

Dr. Einstein's Medical Mystery

Description

Students complete a medical mystery. They must de-code the medical report (cryptography link), use the doctor's instructions to "diagnose" the patient using their sense of smell (cancer sniffer link) and then complete a marble maze challenge to get the "drugs" to the right "cell" (drugbot link)

Science Skills

Cryptography activities:

Analysing and Logical processes

Decoding

Diagnostic activities:

Categorizing and classifying

Predicting and observing

Drug Carrier activities:

Building models

Testing and Measuring

Outline

Time	Activity	Resources
5 minutes	Welcome Introduction to workshop leader Introduction to workshop	None
1 minute	Setting the Scene The group must solve a Medical Mystery – the doctor has sent all the information in a different language – the group must find out what is wrong to help the patient	None
10 minutes	The Medical Report Each family is given a copy of the medical report in code that they need to decipher.	Dr. Einstein's Medical Report – KS3
10 minutes	Smelling activities	Smell Balls Dr. Einstein's Smell Test –

Key Stage 3 Workshop

	Families examine nine different Smell Balls and fill in the Smell sheet. These answers provide a diagnosis, and will describe what to create in the last part of the workshop. Facilitators are encouraged to give clues if the family is having difficulty.	KS3
25 minutes	Marble maze Participants create a marble maze; testing and creating a path to move the drugs (the marble) to the right cell (set end point).	Marble maze kits: board, scrap bags
3 minutes	Wrap-up	

Introduction: 5 minutes

Welcome to Dr. Einstein's medical mystery! My name is X and I work here at X.

Before we get started here is some information about this room. (Toilets, fire exits, other safety information.)

The idea for this medical mystery came from the Move over Einstein exhibition. Who saw Move over Einstein on the exhibition floor? Great! Can someone tell me something that they tried at the exhibition?

We are going to try to solve a medical mystery today that is going to take ideas from three of the exhibits at Move over Einstein. After the workshop if you have time to go back to the exhibition, see if you can work out which ones they are.

Cryptography: 10 minutes

Let's get started.

We have a big problem, a great big mystery, and I'm going to need everyone here to work really hard together to help our friend, Norman Nano. He is really sick! His doctor, Dr. Einstein, sent over his medical files – but they are in another language! We need you to translate this medical report into words we understand, so we know how to help Norman Nano. The medical report will tell us how to work out what is wrong with Norman, and then how to help him. We are going to have to use the science that Einstein discovered to help us!

Is everyone ready?

After activity:

Great job everyone! So, who can tell me what the message was from Dr. Einstein? That's right. Now, what we just did was called CRYPTOGRAPHY. When you use cryptography, you need two things, a cipher, which is scrambled up, and a key, which helps you work things figure out. In our this mystery which sheet was the cipher? And which part was the key?

We use codes all the time in real life when we want information to be secret. Most of the time we don't even realise it. One example is when you buy something on the internet, your credit card

number is turned into a code so that other people can't use it to buy other things before it gets to the company.

Codes like this work the same way as the code we just used, but instead of using symbols the key is made up of complicated math problems.

If you go to the exhibit you can learn about how scientists are working on a key that isn't made of numbers, words or even math problems: it's made of light!

Albert Einstein worked to figure out that light can act as a particle and as a wave. We can observe a particle of light, but when we do we actually change it.

If you left at the room and I looked at this pencil, you would never know I had done that if you came back into the room later. That is because a pencil doesn't change if you look at it. But light does change if you look at it. It changes the way it acts.

Let's think about the code we you just used. If I left the room you could figure solve the code and write down the answer on a piece of paper and put it in your pocket. I would never know. But with a key made of light, I would know right away that someone had worked out the message, and that I needed to write a new message to send.

Smell Detection: 10-15 minute

Well, going back to our message from Dr. Einstein it looks like we need to do a smell test.

What we're going to do is fill out this smell sheet to find the secret word. Around the room I have put nine SMELL BALLS and they each have a different number. You need to go around the room and figure work out what each smell scent is and write the name of it by the right number on the sheet. If you need a hint or a clue, or maybe a bit of help with the spelling, find one of the workshop leaders.

If you don't get to finish all the smell balls, you might have a guess at what the secret word is anyway.

(form small groups and spread around the room to begin activity)

Well, you did some great detective work! You had to use your sense of smell to work out what was in each ball. People have a sense of smell, and so do animals. Put up your hands if you think that machines can smell things! Well – that was a tricky question, because there is a way that some machines can smell in a way, but it is very different to how we do.

It is called SPECTROSCOPY and it means that that machine uses chemistry to figure work out what is inside a material. A machine can even tellfigure out what is in a material you can't see – like your breath. Has anyone heard of a breathalyser? Do you know what they are used for? A breathalyser looks at all the different gases in a person's breath and determines if any of them are from alcohol.

Scientists have been working on a machine that works like a breathlyzer but looks for a chemical called ethane. Ethane is found near oil rigs, and it is a good way to search for new sources of oil. But then other scientists discovered that if ethane is found on the breath it can mean that a lot of cells have been dying. This could mean a lot of things, including that the patient has cancer. So this machine could help doctors see if patients have cancer and do more tests or give early treatments.

Drug Transporters (15-20 minutes)

So, who can tell me what the secret word was? That's right it was DRUG MOVER. What could that mean? It's actually another phrase for something that scientists are working on: "chemical carriers". A chemical carrier take a little bit of medicine and puts it in a tiny container that can move around the body. The chemical carrier is bounced around the body by a force called Brownian motion, and uses chemical signalling to know where it needs to go. It's like going through a maze with your eyes closed and listening to directions on what to do.

These machines are so small we couldn't see them with our eyes. That would be a pretty hard machine to make here in the workshop. Instead, we are going to help our patient by making our own drug mover.

This mover is going to be powered by an invisible force that is all around us. What is the name of the force that works on this ball if I drop it? That's right, it's called gravity. Our drug mover is going to be powered by gravity. We're going to build a model. Instead of a little bottle, or vial, of medicine, we're going to use a marble. Every group is going to get a model of Norman like this. Now your challenge is to move the medicine – the marble – from his mouth, to his feet, where it really hurts. You can use anything from your box to help you, and you can use blue tac to stick it on.

The challenge is to move the medicine from his mouth to his feet in exactly 10 seconds. Can you do it? Not nine seconds, or eleven seconds, but exactly 10 seconds. Let's see how you get on. I'll tell you when the time is up, and then we can have a competition with all of the skeletons!

Summary

Well done everyone. You've done a great job of working out this medical mystery using the cipher from Dr. Einstein's office, and decoding it using the key. You've found out a bit about how scientists are working on a key that is made of light instead of one you can write down on paper. Then the smell test helped work out the next step, but you used your noses instead of machines! Then you found out from the secret word that you needed to make a Drug Mover, and made some great models of how these tiny machines might work.

Workshop Materials

Resource name	Quantity
MDF boards with laminated image of skeleton	10
Marble maze plastic bags containing: <ul style="list-style-type: none"> ▪ Blu-tack ▪ Plastic Spools ▪ Marbles ▪ Scraps material 	10
Workshop smell balls including: <ul style="list-style-type: none"> ▪ Laminated number on side ▪ Smell sack (nylon, cotton) inside 	9
Plastic storage container with smell oils: <ul style="list-style-type: none"> ▪ Lavender ▪ Orange ▪ Coconut ▪ Ginger ▪ Cinnamon ▪ Almond ▪ Vanilla ▪ Lemon ▪ Strawberry 	1 box with 1 vial of oil per smell
Plastic storage container with replacement marbles.	
Plastic storage container with replacement plastic spools	
Large storage box for all materials	

Preparing the Workshop Materials

Cryptography Activity

Each student needs photocopies of each of the three worksheets:

- Dr. Einstein's Medical Report (cipher)
- Dr. Einstein's Medical Report (key)
- Dr. Einstein's smell test

Smell test Test Activity

The smell balls should be prepared prior to the workshop. The balls will hold their smells for approximately one week, at which point they should be refreshed.

To refresh the balls, open the plastic ball carefully using the opening. Wear plastic gloves to avoid contact with the smell oils. Remove the Smell sack and untie the nylon material. Remove the cotton pad and do not rinse or wash it. Pour a small amount of the appropriate oil onto the cotton. It should not be dripping, and you should be able to wring the cloth without squeezing out any liquid at all. Fold the cotton into a square and retie it in the nylon material.

Smell Ball Number	Smell Oil
1	Lavender
2	Orange
3	Coconut
4	Ginger
5	Cinnamon
6	Almond
7	Vanilla
8	Lemon
9	Strawberry

Marble Maze Activity

Prior to the workshop each of the activity bags should be checked for the appropriate materials. Ensure there is a sufficient amount of blue tac in the bag or on hand to pass to participants. If scrap materials have been lost or damaged you can fill the bag with additional pieces. Alternatively a scrap box can be used and participants can choose pieces as they need them.

Worksheet Answers

The Secret Message reads:

Thank you for your help. Please do a smell test to help the patient. Good luck from Dr. Einstein.

lavenDer
orangeorRangeoRange
coconUt
Ginger

cinnaMon
almOnd
Vanilla
IEmon
stRawberry

Secret Word: **DRUG MOVER**