Interview questions for discussion: Sciences

IMPORTANT: This random selection of sample questions available on the internet is intended to help you practise thinking through some interesting problems aloud. It is *extremely* unlikely that you will be asked any of these specific questions in your interview.

Some of these questions will seem daunting or irrelevant – don't worry! Remember that:

- An interview is a conversation, not an interrogation – so questions will arise in a natural way, and interviewers will prompt you, question your views and ask linked questions. Some of the simpler questions here would be followed by deeper questioning, and the more complex ones might be preceded by introductory questions.
- *Your* interview questions will usually be based on subjects you studied at A-level, and will often focus on topics you highlight as ones you enjoy. If not, they will be intended to be unfamiliar to all candidates, to see how you think about a new problem.
- Where scientific constants are required, you can always ask your interviewers if you don't know them. This goes for any information that you feel you are missing.

Example Question with possible follow-up questions/hints:

"Here's a picture of a gravity dam. How would you design one of these dams for holding back water?" (Engineering)

- What forces are acting on the dam, and how do these affect the wall's stability?
- Construct some basic mathematical expressions predicting the point at which water would push the wall over.
- Discuss failure by sliding, structural design, advantages of solid and hollow designs, the effect of water seeping under the dam.

Example Questions by subject:

Medicine / Veterinary Medicine:

"Should someone sell their kidney?"

"What are you views on the recent reforms of the NHS?"

"What do you think of assisted suicide?"

"Why is there a higher probability of being killed by an asteroid collision than by a heart attack?"

"What makes a good doctor?"

"Would you give a 60-year-old woman IVF treatment?"

"On your recent work placement in the hospital/care home, can you give me any examples of bad practice that you witnessed? What about a difficult situation? How was it handled? What did you learn?"

"How do embryonic stem cells differentiate into specialised tissue? What are your views about the ethics of stem cell research?"

"When someone's hyperventilating, what do you get them to do? Why? What would this do to blood pH?"

"Put these countries in order by their crude mortality (deaths per thousand of the population): Bangladesh, Japan, South Africa, the UK."

"Why do dogs behave badly?"

"How have vets' lives changed in the last 30 years?"

"Would you prefer a large or small animal practice?"

Biological Sciences (and Medicine / Veterinary Medicine):

"What do you like most about the human body?"

"How would you simulate altitude in your living room?"

"Would it matter if tigers became extinct?"

"If you could save either the rainforests or the coral reefs, which would you choose?"

"If a carrot can grow from one carrot cell, why not a human?"

"Are humans still evolving?"

"Ladybirds are red. So are strawberries. Why?"

"Why do a cat's eyes appear to 'glow' in the dark?"

"Why does your heart rate increase when you exercise?"

"How would you describe a human to a person from Mars?"

"Here's a cactus. Tell me about it."

"Why do lions have manes?"

"Explain the relation between the structure and function of DNA."

"Why do living systems need hormones?"

"How would you determine whether leukaemia patients have contracted the disease because of a nearby nuclear power station?"

"Tell me about the differences between U.V. and X-ray spectroscopy"

"Why is it that in a sample of molecules, the energy given out in form of the electromagnetic spectra is less than that absorbed (Bearing in mind that in a sample of atoms it is the same)? How would the spectra be affected if an atom was bonded, as opposed to alone?"

"Why is glycogen a better storage molecule than glucose?"

"Can you describe an experiment to differentiate between a normal and a multi-resistant strain of bacteria?"

"What would life be like without enzymes?"

Chemistry / Biochemistry (and Medicine / Veterinary Medicine):

"How would you adjust ethanol to make it a stronger acid? How would you adjust carboxylic acid to make it stronger?"

"Draw ethanol and propane. What are their states at room temperature? Why do they differ?"

"Tell me about the structure of Sodium Chloride. Why does it have a high melting point? Why is it so strong?"

"Here is a blank graph. Sketch the curve of this equation: (V(r) = A/r^12 - B/r^6)) and then interpret the graph, differentiate the equation and label the minimum points."

"Draw out the mechanism for the alkylation of benzene."

"Tell me about alcohols, aldehydes and ketones. How can they be distinguished - both chemically and physically?"

"Compare these two model molecules. They are optical isomers (chiral centre). What effects does this have - in nature and in pharmaceuticals?"

"Draw the mechanism of the bromination of cyclohexene. Tell me about the geometrical and optical isomers of that molecule."

"How many water molecules are there in this 180ml cup?" (State your assumptions: temperature and pressure, dissociation, ions, relative mass of O=16, H=1 etc.)

"If I've got an alkane and I'd like to know more about it, what should I do?"

"How and why are the structures of Carbon Dioxide and Silicon Dioxide different?"

“Why are some objects opaque and some transparent?”

“Explain the trend in ionisation potentials as you go across a period.”

“Explain the greenhouse effect. Why isn't nitrogen a greenhouse gas? Why is the radiation reflected from the earth of a lower frequency than the incoming radiation from the sun?”

“Define pH. When you have a concentration of H+ ions of 0.01, what is the pH? Dilute 1000 times. What's the pH now? Dilute 1000 times again. What's the pH now?”

“What metals play an important role in Biology?”

Tell me about the interaction between:
(i) the chlorine atoms in the molecule Cl2;
(ii) two chlorine ions in NaCl;
(iii) two chlorine molecules.

“Three isomeric compounds have the molecular formula C3H4. Draw possible structures showing how the atoms are arranged in space, and comment on the bonding in each compound.”

Psychology:

“What is ‘normal’ for humans?”

“Why do human beings have two eyes?”

“How would you design a scientific experiment to show that a certain substance is addictive?”

“How come a painting by a four year old of “a tiger amongst tulips” (as described by the child) doesn’t look like a tiger, despite the child studying a tiger at the zoo the day before and being satisfied with the outcome?”

“Design an experiment to show whether monkeys’ behaviour is innate or learnt.”

“What do you like most about the brain?”

“Is it moral to hook up a psychopath (whose only pleasure is killing) to a reality-simulating machine so that he can believe he is in the real world and kill as much as he likes?”

“A large study appears to show that older siblings consistently score higher than younger siblings on IQ tests. Why would this be?”

Maths / Physics / Engineering:

“I am an oil baron in the desert and I need to deliver oil to four different towns which happen to lie on a straight line. In order to deliver the correct amounts to each town, I must visit each town in turn, returning to my warehouse in between each visit. Where should I position my warehouse in order to drive the shortest distance possible? Roads are no problem since I have a friend who is a sheikh and will build me as many roads as I like for free.”

“Draw the graph of y= (x-3)(x-2) / (x 2)(x-1)”

“How would you design a gravity dam for holding back water?”

“How hot does the air have to be in a hot air balloon if I wanted to use it to lift an elephant?”

“What was the most beautiful proof in A-Level Mathematics?”

“If you had a cylinder, sealed at both ends, with the pressure rising inside, would it blow at the end or split along the side first?”

Draw graphs of:
y=sin(1/x)
y=x*sin(1/x)
y=(x^3)*sin(1/x)

“Seen from the Moon, the Earth has 3.6 times the angular diameter of the Sun. What is the ratio of densities of the Sun and the Earth?”

“If you could have half an hour with any mathematician, living or dead, who would you choose?”

“A golfer driving from the tee swings his club so that the head completes a (virtually) complete circle in 0.5s. Make a reasoned estimate of the maximum distance he could hit the ball.”

“There is a pile of 129 coins on a table, all unbiased except for one which has heads on both sides. Bob chooses a coin at random and tosses it eight times. The coin comes up heads every time. What is the probability that it will come up heads the ninth time as well?”

Twenty balls are placed in an urn. Five are red, five green, five yellow and five blue. Three balls are drawn from the urn at random without replacement. Write down expressions for the probabilities of the following events (You need not calculate their numerical values).
(i) Exactly one of the balls drawn is red.
(ii) The three balls drawn have different colours.
(iii) The number of blue balls drawn is strictly greater than the number of yellow balls drawn.

“Why is the pole vaulting world record about 6.5m, and why can't it be broken?”

“Differentiate d/dx 2x(x+1)”

1. Prove for a 3 digit number that if the sum of the digits is a multiple of 3, the 3 digit number is a multiple of 3.
2. Do the same as Q1, but in hexadecimal.
3. Do same as Q2, but for multiples of 5.

“Here is a model of a dodecahedron. Without counting, work out how many edges it has.
How many vertices? If a string is tied inside the dodecahedron between vertices, forming a cube, how many possible positions could there be for a cube inside the dodecahedron?”

Sketch the curve (y^2-2)^2+(x^2-2)^2=2.

“How many squares can be made from a grid of ten by ten dots (ignore diagonal squares)?”

“What is the integral of x squared multiplied by the cosine of x cubed?”

“Come up with a rule for the nth derivative of 1/x”

“Draw the graph of (2x+3)/(x^2+1)”

“Why is copper red and aluminium white(ish)?”

“Why do aeroplanes tilt to turn corners?”

“What height does a geostationary satellite need to be at?”

“Sketch y=cos(x) and y=cos(2x), then shade the area represented by the integral of cos(x) from pi to zero.”

Computer Science:

“Tell me about binary searches. What about their efficiency?”

“It is a fact that, apart from the peripherals, the whole of a computer can be made from NAND gates (a logic gate that produces an output that is false only if all its inputs are true). The Egyptians created NAND gates using marbles rolling down chutes and used them for booby trapping pyramids. So did the Egyptians invent the computer? If not, explain fundamentally why not.”

“‘The game of chess will be played perfectly by the computers of 2020’ What is the meaning of this statement and is it likely to be true?”

“You are given 10 boxes, each large enough to contain exactly 10 wooden building blocks, and a total of 100 blocks in 10 different colours. There may not be the same number in each colour, so you may not be able to pack the blocks into the boxes in such a way that each box contains only one colour of block. Show that it is possible to do it so that each box contains at most two different colours.”