PiXL

Gateway: Progression

- OCR CAMBRIDGE TECHNICALS SCIENCE

Contents:

The Perfect Vocational Student?

List 10 skills or qualities that you will need to demonstrate to be 'the perfect vocational student'.

1
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The BTEC course you are about to embark on will enable you to discover different ways of studying and learning. For example:

Teaching and Learning styles

- Group/Pair work Discussions
- Class debates
- Student presentations
- Research Projects
- Media – film / music / interactive websites
- Role play
- Replication of studies

- Independent study/reading
- Extended writing
- Quizzes and games

To get you in the habit, choose one of the above and come back in September with an example of how you have done it. For example, you may make a short film about your summer or research something that you are interested in.

Below, explain in more than 100 words what you are going to do.

Organisation is the Key to Good Study Skills

How to be organised:

- Number and date all of your notes and handouts to keep them in order.
- Use a folder and file dividers to separate each unit for coursework.
- Take responsibility for catching up if you miss a lesson due to illness. Find the resources that you missed and also photocopy a friend's written notes.
- Check the relevant section in the textbooks and make extra concise notes if it improves your understanding. If you don't feel confident about a particular area, consult your teacher. Never be afraid to ask for help if you don't understand.
- Always come prepared to class, bringing course handbook, writing equipment, class notes from previous lessons, diaries etc.
- If at any point you feel overwhelmed by the work – call for help – wave – don't drown!

Watch this video:

https://www.youtube.com/watch?v=Nk2MBb96RJo

Over the summer break start thinking about how you will implement these Top 10 Tips and ensure that you have but everything you need in place for September.

Below write down the 3 you most need to focus on:

1.

2.

3.

Assignment Action Plan Proforma

Before starting each new assignment it is important that you think carefully about how you will complete your work to the highest standard you can, whilst always meeting the given deadlines. Answer the following questions – use the answers as a guide.

In summary, what do I need to do for each task? Talk about each individual task.	
When do you plan to start the tasks for this assignment?	
When do you plan to finish each of the tasks?	
Are there any words you don't understand from your assignment brief or from the lessons?	
How often will you review your work with your tutor?	
What is your final deadline?	
How will you check your work is written well and is accurate?	

Ask your teacher for a mock assignment in the vocational area you are studying. Over the summer break, fill in this action plan as if this was the real thing. Good habits lead to success and getting used to planning this out will really help.

Key Words in Vocational Assignments!

Understanding the command words for different levels is vitally important for success. Below are sample words that may be used in assignments for the different levels. Fill in the definition of these words on the right-hand side on the table for Pass, Merit and Distinction.

Key Words for a Pass

Complete	
Demonstrate	
Describe	
Identify	
List	
Name	
Outline	
State	

Key Words for a Merit

Analyse	
Comment on	
Compare & Contrast	
Describe	
Explain	
Justify	
Assess	
Discuss	

Key Words for a Distinction

Analyse	
Evaluate	
Justify	
Recommend	
Draw conclusions	

Movie Recommendations

If you have 30 minutes to spare, here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link or scan the QR code to

What Doctors Don't Know About the
Drugs They Prescribe

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

When a new drug gets tested, the results of the trials should be published for the rest of the medical world — except much of the time, negative or inconclusive findings go unreported, leaving doctors and researchers in the dark.

How Spectroscopy Could Reveal Alien Life
Available at :
https://www.ted.com/talks/garik_israelian_what_s_inside_a_star
Garik Israelian is a spectroscopist, studying the spectrum emitted by a star to figure out what it's made of and how it might behave. It's a rare and accessible look at this discipline, which may be coming close to finding a planet friendly to life.

The fascinating physics of everyday life Available at : https://www.ted.com/talks/helen_czerski_fun_home_experiments_that_teach_you_physics?language=en

Physicist Helen Czerski presents various concepts in physics you can become familiar with using everyday things found in your kitchen.

Research Activities

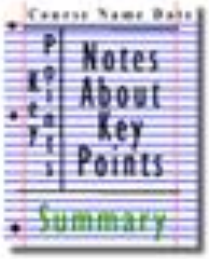
Research, reading and note making are essential skills for vocational science study. For the following task, you are going to produce 'Cornell Notes' to summarise your reading.

1. Divide your page into three sections like this

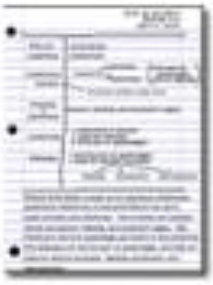
2. Write the name, date and topic at the top of the page

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

Research Activities

Vocational Science A-level will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying:

Biology Cells

The cell is a unifying concept in biology, you will come across it many times during your two years of A level study. Prokaryotic and eukaryotic cells can be distinguished on the basis of their structure and ultrastructure. In complex multicellular organisms, cells are organised into tissues, tissues into organs and organs into systems. During the cell cycle genetic information is copied and passed to daughter cells. Daughter cells formed during mitosis have identical copies of genes while cells formed during meiosis are not genetically identical.

Read the information on these websites (you could make more Cornell notes if you wish): http://www.s-cool.co.uk/a-level/biology/cells-and-organelles
http://www.bbc.co.uk/education/guides/zvjycdm/revision

And take a look at these videos:
https://www.youtube.com/watch?v=gcTuQpuJyD8
https://www.youtube.com/watch?v=L0k-enzoeOM
https://www.youtube.com/watch?v=qCLmR9-YY7o

Task:

Produce a one page revision guide to share with your class in September summarising one of the following topics: Cells and Cell Ultrastructure, Prokaryotes and Eukaryotes, or Mitosis and Meiosis.

Whichever topic you choose, your revision guide should include:

- Key words and definitions
- Clearly labelled diagrams
- Short explanations of key ideas or processes.

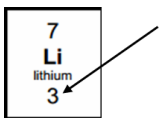
Chemistry Electronic structure, how electrons are arranged around the nucleus

A periodic table can give you the proton / atomic number of an element, this also tells you how many electrons are in the atom.

You will have used the rule of electrons shell filling, where:

The first shell holds up to 2 electrons, the second up to 8, the third up to 8 and the fourth up to 18 (or you may have been told 8).

Atomic number =3, electrons = 3, arrangement 2 in the first shell and 1 in the second or Li = 2,1



At A level you will learn that the electron structure is more complex than this and can be used to explain a lot of the chemical properties of elements.

The 'shells' can be broken down into 'orbitals', which are given letters: 's' orbitals, 'p' orbitals and 'd' orbitals.

You can read about orbitals here:

http://bit.ly/pixlchem1
http://www.chemguide.co.uk/atoms/properties/atomorbs.html#top

Now that you are familiar with s, p and d orbitals try these problems. Write your answer in the format: 1s2, 2s2, 2p6 etc.

Q1. Write out the electron configuration of:

a) Ca b) Al c) S d) Cl e) Ar f) Fe g) V h) Ni i) Cu j) Zn k) As

Q2. Extension question, can you write out the electron arrangement?

Chemistry Titrations

One key skill in Vocational Science is the ability to carry out accurate titrations. You may well have carried out a titration at GCSE, at A level you will have to carry them out very precisely **and** be able to describe in detail how to carry out a titration.

You can read about how to carry out a titration here, the next page in the series (page 5) describes how to work out the concentration of the unknown.

http://bit.ly/pixlchem11
http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/further_analysis/analysing_substances/revision/4/

Remember for any titration calculation you need to have a balanced symbol equation; this will tell you the ratio in which the chemicals react.

E.g. a titration of an unknown sample of sulfuric acid with sodium hydroxide.

A 25.00cm^3 sample of the unknown sulfuric acid was titrated with 0.100$moldm^{-3}$ sodium hydroxide and required exactly 27.40cm^3 for neutralisation. What is the concentration of the sulfuric acid?

Step 1: the equation $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Step 2: the ratios 2 : 1

Step 3: how many moles of sodium hydroxide 27.40cm^3 = 0.0274dm^3 number of moles = c x v = 0.100 x 0.0274 = 0.00274 moles

step 4: using the ratio, how many moles of sulfuric acid

for every 2 NaOH there are 1 H_2SO_4 so, we must have 0.00274/2 =0.00137 moles of H_2SO_4

Step 5: calculate concentration. concentration = moles/volume in dm^3 = 0.00137/0.025 = ***0.0548 moldm^{-3}***

Here are some additional problems which are harder, ignore the questions about colour changes of indicators.

http://bit.ly/pixlchem12

http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.htm

Use the steps on the last page to help you.

Q1. A solution of barium nitrate will react with a solution of sodium sulfate to produce a precipitate of barium sulfate. $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$

What volume of 0.25$moldm^{-3}$sodium sulfate solution would be needed to precipitate all of the barium from 12.5cm^3 of 0.15 mol dm^{-3} barium nitrate?

Physics Recording Data

Whilst carrying out a practical activity you need to write all your raw results into a table. Don't wait until the end, discard anomalies and then write it up in neat.

Tables should have column heading and units in this format quantity/unit e.g. length /mm

All results in a column should have the same precision and if you have repeated the experiment you should calculate a mean to the same precision as the data.

Below are link to practical handbooks so you can familiarise yourself with expectations.

http://filestore.aqa.org.uk/resources/physics/AQA-7407-7408-PHBK.PDF http://www.ocr.org.uk/Images/295483-practical-skills-handbook.pdf
http://www.ocr.org.uk/Images/295483-practical-skills-handbook.pdf

Below is a table of results from an experiment where a ball was rolled down a ramp of different lengths. A ruler and stop clock were used.

Task: Identify the errors the student has made.

	Time			
Length/cm	**Trial 1**	**Trial 2**	**Trial 3**	**Mean**
10	1.45	1.48	1.46	1.463
22	2.78	2.72	2.74	2.747
30	4.05	4.01	4.03	4.03
41	5.46	5.47	5.46	5.463
51	7.02	6.96	6.98	6.98
65	8.24	9.68	8.24	8.72
70	9.01	9.02	9.0	9.01

Physics Graphs

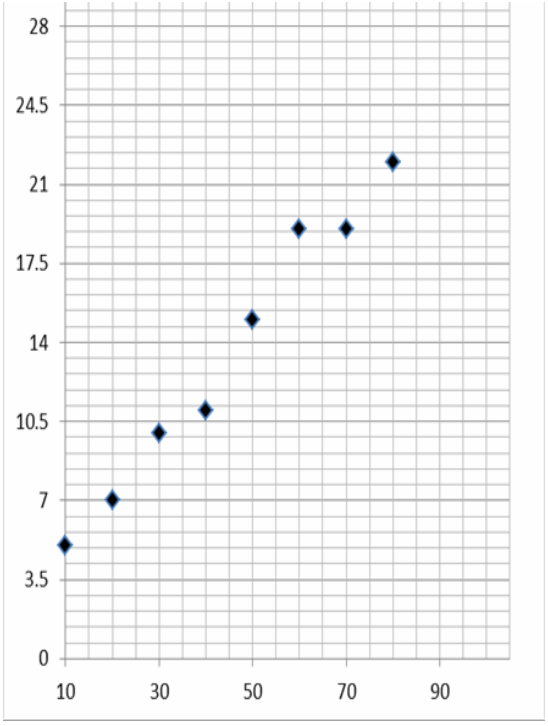
After a practical activity the next step is to draw a graph that will be useful to you. Drawing a graph is a skill you should be familiar with already but you need to be extremely vigilant at A level. Before you draw your graph to need to identify a suitable scale to draw taking the following into consideration:

- the maximum and minimum values of each variable
- whether 0.0 should be included as a data point; graphs don't need to show the origin, a false origin can be used if your data doesn't start near zero.
- the plots should cover at least half of the grid supplied for the graph.
- the axes should use a sensible scale e.g.

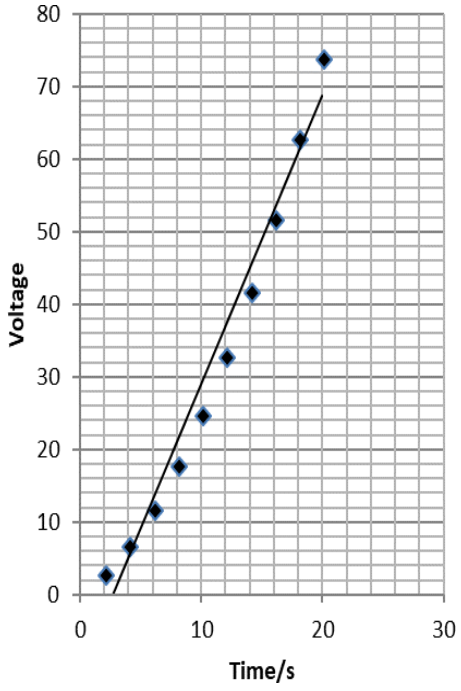
multiples of 1,2, 5 etc) Identify how the

following graphs could be improved

Graph 1



Graph 2



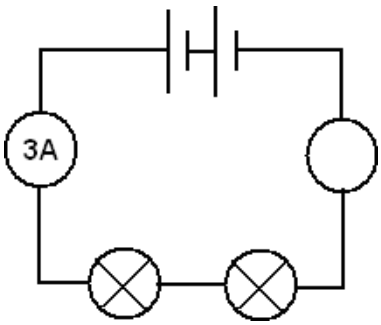
Physics Electricity

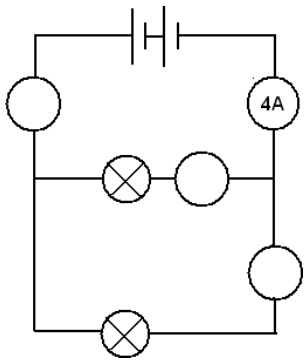
At A level you will learn more about how current and voltage behave in different circuits containing different components. You should be familiar with current and voltage rules in a series and parallel circuit as well as calculating the resistance of a device.

http://www.allaboutcircuits.com/textbook/direct-current/chpt-1/electric-circuits/
http://www.physicsclassroom.com/class/circuits

Task:

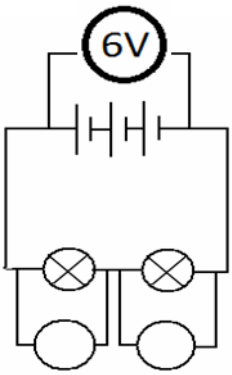
1a) Add the missing ammeter readings on the circuits below.

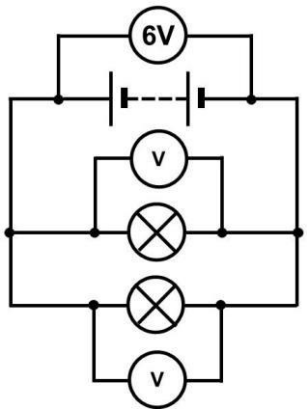




b) Explain why the second circuit has more current flowing than the first.

2) Add the missing potential differences to the following circuits





Vocational Science Baseline Assessment

The following 30 minute test is designed to test your recall, analysis and evaluative skills and knowledge.

Remember to use your exam technique: look at the command words and the number of marks each question is worth. A suggested mark scheme is provided for you to check your answers

All data is given on this paper, you will not need a periodic table

Answer all questions.

1. Here is part of a periodic table, use it to answer the following questions

10.8 **B** 5 boron	12.0 **C** 6 carbon	14.0 **N** 7 nitrogen	16.0 **O** 8 oxygen	19.0 **F** 9 fluorine	20.2 **Ne** 10 neon
27.0 **Al** 13 aluminium	28.1 **Si** 14 silicon	31.0 **P** 15 phosphorus	32.1 **S** 16 sulphur	35.5 **Cl** 17 chlorine	39.9 **Ar** 18 argon

a. Which is the correct electron configuration for a nitrogen atom, circle the correct answer [1]

$1s^2 2p^5$ $1s^1 2p^6$ $1s^2 2s^2 2p^3$ $1s^2 2s^5$ $1s^2 2s^2 2p^6 3s^2 3p^2$

b. Which is the correct electron configuration for a chlorine atom, circle the correct answer [1]

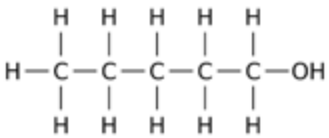
$1s^2 2s^8 2p^7$ $1s^2 2s^2 2p^8 2d^5$ $1s^2 2s^2 2p^6 3d^7$ $1s^2 2s^2 2p^6 3p^7$ $1s^2 2s^2 2p^6 3s^2 3p^5$

c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

$1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^3$ $1s^2 2s^2 2p^6 3s^2$ $1s^2 2s^2 2p^6 2d^1$

2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
Atomic numbers: H =1, O =8

3. A student carried out a reaction with this molecule:



a. What is the name of this molecule? _____ [2]

4. a) Name the 3 particles (from GCSE) that make up an atom.

b) Which one of the above particles is not found in the nucleus of an atom?

c) Which of the above particles will be found in varying quantities in the nuclei of isotopes of the same element?

5. a) Complete the following table

Voltage (_)	_____(A)		
	Repeat 1	Repeat 2	Average
2	0.23	0.26	0.25
4	0.46	0.53	
6	0.69	0.78	0.74
8	0.92	1.04	0.98
10	1.15	1.30	1.23

[3]

6. a) Use your piece of graph paper to plot a graph of Current (x-axis) against Voltage (y-axis) drawing a line of best fit through your data points. **[4]**

7. Every living organism is made of cells.

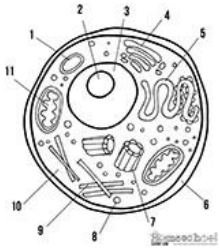


Image taken from http://prestigebux.com/worksheet/label-an-animal-cell-worksheet

a) Label the following parts of the animal cell:

2 .....

5 .....

8 .....

(3)

b) Describe how the structure of the cell membrane is related to its function?

.....

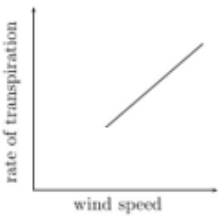
.....

.....

(3)

Scientists need to be able to interpret data in graphs to decide if there are trends in the results.

8. For each graph below, describe the trend.



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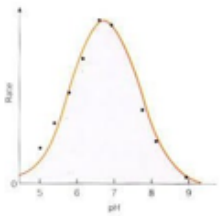

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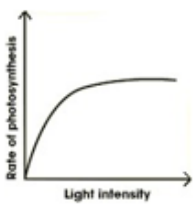


.....

.....(4)

Images taken from: http://www.everythingmaths.co.za/science/lifesciences/grade-10/05-support-and-transport-systems-in-plants/images/56aff2f9b6c5b041688f745ca928990c.png
http://www.bbc.co.uk/staticarchive/afa3f2b16b4d58d077943c96929c9a4020fea83a.gif
http://www.rpi.edu/dept/chem-eng/Biotech-Environ/Projects00/temph/enzyme.html
http://www.myearthwatchexperience.com/Essential%20Ecology.htm

Vocational Science Baseline Assessment Answers

1. .

   a. Which is the correct electron configuration for a nitrogen atom, circle the correct answer [1]

   $1s^2 2p^5$ $1s^1 2p^6$ $1s^2 2s^2 2p^3$ $1s^2 2s^5$ $1s^2 2s^2 2p^6 3s^2 3p^2$

   b. Which is the correct electron configuration for a chlorine atom, circle the correct answer [1]

   $1s^2 2s^8 2p^7$ $1s^2 2s^2 2p^8 2d^5$ $1s^2 2s^2 2p^6 3d^7$ $1s^2 2s^2 2p^6 3p^7$ $1s^2 2s^2 2p^6 3s^2 3p^5$

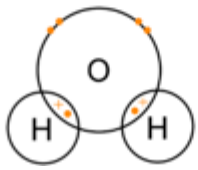
   c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

   $1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^3$ $1s^2 2s^2 2p^6 3s^2$ $1s^2 2s^2 2p^6 2d^1$

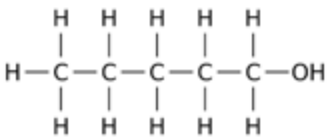
2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
   Atomic numbers: H =1, O =8

1 mark for 2 x shared electrons

1 mark for lone pairs



3. A student carried out a reaction with this molecule:



   a. What is the name of this molecule? pentan-1-ol [2]

Pentanol = 1 mark pentan-1-ol = 2 marks

4.

a) Name the 3 particles (from GCSE) that make up an atom

Proton, Neutron, Electron (any order)

[1]

b) Which one of the above particles is not found in the nucleus of an atom?

Electron

[1]

c) Which of the above particles will be found in varying quantities in the nuclei of isotopes of the same element?

Neutron

[1]

Q5

a)

Voltage (V)	Current (A)		
	Repeat 1	Repeat 2	Average
2	0.23	0.26	0.25
4	0.46	0.53	0.50
6	0.69	0.78	0.74
8	0.92	1.04	0.98
10	1.15	1.30	1.23

1 Mark for correct unit (V or volts)

1 Mark for correct heading (Current in Amps or A)

1 Mark for correct average, 1 Mark if rounded to correct number of s.f.

[3]

Q6

a) Use your piece of graph paper to plot a graph of Current (x-axis) against Voltage (y-axis) drawing a line of best fit through your data points.

1 mark if BOTH x and y axis cover

half the graph paper 1 mark for

correctly labelling x and y axis

including units 1 mark if data

points are correctly plotted

(check 3)

1 mark for correct line of best fit (with even spread of points above and below)

[4]

Question	Answer	Marks
7a	2 Nucleolus 5 Smooth Endoplasmic Reticulum 8 Golgi body	1 1 1
7b	Any 3 from the following structure **and** function must be given. Lipid bilayer - has a hydrophobic inside and hydrophilic outside, allowing for selective permeability Proteins - allow for specific substances to come or some molecules to pass through Cholesterol - allows for fluidity of the membrane Glycoproteins - for cell identification they serve as markers	 1 1 1 1

8.

Top left: transpiration increases when wind speed increases/there is a positive correlation	1
Top right: rate increases with pH until the optimum is reached, after the optimum, rate decreases	1
Bottom left: Increasing light initially increases the rate of photosynthesis, but after a while remains constant	1
Bottom right: Population increases slowly at first and then increases at a greater rate/increases exponentially	1