



Summer Application Bootcamp – Interview Preparation Workshop (Sciences & Maths)

Interview Question Pack

In this pack, you will find questions for Sciences & Maths subjects for you to practice your critical thinking, oracy, and problem-solving skills. These questions have been compiled to give you an insight into the types of questions that are asked at Oxbridge interviews and to allow you to practice the key skills that interviewers are looking for in interview responses.

Please note that these questions are NOT intended for you to prepare specific answers ahead of your interview. Interview questions change each year and interviewers are not looking for pre-prepared answers.

In your breakout rooms:

1. Introduce yourselves – name, where you're from, what A-Levels (or equivalent) you're taking, what subject(s)/universities you want to apply to
2. Discuss the question prompts together. There is no need to answer all the questions – feel free to focus on whichever questions you find most interesting. Please try and make sure that all students have a chance to share their ideas. If you run out of questions, you can either move onto questions from a related subject, or work through questions [Oxpire](#), [NRICH](#), [bioNRICH](#), [chemNRICH](#) or [Isaac Physics](#).
3. We will return to the main room at 2:30pm, and you'll have the chance to share some of the things that you've been talking about in your breakout rooms.

Hayley will be in the main room and circulating through the breakout rooms, so if you have any questions or concerns, please just let her know.

Biology (see also Chemistry)

- Why do some habitats support higher biodiversity than others?
- Why do many animals have stripes?
- If you could save either the rainforests or the coral reefs, which would you choose?
- Is it easier for organisms to live in the sea or on land?
- Why do lions have manes?
- Ladybirds are red. So are strawberries. Why?
- Would it matter if tigers became extinct?
- Why is sugar in your urine a good indicator that you might have diabetes?
- Why do a cat's eyes appear to 'glow' in the dark?
- "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?"

Chemistry/Chemical Engineering and Biotechnology (see also Biology, Physics)

- How many different molecules can be made from six carbon atoms and twelve hydrogen atoms?
- "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?"
- "Draw out the mechanism for the alkylation of benzene."
- "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?"
- What is an amino acid and why are there only twenty?
- Why do we need ATP, why not just release energy from glucose directly?
- How many moles of H₂O are in a single cup of water?
- What volume of wine can be drunk to reach the legal concentration of alcohol in the blood for driving?
- How do amino acids bond to form a peptide?
- How would you differentiate between salt and sugar without tasting them?
- How does blood maintain its pH?
- What is the concentration of water?
- Why are explosions a risk in flour mills? What stops bags of flour exploding in the kitchen?
- What would life be like without enzymes?
- How does a glow-stick work?



Computer Science (see also Maths)

- 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.

Maths

- 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 $y = \frac{(x-3)(x-2)}{(x^2)(x-1)}$
- What was the most beautiful proof in A-Level Mathematics?
- Draw graphs of: $y = \sin(1/x)$ $y = x \sin(1/x)$ $y = (x^3) \sin(1/x)$
- 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).
 - Exactly one of the balls drawn is red.
 - The three balls drawn have different colours.



- The number of blue balls drawn is strictly greater than the number of yellow balls drawn.
- 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 n th derivative of $1/x$
- Draw the graph of $(2x+3)/(x^2+1)$
- Sketch $y=\cos(x)$ and $y=\cos(2x)$, then shade the area represented by the integral of $\cos(x)$ from π to zero.
- Imagine a ladder leaning against a vertical wall with its feet on the ground. The middle rung of the ladder has been painted a different colour on the side, so that we can see it when we look at the ladder from the side on. What shape does that middle rung trace out as the ladder falls to the floor?
- How many ways are there to cover a $2 \times n$ rectangular grid with 2×1 tiles?

Medicine (see also Biology)

- Should someone sell their kidney?
- What are your 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.
- How successfully has the government mitigated the impact of the COVID 19 pandemic on the profession and the sector?
- What would be the implications if everyone became a vegan?
- Should people who refuse vaccination for themselves be denied treatment for any associated illnesses they develop?
- How can we reduce our dependence upon antibiotics?



- Why is sugar in your urine a good indicator that you might have diabetes?
- "Explain the relation between the structure and function of DNA."
- "Why do living systems need hormones?"

Physics/Engineering (see also Maths)

- 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?
- 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?
- 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?
- Why is the pole-vaulting world record about 6.5m, and why can't it be broken?
- 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?
- 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.
- 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?
- A ball, initially at rest, is pushed upwards by a constant force for a certain amount of time. Sketch the velocity of the ball as a function of time, from start to when it hits the ground.

Psychological and Behavioural Sciences

- A large study appears to show that older siblings consistently score higher than younger siblings on IQ tests. Why would this be?
- 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?
- Should interviews be used for selection?
- An experiment appears to suggest Welsh speakers are worse at remembering phone numbers than English speakers. Why?



- Imagine that 100 people each put £1 into a pot for a prize that will go to the winner of a simple game. Each person has to choose a number between 0 and 100. The prize goes to the person whose number is closest to $\frac{2}{3}$ of the average of all of the numbers chosen. What number will you choose, and why?

Veterinary Medicine (see also Biology)

- Why do dogs behave badly?
- How have vets' lives changed in the last 30 years?
- Would you prefer a large or small animal practice?
- Would it matter if tigers became extinct?
- If you could save either the rainforests or the coral reefs, which would you choose?
- How successfully has the government mitigated the impact of the COVID 19 pandemic on the profession and the sector?
- What would be the implications if everyone became a vegan?
- "Explain the relation between the structure and function of DNA."
- "Why do living systems need hormones?"
- Should people who refuse vaccination for their pets be denied treatment for any associated illnesses they develop?
- How can we reduce our dependence upon antibiotics?