Corby Technical School
Cambridge Technical Applied Science Transition Booklet

What is included:

- Book recommendations
- Movie recommendations
- Guidance on how to make notes
- Research activities
- **5 Week Transition Classes (topics and practice)**
- Ideas for day trips
- Science on social media
- Science Websites
- Science things to do

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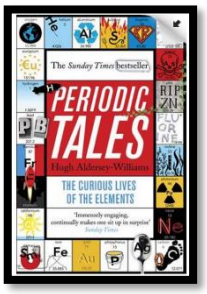
Book Recommendations

Periodic Tales: The Curious Lives of the Elements (Paperback) Hugh Aldersey-Williams

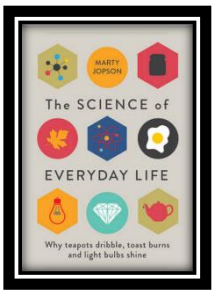


ISBN-10: 0141041455

http://bit.ly/pixlchembook1

This book covers the chemical elements, where they come from and how they are used. There are loads of fascinating insights into uses for chemicals you would have never even thought about.

The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine (Hardback) Marty Jopson



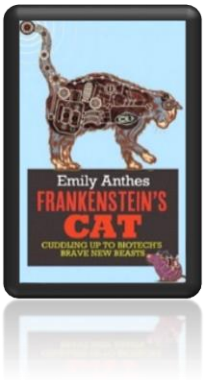
ISBN-10: 1782434186

http://bit.ly/pixlchembook2

The title says it all really, lots of interesting stuff about the things around you home!

An easy read.. Frankenstein's cat

Discover how glow in the dark fish are made and more great Biotechnology breakthroughs. Available at amazon.co.uk



Do not feel you need to buy the latest edition (unless you are doing Salters chemistry!) You can pick up an old edition for a few pounds on ebay, gives you a real insight into how chemistry is used to solve everyday problems from global pollution through feeding to world to making new medicines to treat disease.

Videos to watch online

Hopefully you'll get the opportunity to soak up some of the Sun's rays over the summer – synthesising some important Vitamin-D – but if you do get a few rainy days where you're stuck indoors here are some ideas for films to watch or clips to find online.

Science Fictions Films

1. **Moon (2009)**
2. **Gravity (2013)**
3. **Interstellar (2014)**
4. **The Imitation Game (2015)**
5. **The Prestige (2006)**

Online Clips / Series

1. **Minute Physics –** Variety of Physics questions explained simply (in felt tip) in a couple of minutes. Addictive viewing that will have you watching clip after clip – a particular favourite of mine is "Why is the Sky Dark at Night?"

   https://www.youtube.com/user/minutephysics

2. **Rough science – the Open University – 34 episodes available**

Real scientists are 'stranded' on an island and are given scientific problems to solve using only what they can find on the island.

Great fun if you like to see how science is used in solving problems.

There are six series in total

http://bit.ly/pixlchemvid1a

http://www.dailymotion.com/playlist/x2igjq_Rough-Science_rough-science-full-series/1#video=xxw6pr

or

http://bit.ly/pixlchemvid1b

https://www.youtube.com/watch?v=lUoDWAt259I

3. **Growing New Organs**

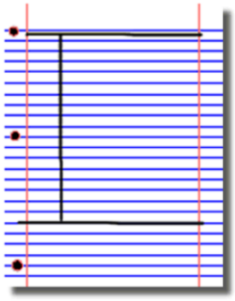
Available at:
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en

Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.

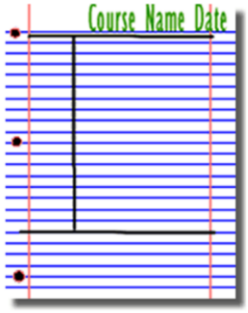
Research Activities

Research, reading and note making are essential skills for Applied Science study as the course work requires a lot of independent reading, planning and writing of scientific knowledge. For the following task you are going to produce 'Cornell Notes' to summarise your reading.

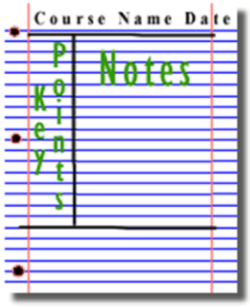
1. Divide your page into three sections like this



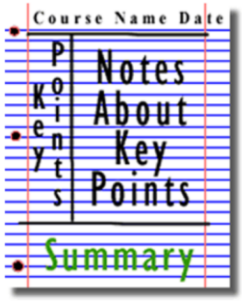
2. Write the name, date and topic at the top of the page



3. Use the large box to make notes. Leave a space between separate idea. Abbreviate where possible.



4. Review and identify the key points in the left hand box



5. Write a summary of the main ideas in the bottom space

Images taken from http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Biology Focus Research Tasks

The Big Picture is an excellent publication from the Welcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A level.
For each of the following topics, you are going to use the resources to produce one page of Cornell style notes.
Use the links of scan the QR code to take you to the resources.

BigPicture

Topic 1: The Cell
Available at: http://bigpictureeducation.com/cell
The cell is the building block of life. Each of us starts from a single cell, a zygote, and grows into a complex organism made of trillions of cells. In this issue, we explore what we know – and what we don't yet know – about the cells that are the basis of us all and how they reproduce, grow, move, communicate and die.

Topic 2: Populations
Available at: http://bigpictureeducation.com/health-and-climate-change
The Earth's climate is changing. In fact, it has always been changing. What is different now is the speed of change and the main cause of change – human activities. This issue asks: What are the biggest threats to human health? Who will suffer as the climate changes? What can be done to minimise harm? And how do we cope with uncertainty?

Chemistry Focus Research Tasks

Use your online searching abilities to see if you can find out as much about the topic as you can. Remember it you are a prospective A level chemist, you should aim to push **your** knowledge. Some starting points for your research have been provided to support.

You can make a 1-page summary for each one you research using Cornell notes:
http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Task 1: The chemistry of fireworks
What are the component parts of fireworks? What chemical compounds cause fireworks to explode? What chemical compounds are responsible for the colour of fireworks?

Task 2: Aspirin
What was the history of the discovery of aspirin, how do we manufacture aspirin in a modern chemical process?

Physics Focus Research Tasks

Task 1: https://phet.colorado.edu/en/simulations/category/html

PhET create online Physics simulations when you can complete some simple experiments online. Open up the resistance of a wire html5 simulation. Conduct a simple experiment and make a one page summary of the experiment and your findings.

Task 2: http://home.cern/about

CERN encompasses the Large Hadron Collider (LHC) and is the largest collaborative science experiment ever undertaken. Find out about it here and make a page of suitable notes on the accelerator.

Pre-Knowledge Topics

As part of the course, you will carry out a series of practical work as part of unit 2. Over the four weeks you will look at the science behind the various practical application of one of these practicals, chromatography.

Week 1 – Separating Techniques

Activity 1: Key terms definitions

Provide definitions for the following key terms:

The mobile phase

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The stationary phase

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Adsorbent

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Adsorption

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Thin layer chromatography

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Activity 2: What is chromatography?

Complete:

Chromatography is an analytical technique that separates components in a …… .

There are a few different types of chromatography but they all have two phases and work on the same principle.

They all have:

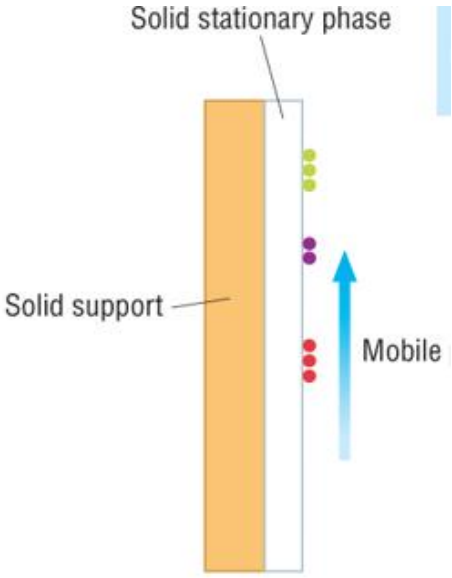
1. A …… phase which is fixed in place
2. A …… phase – which moves in a definite direction.

The two types of chromatography you need to know about are:

- Thin layer chromatography (TLC)
- Gas chromatography (GC)

Activity 3: How is separation achieved in a solid stationary phase?

Explain ***why*** and ***how*** the components in the mixture separate out as the mobile phase moves through the stationary phase in TLC (page 242)



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Notes: .....

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Activity 4: Carrying out TLC

Thin layer chromatography, TLC uses a TLC plate.

Describe a TLC plate.

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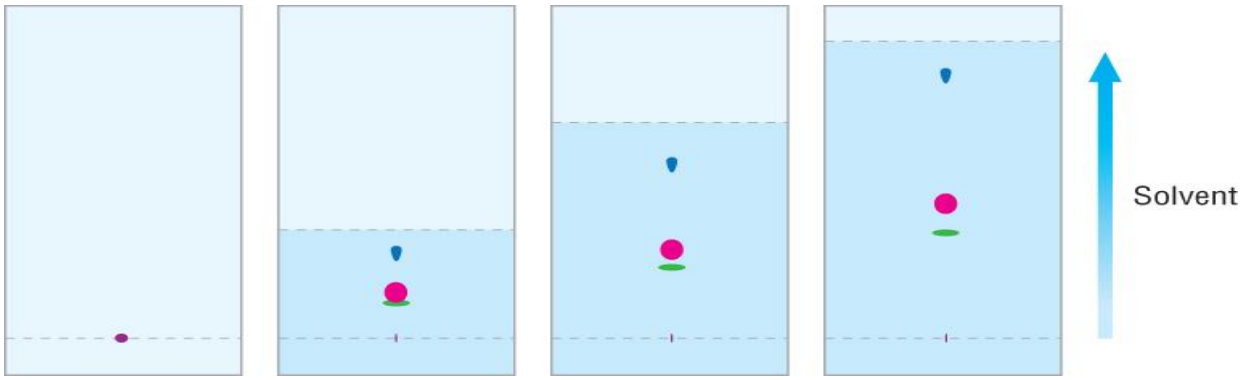
Carrying out TLC.

Describe how you would carry out TLC to analyse a mixture. Make sure you give detailed information about each of the Stages:

Stage 1: Preparing plate

Stage 2: Running and developing plate



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- If the components in a mixture are coloured, then they can be seen easily, but if the components are colourless, we need to use a *locating agent* to 'develop' the TLC plate
- If the substances in the mixture are colourless it is possible to make the spots visible by reacting them with something which produces a coloured product. Solution of Ninhydrin can be used to show amino acids (coloured compounds are formed when ninhydrin reacts with amino acids).
- Fluorescence added to the stationary phase-shining UV light – no glow where the spots are.

Activity 5: Interpretation of a TLC plate ; Rf values

- The R_f value can be calculated using the formula:

$$R_f = \frac{\text{distance moved by the ……}}{\text{distance moved by the ……..}}$$

- The R_f value for a given substance under exactly the same conditions (temperature, the exact composition of the solvent, type of stationary phase,) would always be the same.
- By comparing R_f values from an experiment with tables of known R_f values we can identify the unknown substance.
- A chromatogram can be run with samples of known substances alongside the mixture. It is easy to identify a component by comparing the distances travelled by the components and the known substance.

Activity 6 : Limitations of TLC

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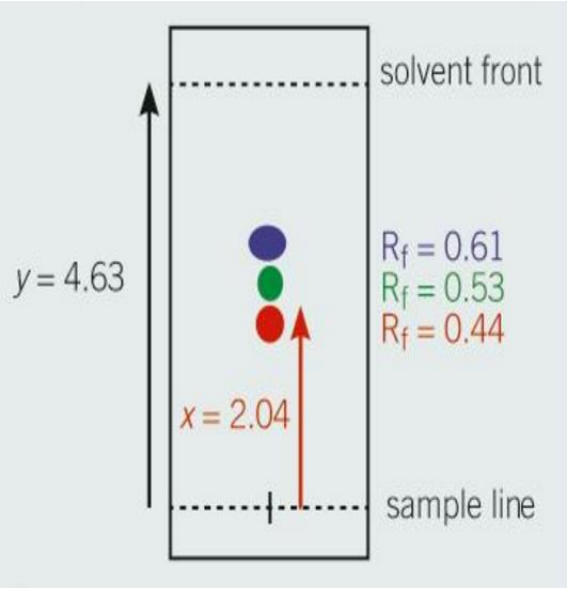
Activity 7 : Checking your learning/Homework



Show how the following R_f values were obtained

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Use the values for R_f values for six amino acids given below to identify the three amino acids present in the mixture.

Table 1 *R_f values for six amino acids*

Amino acid	R_f value
alanine	0.33
aspartic acid	0.24
valine	0.44
leucine	0.61
cysteine	0.37
isoleucine	0.53

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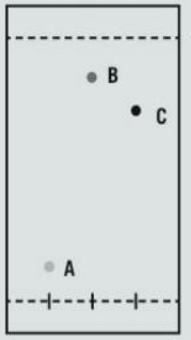
3 The thin layer chromatography plate shown below has a polar stationary phase. It was developed using hexane as the solvent.



Which sample has the most polar molecules?

A sample A

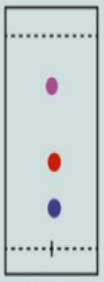
B sample B

C sample C

D There is not enough information to determine which sample has the most polar molecules. *(1 mark)*

Summary question 2 page 247 – check your answer.

2 A sample of paint was analysed by TLC. The TLC plate is shown below. Calculate the R_f values for the components in the paint.



▲ **Figure 10** *A TLC plate for a sample of paint*

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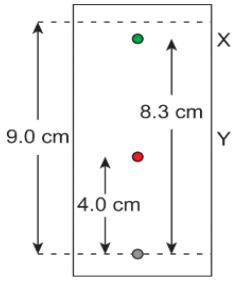
Question

A thin layer chromatogram (TLC) is shown below for a simple mixture:



The solvent used in the chromatogram was hexane. Two dyes were found and labelled **X** and **Y**.

Which answer best describes the R_f values and the relative solubilities in hexane of the two pigments in the sample?

- The R_f value for **X** is 0.92.
  The R_f value for **Y** is 0.40.
  Y is less soluble in hexane.
- The R_f value for **X** is 0.40.
  The R_f value for **Y** is 0.83.
  Y is less soluble in hexane.
- The R_f value for **X** is 0.44.
  The R_f value for **Y** is 0.92.
  Y is less soluble in hexane.
- The R_f value for **X** is 0.83.
  The R_f value for **Y** is 0.40.
  Y is less soluble in hexane.

Question

1 A substance, X, has been identified as part of a mixture. When a TLC plate is run in a solvent at 20 °C, the R_f value of X was found to be 0.86.

When a TLC plate was run under identical conditions, it was found that the distance moved by the solvent front was 9.2 cm. Calculate the distance moved by X on this chromatogram.

Answer

Step 1 Write the equation used to calculate the R_f value.

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Step 2 Rearrange the equation to find the distance moved by the spot.

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Question.

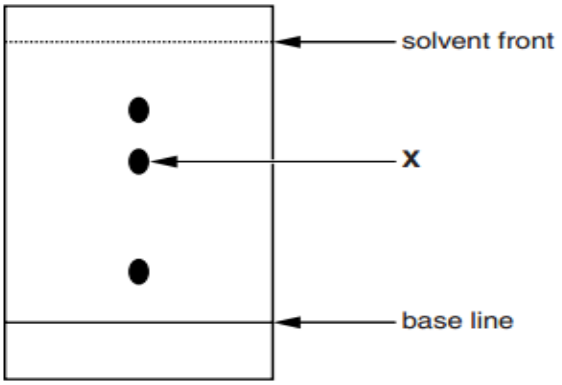
(b) The student then hydrolysed a section of sericin protein. She analysed the amino acids formed using Thin-Layer Chromatography (TLC).

(i) Name the process by which TLC separates amino acids.

..... **[1]**

(ii) The chromatogram the student obtained, and a table of R_f values for amino acids, are shown below.

Estimate the R_f value for the amino acid found at **X**. Hence identify the amino acid found at **X**.



Amino acid	R_f value
alanine	0.38
aspartic acid	0.15
glycine	0.26
leucine	0.75
methionine	0.58
threonine	0.35

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..... **[2]**

Week 2 – DNA

Chromatography can be used to separate strands of DNA, Deoxyribose Nucleic Acid, is a polymer made up a pentose sugar molecule, phosphate group and four nitrogenous bases and is consider the unit of hereditary information.

DNA in its simplest purpose codes to produce protein molecules, which in turn define the characteristic of an organism.

Watch this video on the structure of DNA:

https://www.youtube.com/watch?v=T6_wKPAbf2k&ab_channel=Cognito

DNA can be extracted through a simple procedure, this can the be used is a series of practical procedures

Watch this video on extracting DNA:

https://www.youtube.com/watch?v=RtTZNTil4Tw&ab_channel=FuseSchool-GlobalEducation

Task:

1. Draw and Label a DNA nucleotide

2. Draw and Label a strand of DNA

3. A template strand of DNA is 5'3' TACCGATTGCA 5'3, What is the complementary DNA strand that is created from this template during replication?

4. Write a simple method for the process of extracting DNA

Week 3 – Proteins and Amino acids

As stated last week DNA codes for proteins. Proteins are polymers of amino acid molecules. The order of the amino acids defines the protein and its function.

Watch this video on the process of protein synthesis:

https://www.youtube.com/watch?v=oefAI2x2CQM&ab_channel=AmoebaSisters

Once proteins are made, they need to be folded into specific shapes based on the amino acid sequences.

Watch this video about the structure of proteins

https://www.youtube.com/watch?v=hok2hyED9go&ab_channel=AmoebaSisters

Task:

1. Outline the process of protein synthesis including the process of transcription and translation. Make sure you comment of the role of each molecule present. (you may want to draw diagrams to help).
    - Transcription:
    - Translation:
2. Describe the primary, secondary, tertiary, and quaternary structures of a protein molecule. (you may want to draw diagrams to help).
    - Primary:
    - Secondary:
    - Tertiary:
    - Quaternary:

Week 4 – Leaf structure and Chlorophyll

Another use of chromatography is to separate and identify different light absorbing pigments in plant leaves, such as chlorophyll.

Chlorophyll is a light absorbent pigment found in the chloroplasts of most plant cells and is typically associated with the colour green.

Watch this video on the structure of a leaf:

https://www.youtube.com/watch?v=oT4jvKRYBjA&ab_channel=Cognito

Watch this video on the different leaf pigments and light:

https://www.youtube.com/watch?v=dwz3qozDiyI&ab_channel=Teacher%27sPet

Task:

1. Draw and label a cross section of a leaf.

2. For each part of the leaf, you have labelled explain its function and link this to it structure.

3. Explain why most leaves appears green.

4. Explain why a leaf might contain more than one light absorbing pigment.

Places to visit

1. Go outdoors!
   Have you actually spent any time observing the geology of the area you live in? What rocks or minerals are found in your area? Does your area have a history of extracting minerals? If so what were they, what were they used for, how did they obtain them? Are there any working or remains of mineral extraction industries?

2. Are there any chemical or chemistry based businesses in your area? A big ask, but one that could be really beneficial to you, write them a letter explaining that you are taking A level chemistry and you want to see how chemistry is used in industry and you would like to visit / have some work experience. You never know this could lead to great things!!!!

3. Science museums.
   You could visit your nearest science museum. They often have special exhibitions that may be of interest to you.
   https://en.wikipedia.org/wiki/List_of_science_museums#United_Kingdom

   or

   

   https://www.sciencemuseum.org.uk/virtual-tour-science-museum

4. The UK Association for Science and Discovery Centres (ASDC)
   This association brings together over 60 major science engagement organisations in the UK.
   http://sciencecentres.org.uk/centres/weblinks.php

5. Royal Observatory – London - Visit the Royal Observatory Greenwich to stand on the historic Prime Meridian of the World, see the home of Greenwich Mean Time (GMT), and explore your place in the universe at London's only planetarium.

6. Herschel Museum of Astronomy – Bath – As you walk around the picturesque Roman city – take an hour or two out at the home of one of the great scientists – discoverer of Infra-red radiation and Uranus.

7. @Bristol – Bristol - home to the UK's only 3D Planetarium and one of the biggest science centres.

8. Center of the Cell – whitechapel, London the first science education centre in the world to be located within working biomedical research laboratories.

9. Royal Botanic Gardens, Kew - Science has always been at the heart of Kew. Our research, partnerships and collections contribute to some of the most important issues facing our planet.