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Science

Not so precious after all

By KATE OLIVER

Lusted over, fought over, bled over – no other rock has generated as much attention as diamonds. Just what is it that makes them so special? You'd want to be sure before you buy her a dirty great rock for Valentine's Day, wouldn't you?

Diamonds are rare. Well, they're made of carbon, which is the fourth most common element in the universe. But the carbon atoms in a diamond are arranged in a unique way, which is what makes them so different to other substances composed of carbon, like graphite or soot. What's important in a diamond structure is a regular, close arrangement, which only forms under massive pressures and temperatures, like those deep in the Earth's crust. We can only get at diamonds formed this way when they migrate to the surface.

Until the 1800s the only known diamond mines were in India, and the gems really were scarce. But in 1870, mines were discovered in South Africa that would produce literally tonnes of diamonds. If these were released, diamonds would no longer be a rarity and their price would drop dramatically. This was unthinkable, so a cartel was set up to establish a steady – but

not too large – flow of diamonds, allowing the mine owners to cash in. This organisation – known under different names in different countries, but generically as De Beers – continues to the present day, perpetrating the myth that a diamond is a luxury item.

De Beers are currently facing a threat to their chokehold on supply. Russian inventors have developed a way to grow diamonds. Starting with a seed crystal, which ensures that any new atoms joining onto it will arrange themselves in the way that creates diamonds, a superheated gas of carbon atoms is injected at high pressure. Atoms from the gas join onto the seed crystal, growing the original diamond bigger and bigger. Diamonds made this way cost about £5 a carat to fabricate. A carat, the standard measurement of diamond weight, is about 0.2 grams, and even a very poor quality mined diamond of this weight would set you back £100. A good quality – and cultured diamond is always good quality if you set the machine right – diamond would cost £26,000. Even allowing for the weak dollar at the moment, that's a bit of a rip-off!

But once you've invested in the diamond, you know it's going to last.

For a few million years at least – but the pressure and chemical makeup of the Earth's atmosphere means, on this planet at least, carbon is actually more happy to be arranged as graphite. Your lovely diamond, a symbol of your eternal love, will turn into an oversize pencil lead. It might also be useful for you to know that diamonds can be burnt – keep this in mind for when she cheats on you with your best friend.

Regardless of all these inconvenient facts, diamonds still have a place in our culture as a girl's best friend. In fact, since they make the noses of heat seeking missiles from diamond, because it's transparent to the infra-red radiation they track, diamonds can get a bit too friendly at times. That's without even getting into the issue of blood diamonds. Well, you always hurt the one you love.

One indisputable truth – diamonds are pretty damn hard, due to that critical arrangement of atoms that makes them sparkly and crystalline as well. The arrangement of atoms in diamond is such that each atom has four equally-spaced neighbours to cling to. This is why diamonds are so hard (hard in a



materials science sense means resistance to scratching). When you try to scratch its surface, each crystal has four neighbours to pull on, to avoid being scratched off. This regular arrangement has a downside though – the gaps between the atoms are regular as well, so a diamond will break perfectly into two halves if hit along this line. In fact, you can shatter a diamond using an ordinary hammer. But yes, it is very hard, if you like

that sort of thing.

So, diamonds aren't rare, they aren't expensive, they aren't forever, they're vulnerable to hammer blows – they are perhaps overly friendly, to the point of pain – but they are pretty hard. However, if that's what you look for in a present, you might want to go one better and get her a bouquet of carbon nanotubes instead.

All in all, it's probably best to stick to buying chocolates.

Feel the love of science

By KAREN MANSER

So Valentine's Day is with us again. We may experience feelings of euphoria, rhapsody, comfort, or even rejection from that special someone. But how are we first attracted to someone? Why do we fall in love? While the science of love is still quite new, researchers have been busy searching for answers.

American anthropologist Helen Fisher has suggested that love develops in three stages, from first sight to matrimony.

It takes between 90 seconds and 4 minutes of meeting a man or woman, to decide whether they are a suitable partner – a subconscious decision on whether they have 'good genes'. This first stage, lust, is driven by the hormones testosterone and oestrogen. It's at this stage the sexual part of love is 'switched' on.

Next comes the lovesick stage. Symptoms include, loss of appetite, reduced need for sleep as you stay awake day-dreaming. This may all seem counter productive to attracting your love, but your biochemistry is to blame. Scientists have found that a group of neuro-transmitters known

as monoamines come into play as you constantly pine for your new love. The important key players in this stage are hormones dopamine, adrenaline and serotonin. These are also activated by cocaine, make us sweat and raise our heart beat, and can send someone temporarily insane.

So what is the nature achieving by making us falling in love? It not only stops us looking for another partner but it temporarily or permanent but ultimately love is needed between two individuals to enable us to reproduce and bear children to keep the human race thriving. Unlike chimpanzees, children need to stay with their parents for much longer than seven years.

This is where the final stage of love, attachment, kicks in. This is the bond that keeps long-term couples together. and involve hormones are oxytocin and vasopressin.

Oxytocin is commonly associated with a mother-child bond, as it helps to stimulate breast milk and is released during child birth. But it is also released by man and woman during love making. And so, the theory goes, the more sex a couple has, the deeper their bond becomes. Hence, having sex too soon when you meet someone

can cause someone to foolishly fall in love for the wrong person!

So what can science tell us about infidelity? Molecular biologists have been able to alter the hormones of meadow voles, so that they stay faithful to one female. Researchers at Emory University in Atlanta, Georgia discovered the biological difference between a faithful male vole and those that like the company of more than one female. According to the scientists, fewer receptors for the vasopressin hormone are present in the more promiscuous voles. The receptors of the faithful male are plentiful, increasing bonding during sexual intercourse. The difference between the numbers of receptors is caused by a single gene. This can be altered by introducing a virus to produce a mutant gene.

Also, recently, scientists have been able to switch on genes to make fruit flies gay. But is this ethical? Can we, or should we, apply this to humans? For thousands of years, people have searched for love potions to capture the heart of their most desired and scientists are now making this dream a possibility.

