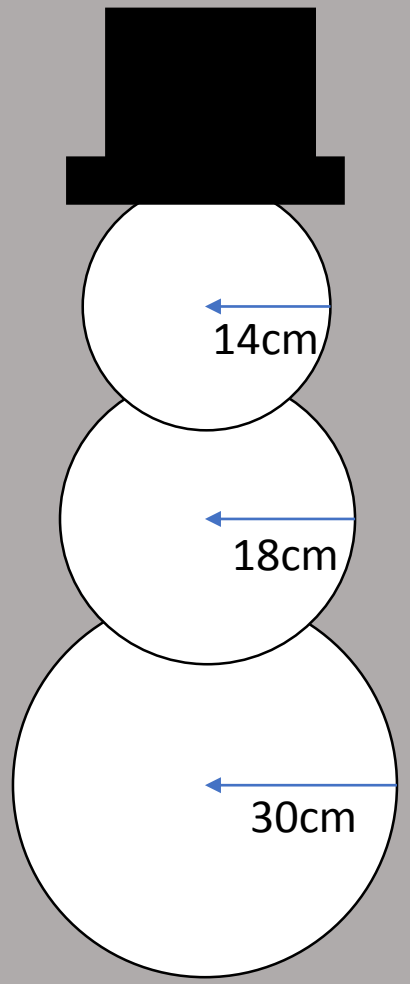
Lets get out of here by creating some spinning helicopters. Get yourself a piece of paper and make the cuts as suggested on the diagram. Fold as it says above and then attach a paper clip to the bottom. Throw it high in the air and watch what happens.

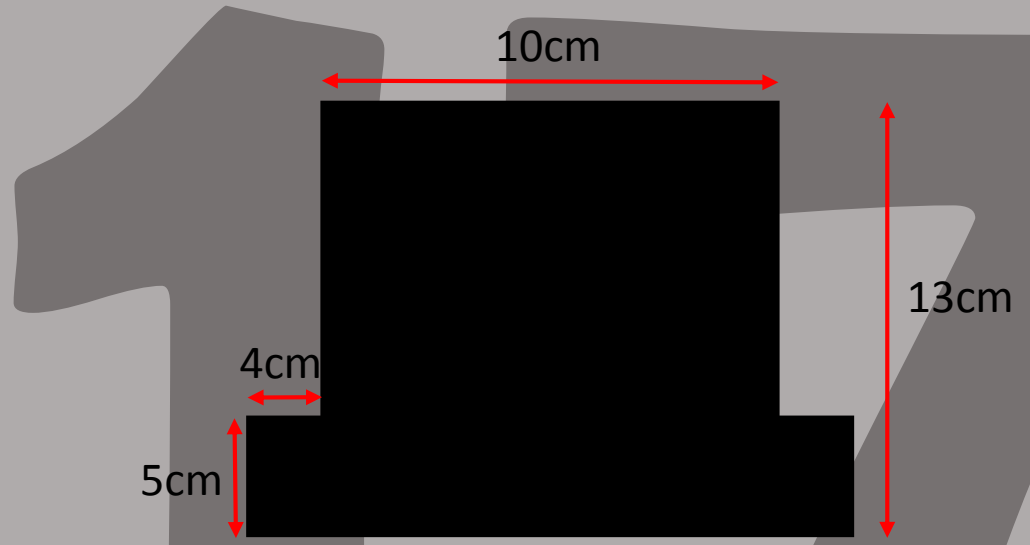
Alex can't wait for Christmas so she has made herself a water clock using some tinfoil, two plastic cups and some water. She wants the timer to be as close to 15mins as possible.

I've used tinfoil to suspend one cup directly about the other. I've punched a small hole in the top cup to allow the water to leak out into the one below. I would like the water to take as close to 15 minutes to drop down but I'm having difficulty managing. Can you do any better?



Hannah has been wanting to build a snowman this year but doesn't know if she's got enough room in the garden. Can you help her work out the area of her snowman?





Hmmm…. This one is giving me brain freeze. You find the area or a circle using the formula: $A = \pi r^2$ and the area of a rectangle using A=LxB.

Mark loves sitting next to the fire on cold Christmas nights but he has run out of fuel! The shopkeeper has what he needs but he doesn't know how to ask for it. Can you solve the riddle below and help Mark get some fuel for his fire?

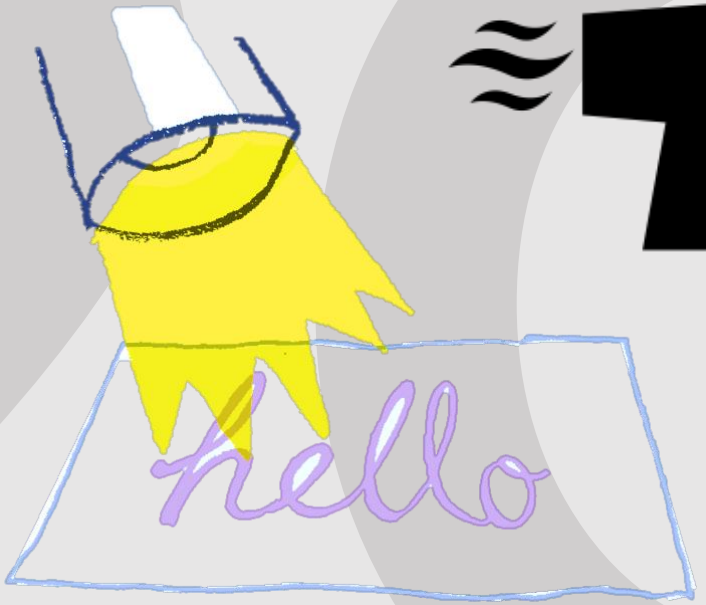
What is black when you buy it, red when you use it and gray when you throw it away?

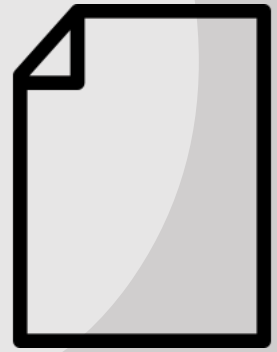
I am seriously freezing and this riddle really has me stumped. My warm and happiness relies on you so don’t leave me in the cold!

Alex is getting ready to throw a New Year party. She's bought some balloons but is struggling to blow them up herself. She has decided to use chemical reactions to help her. For this you need an empty 1 litre bottle, a balloon, white vinegar and some baking soda.

Empty the 1 litre bottle and pour about 120ml of white vinegar in. Next put 2 tablespoons of baking soda into the balloon. Stretch the opening of the balloon over the top of the bottle and make sure it's a tight fit (don't let the baking soda fall in yet). When you're ready hold the balloon upright to tip the baking soda into the bottle and watch as the chemical reaction inflates the balloon!

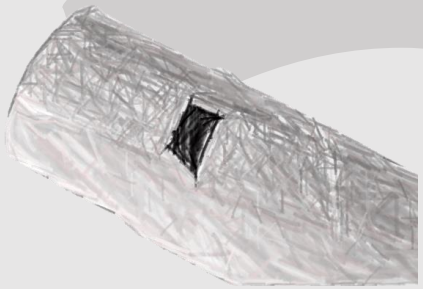
Hannah is looking for a more interesting way to write her letter to Santa this year. She has decided to use invisible ink so that no one else can read her note. She'd like you to write one too. You'll need a lemon, a paintbrush, paper, a few drops of water and a hairdryer.

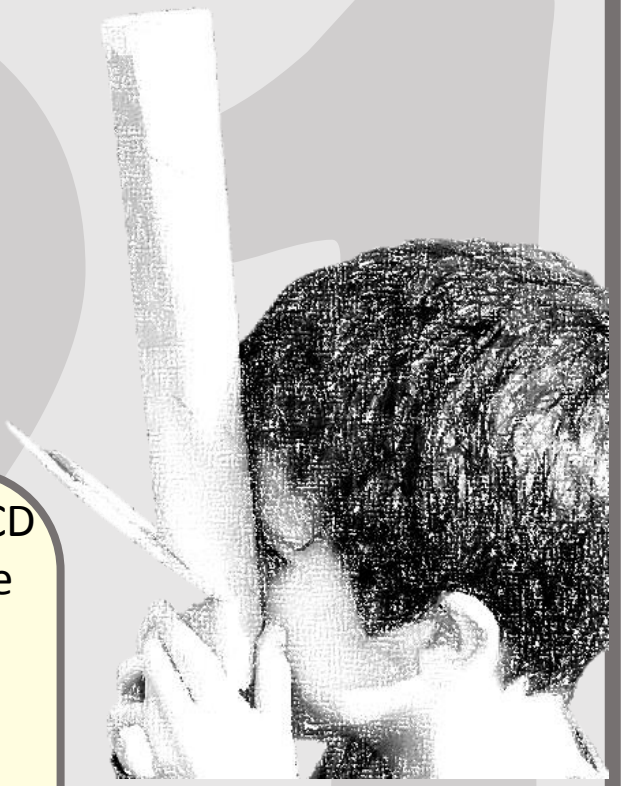




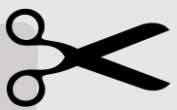
You'll need to mix some lemon juice with a few drops of water. Use a paintbrush to write your note to Santa on paper. When it dries it will disappear. Now heat the paper with a hairdryer and watch your message reappear!

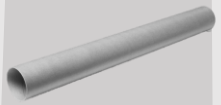
Mark is loving all the Christmas lights around Glasgow this month and wants to bring some of that festive cheer into the STEM Glasgow office. That's why he's going to make the team some spectroscopes so they can enjoy some colourful lights at their desk.



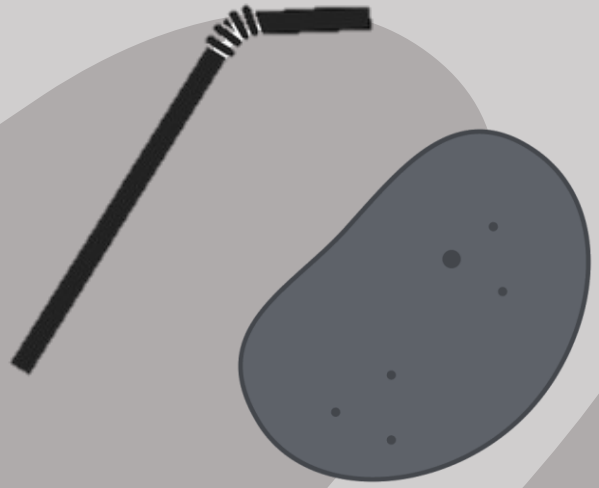


You'll need a an empty paper towel roll, an old CD and a pair of scissors or a cutting knife. First use the scissors to to cut a thin slit at a 45° angle toward the bottom of the cardboard tube. Directly across from the slit, make a small peephole or viewing hole using your scissors. At the top of the roll (opposite end from the slit and viewing hole) cover the end with some card or paper and cut a small rectangle. Put in the CD and test it out!





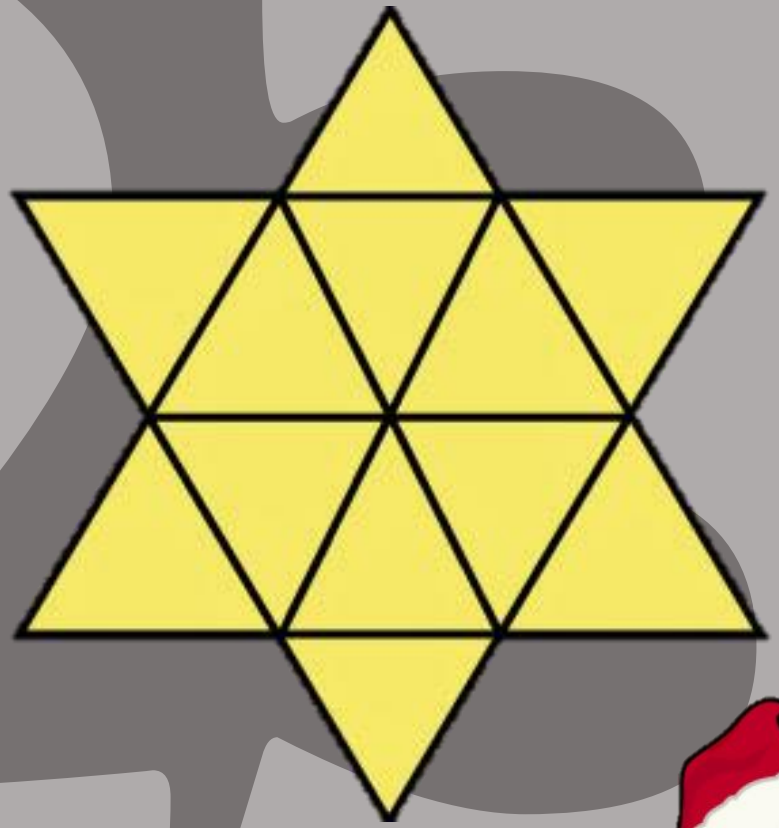
Alex is beginning to look at what food to buy in for Christmas dinner. She's been thinking about the best way to mash her potatoes and has decided to do an experiment with some straws. For this you'll need one raw potato and 2 stiff drinking straws.



I want to see if I can pierce through the potato with just a straw. Take the first straw and hold it by its sides without covering the top. Now try stabbing the potato. What happens?

Next take the second straw and hold it by its sides but also use a finger to cover the hole at the top. Stab the potato again. How was this result different from the first?

Hannah bought herself a new star for the top of her tree and she is mesmerised by the shapes inside. Can you have a closer look and work out how many triangles are inside the star?



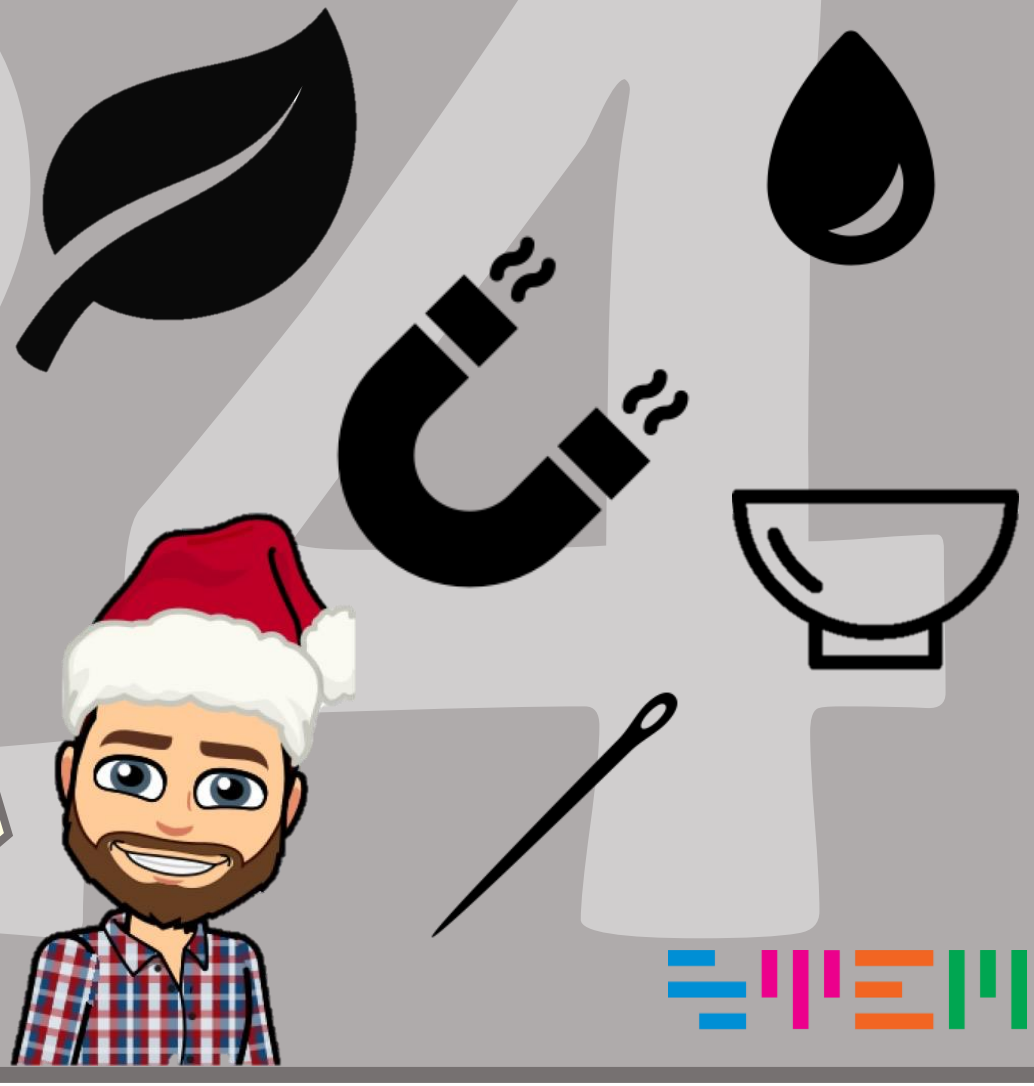
I got this new star for the top of my tree but I can't work out how many triangles are in it. Can you have a close look and let me know the answer?

Mark has volunteered to help Santa navigate his way around the world tonight. For this he needs a compass and Mark needs your to help make one. You'll need a bowl of water, a sewing needle, a magnet and a leaf.

Pressure is on to get this right or no one will get their presents tomorrow morning.

Take the magnet and rub it against one end sewing needle at least ten times (this magnetises it and will make it point north). Make sure to always rub it in the same direction.

Gently place the leaf in the bowl of water so that it floats on the top then carefully put the needle on top of the leaf. The needle will spin until the magnetised end points north.




Thank
You!

#STEMGlasgow

The STEM Glasgow team would like to wish you all a very Merry Christmas and a Happy New Year.

from

Mark, Alex and Hannah

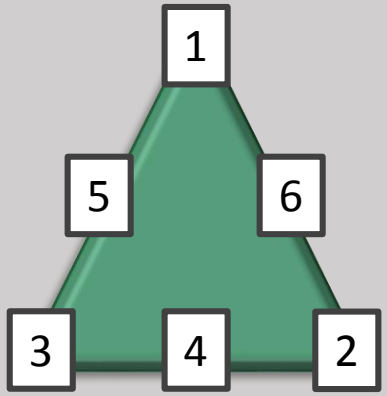
Answers

Challenge 1

A. N/A

Challenge 2

A.



Challenge 3

A. South. If Santa is a the top of the north pole he can only go south.

Challenge 4

A. N/A

Challenge 5

A. Snowy showers with some light wind.

Challenge 6

A. 14 moves is the fewest that can be made.

Challenge 7

A. Snowflake

Challenge 8

A. N/A

Challenge 9

A. N/A

Challenge 10

A. Tree = 20, Present = 5, Snowflake = 2
Equation = 30

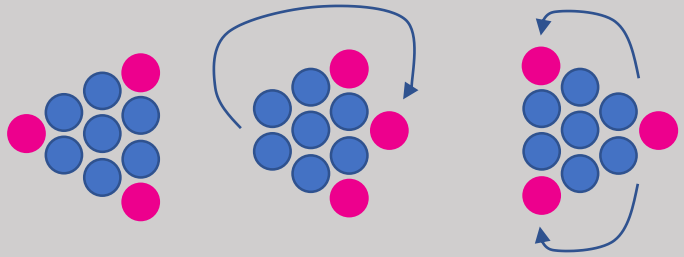
Answers

Challenge 11

A. Set 3

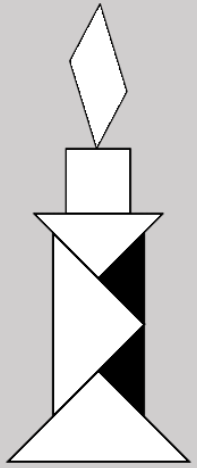
Challenge 12

A. Coins



Challenge 13

A.



Challenge 14

A. Ice Melting = 0℃
Bath = 40℃
PS4 = 40℃
Soup = 76℃
Kettle Boiling = 100℃

Challenge 15

A. N/A

Challenge 16

A. N/A

Challenge 18

A. 10 x 8 = 80 5 x 18 = 90
80 + 90 = 170cm² (Hat)

14 x ∏² = 1934
18 x ∏² = 3198
30 x ∏² = 8883

14014 + 170
= <u>14185cm²</u>

Answers

Challenge 18

A. Coal

Challenge 19

A. N/A

Challenge 20

A. N/A

Challenge 21

A. N/A

Challenge 22

A. N/A

Challenge 23

A. 20 triangles

Challenge 24

A. N/A