

# The Pub Understanding of Science

Back in 1998, The self-styled 'Cross Keys Literary and Philosophical Society' (based in a pub in Thropton, Northumberland) played a major role in formulating questions for a quiz (about science) which was to be made available on some very fancy beer mats.



The following pages show the range of beer mats that were produced. Answers to the questions can be found on the final pages of this document.



## Question 1

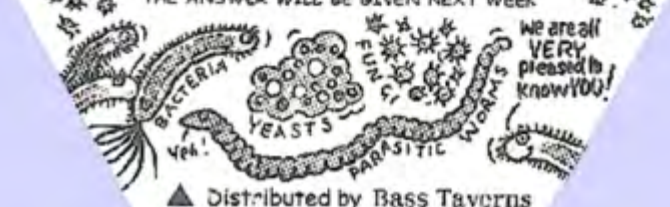
[Click here for the answer](#)

### Drip Mat 1 Challenge

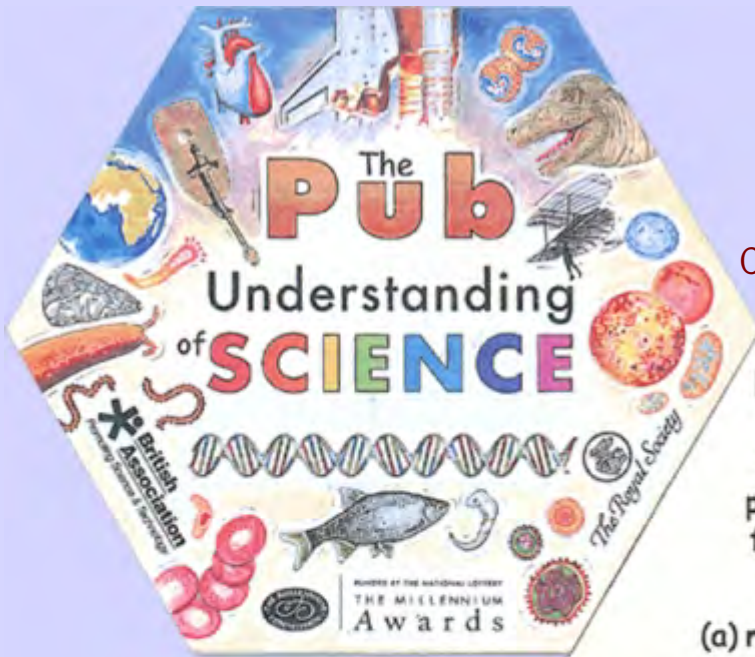
Yeasts have been around much longer than humans and, although we are pleased to have them make alcohol for us, we may not be so pleased to have others as 'house guests' (along with bacteria, fungi, parasitic worms, etc).

What percentage of your cells are human?  
(a) 90% (b) 50% (c) 30% or (d) 10%

THE ANSWER WILL BE GIVEN NEXT WEEK



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## Question 2

[Click here for the answer](#)

### Drip Mat **2** Challenge

Put a handful of ice cubes in a pint glass. Add water till the ice floats. Wait until the ice melts.

Will the level of the water -

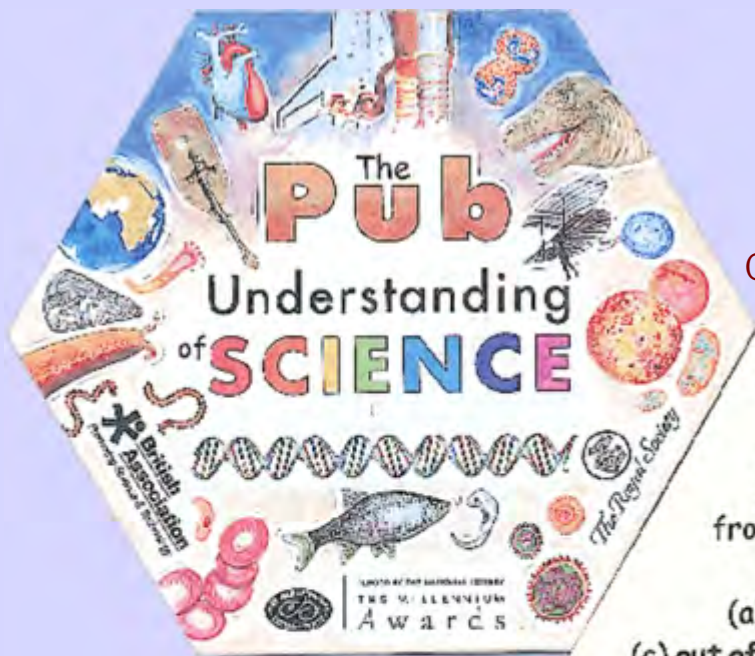
(a) rise (b) fall or (c) stay the same ?

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Meanwhile, 3 hours later....



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## Question 3

[Click here for the answer](#)

### Drip Mat **3** Challenge

Alcohol is made by fermenting grapes, barley malt, sugar, etc. from plants. But from where do plants get most of their food ?

(a) out of the soil (b) out of manure

(c) out of chemical fertilisers (d) out of thin air ?

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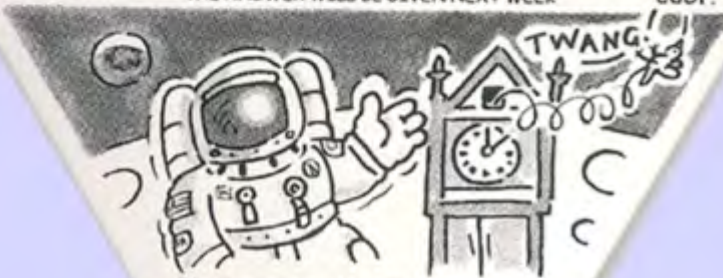
## Question 4

[Click here for the answer](#)

### Drip Mat 4 Challenge

Time, ladies and gentlemen, please !  
If you took a grandfather (pendulum)  
clock to 'The Half Earth Tavern' your  
favourite pub on the moon, would the clock  
(a) gain (b) lose or (c) keep the same time ?

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## Question 5

[Click here for the answer](#)

### Drip Mat 5 Challenge

According to Isaac Walton  
(‘The Compleat Angler’. 1653) ‘Hops  
and turkeys, carps and beer, Came into  
England all in a year’. Hops are used -  
(a) to make beer bitter  
(b) to increase its alcohol content  
or (c) to preserve it ?

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## Question 6

[Click here for the answer](#)

### Drip Mat **6** Challenge

In the bar of 'The Jolly Sailor' the patrons know very well that about 75% of our planet's surface is covered by oceans and seas. These produce vast quantities of seaweed and microscopic plants called phytoplankton. How much of the world's vegetation does this represent per year?  
(a) three quarters (b) one third (c) one tenth?

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## Question 7

[Click here for the answer](#)

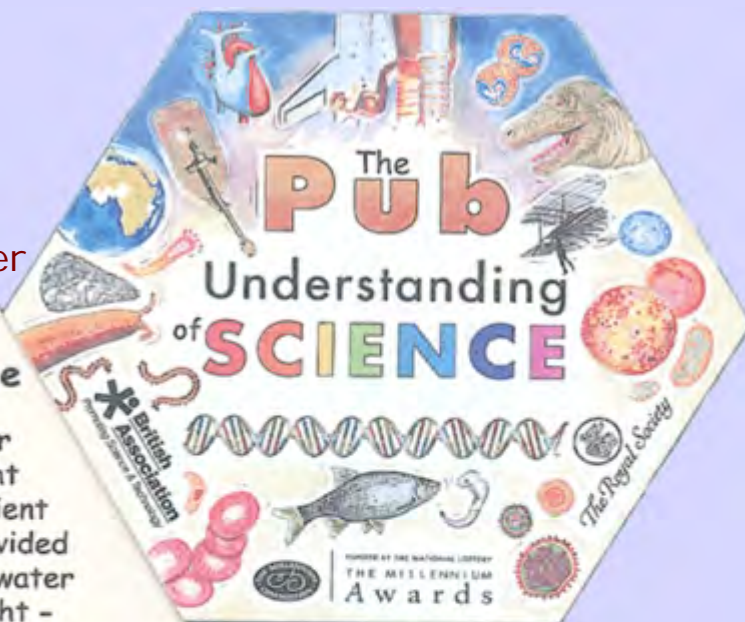
### Drip Mat **7** Challenge

'Water, water everywhere nor any drop to drink'. It is thought by some, but maybe not the Ancient Mariner, that planet Neptune provided us with more water than our local water company does. Might this be right -

☆☆☆ (a) yes? (b) no? ☆☆☆  
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## Question 8

[Click here for the answer](#)

### Drip Mat **8** Challenge

Back in the bar of 'The Jolly Sailor' the cry was heard - 'Up spirits, hands of the mess for grog'. Like naval rum, all spirits are diluted with water before they are dispensed or sold.

Is 'proof' spirit -

- (a) 100% alcohol (b) 60% or (c) less than 60% ?

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....and finally,  
who ordered a  
small  
medium  
sherry?



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## Question 9

[Click here for the answer](#)

### Drip Mat **9** Challenge

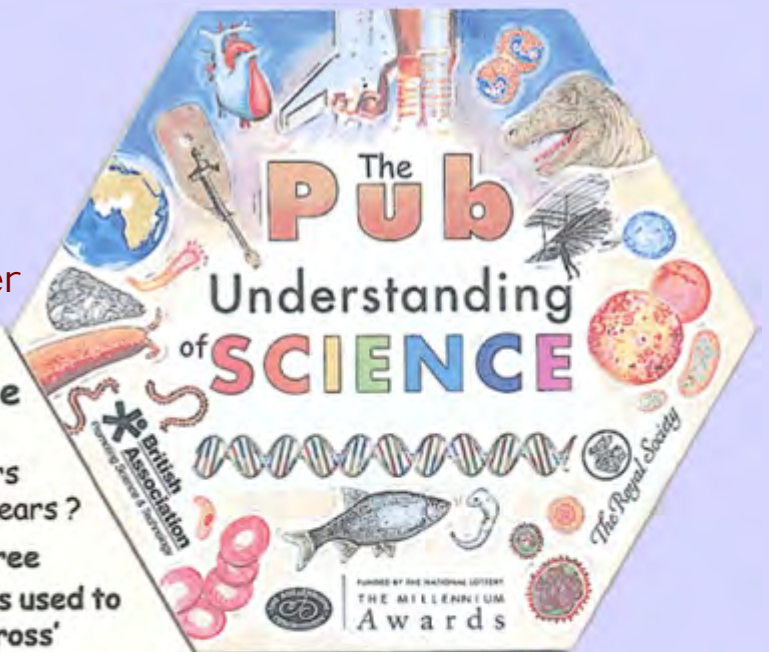
What weighs 10 tonnes, covers 36 acres and has lived for 1,500 years ?

- (a) roots of a Giant Redwood tree  
(b) Prickly Pear, an Australian cactus used to make a drink called 'Southern Cross'  
(c) a recently studied 'toadstool' ?

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## Question 10

[Click here for the answer](#)

### Drip Mat 10 Challenge

Beer mats such as these have six equal angles (i.e. they are hexagonal). They share this feature with a World Cup football and the Nobel Prize winning 'Bucky Ball' (a form of carbon), both of which are structures based on a number of hexagons and pentagons.

How many hexagons and pentagons would you need to make a football?

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## Question 11

[Click here for the answer](#)

### Drip Mat 11 Challenge

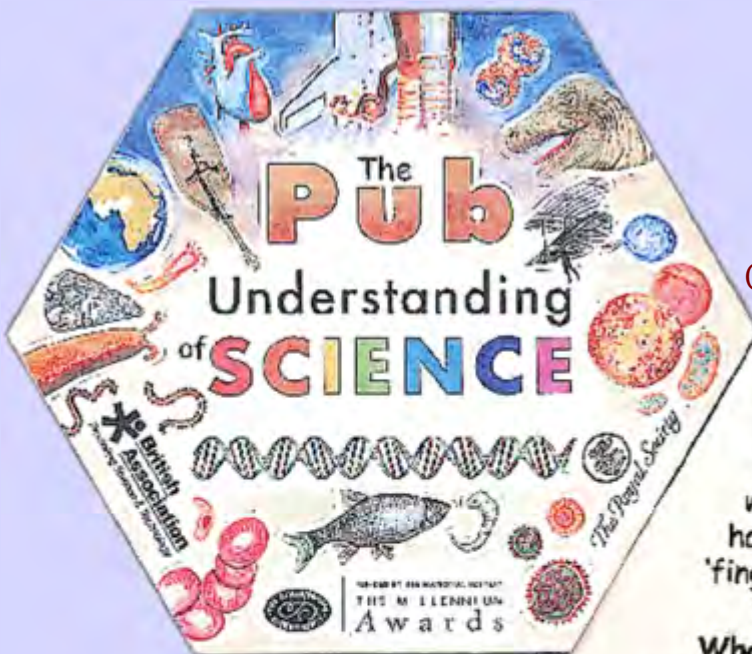
Being a well run house, no-one who frequents 'The Jolly Sailor' has yet been subjected to genetic 'finger-printing'. The DNA underlying this process is spiral in shape.

What, in this regard, does DNA have more in common with hops and wood screws?

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## Question 12

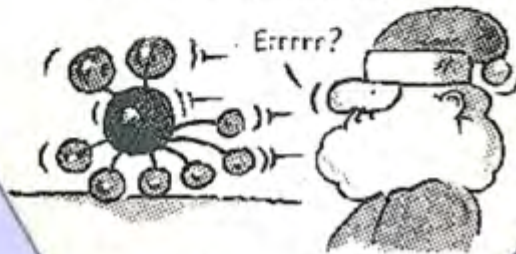
[Click here for the answer](#)

### Drip Mat 12 Challenge

Merry Christmas!

If you could join two atoms of carbon together and add six atoms of hydrogen and one atom of oxygen - what might you get?

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## Question 13

[Click here for the answer](#)

### Drip Mat 13 Challenge

A Happy New Year to you!

Champagne is called 'bubbly' because it gives off so many bubbles of carbon dioxide ( $\text{CO}_2$ ) when opened.

Would a bubble of  $\text{CO}_2$  weigh -

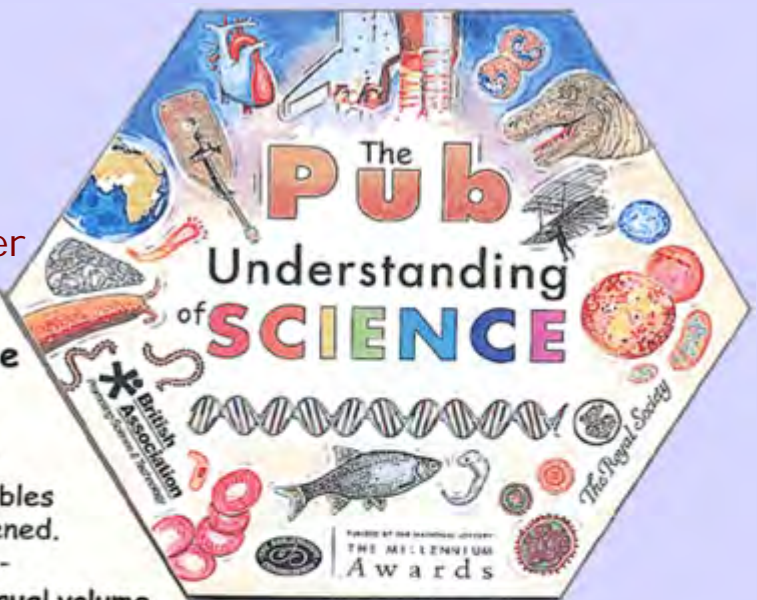
- (a) the same as a bubble of oxygen of equal volume
- (b) more or (c) less?

★ If you've drunk a glass or two by now you probably don't care but have a guess anyway! ★

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## Question 14

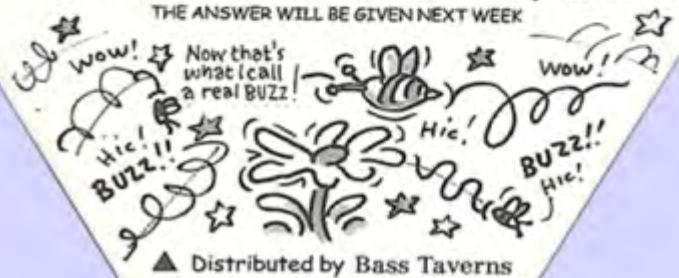
[Click here for the answer](#)

### Drip Mat 14 Challenge

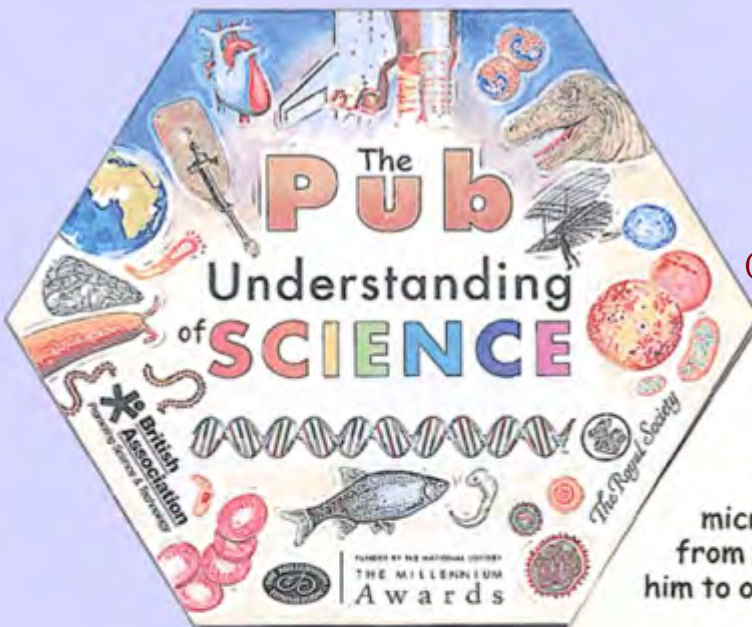
Despite his famous green fingers, the landlord of 'The Jolly Sailor' hasn't had much luck growing

- (a) *Agave tequilana* (b) *Oryza sativa*  
(c) *Saccharum officinarum* (d) *Hordeum vulgare*  
Which spirits are made from these plants?

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## Question 15

[Click here for the answer](#)

### Drip Mat 15 Challenge

In 1847, at the age of 25, Louis Pasteur looked down his microscope at the crystalline material from the bottom of wine bottles. This led him to one of the defining moments in science. What was it?

- (a) pasteurisation (b) 'the germ theory'  
(c) stereochemistry (d) vaccination?

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# Answers....

## Answer to Question 1: (d) 10%.

Amazingly it is estimated that 90% of 'your' cells are not human at all. There are, for instance, many million bacteria (E. coli and the like) in your large intestine.

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## Answer to Question 2: (c) the water level will stay the same.

Since ice is less dense than water it floats and part emerges above the surface. Nevertheless its weight remains unchanged and so when it melts it simply fills the space that it had displaced when it was frozen. Archimedes of Syracuse (287-212 BC) is credited with discovering this principle i.e. that a body immersed in a fluid is buoyed upward by a force equal in magnitude to the weight of the fluid displaced by that body.

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## Answer to Question 3: (d) out of thin air.

Although the atmosphere only contains about 0.03% carbon dioxide (CO<sub>2</sub>), this is the source of 95% or more of the material, other than water, of which plants are made (about 45% carbon and 45% oxygen). The alcohol that we drink is made entirely of carbon, oxygen and hydrogen. Like other plant products this carbon and oxygen originally comes from CO<sub>2</sub> in the air, courtesy of green plants, sunlight and the process of photosynthesis.

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## Answer to Question 4: (b) a pendulum clock will lose time.

As the pendulum reaches the top of its swing, it is the force of gravity which pulls it back down. The moon is much smaller than earth and its gravitational pull correspondingly less (one sixth). Accordingly, the pendulum would move more slowly and the clock would 'lose' time.

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## Answer to Question 5: (a) hops are used to make beer bitter.

Urticales, the "nettle order" of flowering plants, includes two genera of the hemp family, *Humulus* and *Cannabis* which have been economically important for many centuries. Various parts of the hemp plant (*Cannabis sativa*) are used to make fibre and marijuana. The flowers of *Humulus lupulus* are the hops used in brewing. Their principal role is "bittering", i.e. balancing the sweet flavour imparted by the malt, but hops also act as a preservative and were used for this purpose before the advent of refrigeration.

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**Answer to Question 6: (b) one third of the world's vegetation is produced in the seas and oceans.**

The seas and oceans produce about one third of the world's vegetation. It has been calculated that 173, million, million, million tonnes (173 gigatonnes) dry weight of vegetable matter are produced each year of which about 42 gigatonnes come from the open oceans and about 13 gigatonnes from coastal environments.

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**Answer to Question 7: Answer: (a) Yes, they might be right.**

It is suggested that our water originally arrived here (a few billion years ago, as Earth was being formed as ice crystals from space, deflected in our direction by the planets Neptune and Uranus.

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**Answer to Question 8: Answer: (c) less than 60%.**

Until 1740, the strength of spirit was determined by mixing it with gunpowder and igniting the mixture. If it 'blew' the spirit was "proved". Today, proof spirit is only 48% alcohol by weight and 56% by volume.

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**Answer to Question 9: Answer:(c) a 'toadstool' called *Armarillaria bulbosa*.**

Like most 'toadstools' it has an extensive underground portion or 'mycelium' which, in this case, covered 36 acres or more. The fact that it was one fungus rather than many was established by DNA testing.

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**Answer to Question 10: 20 hexagons.**

The 'Soccer' football is made up of twenty hexagons and twelve pentagons. So are "bucky balls", a form of carbon discovered by Nobel prize winners, Curl, Kroto and Smalley. They called it "buckminsterfullerene" in honour of the American architect R. Buckminster Fuller, who designed a famous dome, for the 1967 montreal world exhibition, which also had hexagonal surfaces joined in such a way that they were interspersed with pentagonal (5-sided) surfaces. Given 20 hexagonal beer mats, a fair amount of beer, some sticky tape, and a little help from your friends you could make a passable model of a football or a bucky ball

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**Answer to Question 11: 'Right-handedness'.**

DNA ( the genetic blue print, Watson and Crick's "double helix") is a right-handed or dextral helix; i.e. it is like a spiral staircase which climbs to the right rather than the left. Ordinary wood screws have a 'right-hand' thread. The hops used in brewing are the flowers of *Humulus lupulus*, a climbing plant with stems which twist to the right.

## Answer to Question 12: Lucky.

There are many alcohols but the one that you would buy in a pub or off-licence is ethyl alcohol (ethanol) and its chemical formula is  $\text{CH}_3\text{CH}_2\text{OH}$ . Cheers!

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## Answer to Question 13: (b) More.

The molecular 'weight' of  $\text{CO}_2$  is 44, that of  $\text{O}_2$  is 32. On this basis, a bubble of  $\text{O}_2$  of equal volume would weigh about 25% less than a bubble of  $\text{CO}_2$ .

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## Answer to Question 14:

- (a) Agave tequilana is used to make tequila.
- (b) Oryza sativa to make sake.
- (c) Saccharum officinarum to make rum.
- (d) Hordeum vulgare to make malt whisky.

Being smart, you probably worked this out from their Latin names even if you didn't know that Agave tequilana is a 'cactus', Oryza sativa is rice, Saccharum officinarum is sugar cane and Hordeum vulgare is barley.

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## Answer to Question 15: (c) stereochemistry.

When Louis Pasteur looked at crystals of a form of tartrate derived from wine, he became aware that they all looked exactly alike, whereas crystals of what, until then, had been thought to be an identical kind of tartrate (paratartrate) were a mixture of two types, some asymmetric to the right, some asymmetric to the left. This became the basis of a new science (stereochemistry) which recognises that some organic molecules, differ from one another much as your right hand differs from your left. Usually, only one of these forms is utilised by living organisms. Eventually Pasteur went on to conclude that fermentation was a biological process carried out by micro-organisms ("the germ theory"). In turn this led to many of the observations and processes such as 'pasteurisation' for which he is so justly famous.

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