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Match Wits with the Kids

Jonathan Green

Published by Icon Books

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INTRODUCTION

'An education isn't how much you have committed to memory, or even how much you know. It's being able to differentiate between what you know and what you don't.'

Now, of course being able to tell the difference between what you know and what you don't isn't the same as admitting it. We've all had an education of one kind or another, and much of what we've learnt will have been taught by those much vaunted academic establishments the School of Hard Knocks and the University of Life. But it all began when, as a small child, you first went to infant school …

School days; best days of your life, apparently. And if you still happen to be at school yourself, make the most of it; the need to provide a living for yourself, put a roof over your head and pay taxes are – comparatively – just around the corner.

But if your school days are now more a case of Ancient History than Current Affairs, how much do you remember of what you learnt at school? And I don't mean what you learnt behind the bike sheds. Do you remember how to calculate the area of a circle? Can you recall who won the Battle of Naseby? Do you still know how to conjugate the Latin verb *amare*? If the answer to any of these questions is 'No' and your school days now seem more like something of a school daze, then you've come to the right place! *Match Wits With The Kids* is for you.

There is a rebellious saying that has probably been repeated any number of times over the years, which I first came across, printed on a postcard, when I was a secondary school student. This postcard took pride of place on the noticeboard above the desk where I was religiously made to do my homework every night by my mother, who just happened to be a lecturer. It

obviously struck a chord with me at the time. It went something like this:

The more I study, the more I learn;
The more I learn, the more I forget;
The more I forget, the less I know;
So why study?

As someone who has just picked up *Match Wits With The Kids: A Little Learning for all the Family*, you can probably answer that question for yourself. I suspect that it has been some time since you were last a student yourself and although you rigorously completed your homework and no matter how thorough you were when it came to revising for exams, over the years the pressures of modern living have slowly but surely corroded your memory. In my case, I put this down to having children of my own.

If you are a parent yourself, you have probably picked up this book because somewhere down the line a child of yours is going to come up to you, crumpled exercise book in hand, and ask some dread question such as, 'Dad, what is Pythagoras' Theorem?' or 'Mum, who was the fifth wife of Henry VIII?' or even, 'What does VIII mean?'

It may be that you are a student yourself and despite having the word 'learning' in the subtitle you have not been put off, so here you are reading this introduction. Well you *need* this book because, whether you like it or not, if you are going to get on in life, a few letters after your name along the lines of BA, MSc or PhD are going to make the world of difference. To acquire those letters you are going to need some other letters first, namely G, C, S and E. If you're lucky, there might be an AS or an A thrown into the mix a couple of years after that.

And there's always the possibility that you are a teacher yourself. In my experience, if you are going to be a good teacher you need to do your homework, just as much as your pupils do. If all the kerfuffle surrounding selling a house boils down to location, location, location, then for a lesson to be a success – any lesson in which you wish to impart your hard-won knowledge – then preparation, preparation, preparation is the key. Failing that, blag it. As long as you know more than your students on the day, you'll be okay. And that's where this handy little revision guide comes in.

This is not an exhaustive textbook; it couldn't hope to be. It's a prompt, to remind you of the important facts that you may have forgotten. If you want to know more than just the bare bones, I would suggest you then turn to an encyclopaedia or one of any number of helpful, considerably more detailed and longer textbooks on whatever subject it is you need to gen-up on most. However, hopefully by dipping your toes into the warm paddling pool that is *Match Wits With The Kids*, you will gain a better idea of what it is that you want to glean from the depthless oceans of knowledge.

So sit back, relax, and turn the page, because class is in session!

Jonathan Green
London 2008

✍ English Grammar ✍

Inevitably, a section on English grammar is going to regularly use expressions which themselves need explaining elsewhere, probably in the same section. As a result, while going through the next few pages you are going to need to be prepared to flick back and forth to check the definitions of anything you are not sure of. But then who ever said this was going to be easy?

Sentences, Clauses and Paragraphs

Sentences

A **sentence** is a set of words that make sense of a thought or idea and together convey a statement, a question, an exclamation or a command. These four categories of sentence are described as follows:

Declarative (statements)	The girl sulked.
Interrogative (questions)	Why are you sulking?
Imperative (commands)	Go and tidy your room.
Exclamatory (exclamations)	Stop sulking!

A sentence usually contains a **subject** and a **verb**. Consider the following sentence:

The cat sat on the mat.

The subject of the sentence is 'the cat', the verb is 'sat', and there is also a phrase in there 'on the mat', which tells us where the action took place. There are three types of sentence: simple, compound and complex.

Simple sentences are ones that give you one main piece of information.

As Easy As A, B, C

Algebra, eh? How could we cope without it?

If right now you're thinking, 'quite happily' or you're one of those people who, when you were younger, couldn't understand how something that had nothing to do with numbers could have anything to do with mathematics, then have no fear; this section's for you.

Many of the mathematical problems you face every day (wittingly or unwittingly) can be boiled down to a few simple algebraic equations. It's just a different way of looking at things. You'll encounter other equations when you read up on **Shape** and **Space**, or when you come to look at the chapters covering the sciences.

Algebra is simply the exercise of putting a mathematical problem, which could be written as a sentence, into an equation or formula. Letters are used as symbols, either in place of numbers or to represent other operations.

Many of the 'Think of a number' kind of brain-teasers can be written down as algebraic equations. For example, think of a number. Now double it and add two. Times the result by three and add another three. Take away the number you first thought of. Take four away from what's left. Now subtract five and divide the answer by five. You're back with the number you first thought of – am I right?

This complicated-sounding puzzle can be written down, if we use the letter n to denote the number you have to think of at the beginning. Going through the problem systemically, writing down each of the operations that have to be completed in order

(making use of brackets where appropriate), we end up with the equation:

$$\frac{3(2n+2)+3-n-4-5}{5}=n$$

Try the puzzle again, this time writing out the equation, replacing the n with any number you care to think of. Amazing, isn't it?

There are a number of terms and expressions used in algebra which you just need to know.

Term	**Definition**	**Example**
Expression	Any arrangement of letter symbols and numbers.	$5x + 3y - 5$
Variable	A symbolic representation used to represent a quantity or expression. A variable often represents an unknown quantity that has the potential to change.	$5y = 45$ y is the unknown variable
Formula	This connects two different expressions containing variables, where the value of one variable depends on the values of the other variables, making use of an equals sign.	$b = c + d$
Equation	This is different from a formula because it connects two different expressions which include values which are unknown. Again, the two expressions are joined by an equals sign.	$2x + 3 = 9$
Identity	Similar to an equals sign in appearance (but with an extra bar, '≡'), an identity connects expressions involving unspecified numbers but which always remains true, regardless of which numerical values are put in place of the letter symbols.	$4(a + 5) \equiv 4a + 20$

Term	Definition	Example
Function	A function is the way in which two sets of values are connected so that a value from the first set matches up with a unique value in the second set.	$a = 5b - 3$ The value of a will vary according to the value of b
Substitution	This is the act of replacing a letter symbol in an algebraic equation with a number.	$x = 2y$ If $y = 3$ then $x = 6$
Simultaneous linear equations	These are two equations with two unknown variables.	$4c - d = 8$ $6c + 4d = 34$
Inequalities	There are four inequality signs used in algebra.	$>$ means 'greater than' $<$ means 'less than' $\geq$ means 'greater than or equal to' $\leq$ means 'less than or equal to'
Coefficient	The number that appears in front of a letter symbol.	$5n$ 5 is the coefficient of n

Algebraic expressions can be simplified if like terms (those that are represented by the same letter symbol) are joined together.

e.g. $4x - 2y + 7x - 3y = 11x - 5y$
or $6c + 3b + 2d + 4b - 1b + 5d = 6c + 6b + 7d$

They can also be simplified by multiplying together numbers, letters or brackets accordingly.

e.g. $8c \times 9d = 8 \times 9 \times c \times d = 72cd$
or $(a + 4)(a - 7) = a(a - 7) + 4(a - 7)$
$= a^2 - 7a + 4a - 28$
$= a^2 - 3a - 28$

Chapter Three

BIOLOGY

That's Life!

The science curriculum studied in schools these days has changed quite dramatically from that once taught by lab-coated schoolmasters who always carried the odour of mysterious chemicals about them. This is in part due to continuing advances being made within the sciences, and in part thanks to a general namby-pambiness that now pervades educational establishments.

For example, in the area of biology, the intention is for children at secondary school level to gain an understanding of how the human body works, how plants work, how living things are classified and grouped together, how creatures evolve and their relationship with their environment. Much of this you will have covered yourself during your school days, although students of science today aren't expected to cut up formaldehyde-soaked rats and dead frogs. Long gone are the days when your biology teacher would bring out the scalpel and dissection board, like some desperate wannabe Dr Frankenstein.

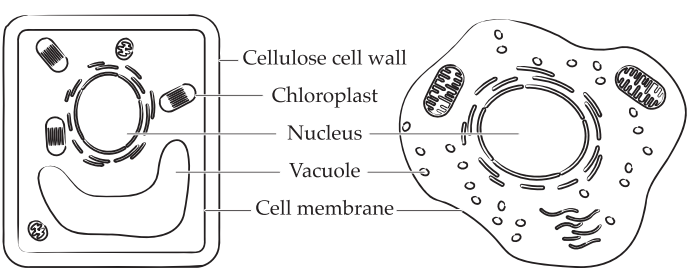
While we would encourage a thorough dissection of all the sciences for academic study, we wouldn't actually want you to chop up the neighbour's cat and cut yourself with your best Sunday roast carving knife in the process. And we certainly wouldn't recommend such an approach while using this book: bodily juices can leave such a nasty stain.

Life and Living Processes

What you would have known as **biology**, school students today are just as likely to encounter in the form of 'Life and Living Processes'. As you will remember, this subject covers everything to do with any living thing (that has existed on the planet) from protozoa, fungi and fish, through to reptiles, birds and mammals – even ourselves.

Cells

Every living thing is made up of **cells**. All cells have inside them a nucleus, which determines how the cell behaves (except for red blood cells which have no nucleus), a mixture of chemicals (which include the cell's nutrition and resultant waste products) called cytoplasm, and a cell membrane through which nutrients and waste can pass.



A plant cell and an animal cell

If you take a look at the illustration above, you will see that the main difference between animal and plant cells is that plant cells also have a cell wall (which compensates for the lack of a skeleton and helps the plant keep its shape) and chloroplasts. The chloroplasts contain chlorophyll, a green chemical which absorbs energy from the sun. It is the chlorophyll that allows the process

called photosynthesis to occur, by which green plants make their own food.

Did you know...?
The biggest cell in humans is the ovum, or female sex cell, at a full 1 mm in diameter. After that comes the nerve cell. The smallest human cell is the male sperm cell. So who says size matters?

Tissue and organs

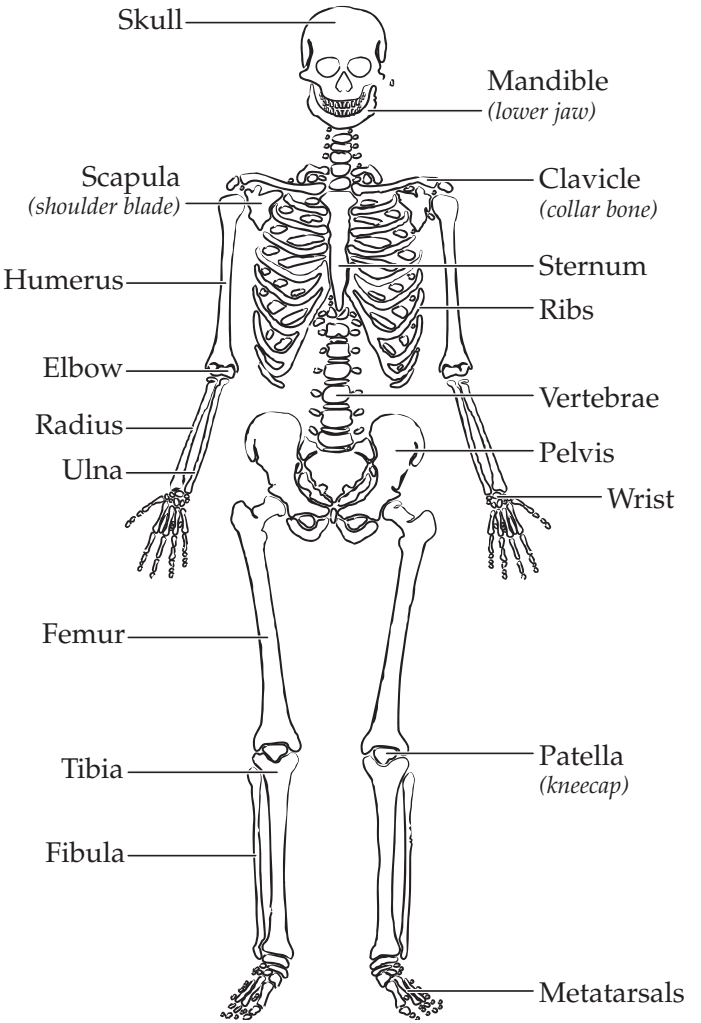
Just as a flat-packed build-it-yourself kitchen is made up of all manner of different components, so a huge variety of cells is needed to make up an animal or plant. Cells of the same type group together to form **tissue** (such as muscles, tendons and nerves, each of which has their own purpose), while several different tissues combine to make up an **organ**.



The Human Animal

It can be easy to forget, with everything that goes on in our busy lives, that humans are animals – highly-evolved animals, but animals all the same.[35] This means that there are certain characteristics and physical needs which we share with all other living creatures: we breathe, we move, we reproduce, our bodies have to stay healthy – and then we die. As the saying goes, all good things must come to an end.

[35] Although in the movie *The Matrix*, Agent Smith compares the human race to a virus because it has spread across the globe unchecked, devouring and destroying all the natural resources it comes into contact with!



The human skeleton

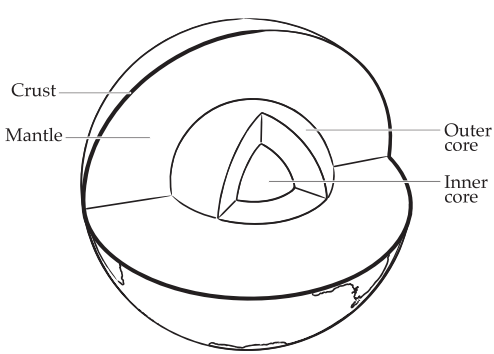
Country	Capital City
Swaziland	Mbabane (administrative capital); Lobamba (royal and legislative capital)
Sweden	Stockholm
Switzerland	Bern
Syria	Damascus
Taiwan	Taipei
Tajikistan	Dushanbe
Tanzania	Dar es Salaam (*de facto* capital); Dodoma (legislative capital)
Thailand	Bangkok
Togo	Lome
Tonga	Nuku'alofa
Trinidad and Tobago	Port-of-Spain
Tunisia	Tunis
Turkey	Ankara
Turkmenistan	Ashgabat
Tuvalu	Vaiaku village, Funafuti province
Uganda	Kampala
Ukraine	Kyiv
United Arab Emirates	Abu Dhabi
United Kingdom	London
United States of America	Washington DC
Uruguay	Montevideo
Uzbekistan	Tashkent
Vanuatu	Port-Vila
Vatican City (Holy See)	Vatican City
Venezuela	Caracas
Vietnam	Hanoi
Yemen	Sanaa
Zambia	Lusaka
Zimbabwe	Harare

The Restless Planet

Although at times it may feel like the Earth can be rather a cold place, beneath the thin crust[96] of solid rock which forms its outer surface, the interior of our planet is a seething ball of unimaginable heat.

The **crust** itself is between 3 miles (5 km) and 56 miles (90 km) thick, the thickest areas being the continents and the thinnest points found at the bottom of the sea. Beneath the crust lies the **mantle**, a layer of semi-solid rock which, although hot enough to melt (existing at temperatures as high as 5,000°C), remains solid as a result of the incredible pressures exerted upon it by the rock above.

1,800 miles (2,900 km) below the mantle we reach the **outer core**, an expanse of liquid iron and nickel. 1,300 miles (2,100 km) thick, the outer core reaches temperatures exceeding 5,000°C. Right at the heart of the planet is the **inner core**, which is thought to be a solid ball of iron and nickel. Over 1,700 miles (2,800 km) across, the core is believed to be 5,500°C, making it as hot as the surface of the sun!



The structure of the Earth

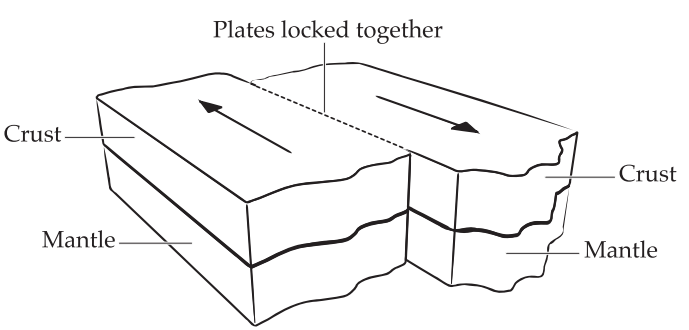
[96] To give you an accurate idea of just how thin the Earth's crust is, if our planet was an apple, the crust would be only as thick as the apple's skin!

The Earth's crust is broken into sections called **tectonic plates** which are constantly in motion, sliding over the semi-solid mantle, moving a few centimetres a year. There are seven major plates and twelve smaller ones, which are categorised as either continental plates (which cannot sink into the mantle, being less dense, and so form the landmasses) or oceanic plates (which are heavier and so can sink into the mantle, and form the sea bed).

It is the movement of the tectonic plates that has shaped the face of our world, changing it constantly over hundreds of millions of years. This movement is also responsible for such phenomena as earthquakes and volcanoes.

Earthquakes

Earthquakes mainly occur where two tectonic plates, which are moving at different speeds or in different directions, meet and then lock together due to friction (called a **conservative boundary**). The pressure builds until a plate breaks along a fault line (such as the San Andreas Fault in California, on the western coast of the USA). When this happens an earthquake occurs, and the effects can be truly devastating.



A conservative boundary