Google Interview Questions

You are shrunk to the height of a penny and thrown into a blender. Your mass is reduced so that your density is the same as usual. The blades start moving in sixty seconds. What do you do?

Those who were paying attention in rocket- science class will recall the formula for the energy of a projectile: $E = mgh$. E is energy (of a bottle rocket, let's say), m is its mass, g is the acceleration of gravity, and h is the height the bottle rocket attains. The height increases in direct proportion with energy (as long as mass stays the same).

Suppose you tape two bottle rockets together and light them simultaneously. Will the double rocket go any higher? No; it's got twice the fuel energy but also twice the mass to lift against gravity. That leaves the height, h, unchanged. The same principle applies to shrunken humans jumping. As long as muscle energy and mass shrink in proportion, jump height should stay the same.

The blender riddle encapsulates the process of inventing a new product. You begin by brainstorming. There are many possible answers, and you shouldn't be in a hurry to settle for the first idea that seems "good enough." Coming up with a superior response requires listening carefully to the question's wording. "Imagination is more important than knowledge," Einstein said. You don't have to be an Einstein to answer the question well, but you do need the imagination to connect it to some knowledge you acquired long ago.

For many of us, the knee- jerk response is a facetious one. (One try, posted on a blog: "One might assume that since the blender is about to be turned on, that food will soon be entering, so I'd probably just put my neck to the blade rather than be suffocated by some raunchy health drink.") The two most popular serious answers seem to be (1) lie down, below the blades, and (2) stand to the side of the blades. There ought to be at least a penny's width of clearance between the whirring blades and the bottom or sides of the blender jar.

Another common reply is (3) climb atop the blades and position your center of gravity over the axis. Hold tight. The net centrifugal force will be near zero, allowing you to hold on. Like many of Google's interview questions, this one leaves a lot unsaid. Who or what has thrown you into the blender, and for what reason? If a hostile being is bent on making a human smoothie, your long- term chance of survival will be small, no matter what you do. Will liquid be added to the blender? Is there a top on it? How long will the blades be spinning? Should the blades spin a long time, answer 3 would make you dizzy. That could cause you to lose consciousness and fall off. You're welcome to question the interviewer on these points. The canonical responses are "Don't worry about hostile beings," "No liquid will be added," "There's no lid," and "Figure the blades will keep spinning until you're dead." Another approach is to (4) climb out of the jar. The interviewer will ask how you propose to accomplish that. You don't have suction cups. One bright response is, at that size you're like a fly and can climb glass. A dumb answer is to (5) use your phone to call or text for help. This depends on your phone's having been shrunk with you and being able to access the nearest (not shrunken) mobile phone tower. It also depends on 999 or your Twitter posse sending help in less than sixty seconds. Still another popular answer is to (6) rip or unravel your clothes to make a "rope" and use it to climb out of the jar. Or (7) use your clothes and personal effects to jam the blades or motor somehow. As we've seen, both have problems.

None of the above answers scores you many points at Google. Current and ex–Google interviewers have told me that the best answer they've heard is (8) jump out of the jar. Huh? The question supplies an important clue, that word density. "Being shrunk to the size of a penny" is not a realistic predicament. For starters, it might mean eliminating 99.99+ percent of the neurons in your brain. To deal with a question like this, you have to decide where to suspend disbelief and what to take in earnest. The fact that the interviewer mentions a detail like density is a nudge. It says that things like mass and volume matter in this question (while neuron count might not) and that a successful answer can use simple physics. In short, the question wants you to consider change- of- scale effects. You probably remember hearing about them in secondary school. An ant is able to lift about fifty times its body weight. It's not because ant muscles are better than human muscles. It's just because ants are *small.* Were you shrunk to penny size, you'd be able strong enough to leap like Superman, right out of the blender.

You're in a car with a helium balloon tied to the floor. The windows are closed. When you step on the accelerator, what happens to the balloon— does it move forward, move backward, or stay put?

The near-universal intuition is that the balloon leans backward as you accelerate. Well, the intuition is wrong. Your job is how to deduce how the balloon does move and to explain it to the interviewer.

When the car accelerates, the air is pushed backward, just as your body is. This sends a lighter-than-air balloon forward. When the car brakes suddenly, the air piles up in front of the windshield. This sends the balloon backward. Centrifugal force pushes he air away from the turn and sends the balloon toward the center of the turn. Of course, the same applies when the balloon is tied to something; it's just less free to move. The short answer to the question is that the balloon nods in the direction of any acceleration.

Don't believe it? Go to the supermarket, buy a helium balloon, and tie the string to the gear stick or hand brake. Drive back home. You'll be astonished. The balloon does exactly the opposite of what you'd expect. When you step on the accelerator, it bobs forward, like it's trying to race the car to the next light. Brake hard enough to throw the kids' toys out of the backseat, and the balloon pulls backwards. In a high-speed turn, as your body leans outward, the crazy balloon veers inward. It's so freaky that there are videos of this on YouTube.

If you had a stack of pennies as tall as the Empire State Building, could you fit them all in one room?

This may sucker you into thinking that it is one of those interview questions where you're intended to estimate an absurd quantity. Hold on— the question doesn't ask how many pennies. It asks, will the stack fit in a room? The interviewer wants a yes- or- no answer (with explanation, of course). That should be a clue, as should the fact that the question doesn't say how big the room is. Rooms come in all sizes. Intuition might suggest that the stack wouldn't fit in a phone booth but would fit easily in the Hall of Mirrors at Versailles. The answer is roughly this: "The Empire State Building is about a hundred stories tall [it's 102 exactly]. That's at least a hundred times taller than an ordinary room, measured from the inside. I'd have to break the skyscraper- high column of pennies into about a hundred floor- to- ceiling- high columns. The question then becomes, can I fit about a hundred floor- to- ceiling penny columns in a room? Easily! That's only a ten- by- ten array of penny columns. As long as there's space to set a hundred pennies flat on the floor, there's room. The tiniest New York apartment, an old- style phone booth, has room."

How many bottles of shampoo are produced in the world in a year?

People in affluent countries run through several bottles of shampoo a year. Many in developing nations can't afford such a luxury as shampoo. You might as well guess that it averages out to one bottle per person (unless you're interviewing at Procter and Gamble, the interviewer won't know any better). The answer is, there are about as many bottles produced per year as there are people in the world, 6 billion. A handy pointer: It's hard to go too far wrong when estimating consumption of popular consumer products. Use your own consumption as a guideline and adjust. The resulting guesstimate won't be orders of magnitude off, and that's all that matters.

It's raining and you have to get to your car at the far end of the car park. Are you better off running or not, if the goal is to minimize how wet you get? What if you have an umbrella?

To answer this question, you must reconcile two conflicting trains of thought. The case for running is this: The longer you are out in the rain, the more drops fall on your head, and the wetter you get. Running shortens your exposure to the elements and thereby keeps you drier. There's also a case for not running. In moving horizontally, you slam into raindrops that wouldn't have touched you had you been standing still. A person who runs in the rain for one minute gets wetter than a person who just stands in the rain for a minute. That valid point is mostly beside the point. You have to get to your car, and there's nothing to be done about that. Imagine yourself zipping across the car park at infinite speed. Your senses are infinitely accelerated, too, so you don't slam into cars. From your point of view, external time has stopped. It's like the "bullet time" effect in a movie. All the raindrops hang motionless in the air. Not a drop will fall on your head or back or sides during the trip. But to get to the car, you've got to carve a tunnel through the rain. The front of your clothing will sop up every single raindrop hanging in the path from shelter to car. When you travel at normal speed, you're fated to run into those same raindrops or, rather, their successors. At normal speed, you also have drops falling on your head. The number of raindrops you encounter will depend on the length of your horizontal path and also on the time it takes to travel that path. The length of the path is a given. The only thing you can control is the time it takes. To stay as dry as possible, you should run as fast as possible. Running makes you less wet— provided you don't have an umbrella.

The interviewer writes six numbers on the room's whiteboard:

10, 9, 60, 90, 70, 66

The question is, what number comes next in the series?

The question is, what number comes next in the series? Similar riddles have been used on psychological tests of creativity. Most of the time, the job applicant stumbles around, gamely trying to make sense of a series that gives every indication of being completely senseless. The majority of candidates give up. A lucky few have a flash of insight. Forget maths. Spell out the numbers in plain English, which gives you the following:

ten
nine
sixty
ninety
seventy
sixty- six

The numbers are in order of how many letters are in their names! Now look more closely. Ten is not the only number you can spell with three letters. There's also one, two, and six. Nine is not the only four- letter number; there's zero, four, and five. This is a list of the largest numbers that can be spelled in a given number of letters.

Now for the payoff, what number comes next? Whatever number follows sixty- six should have nine letters in it (not counting a possible hyphen) and should be the largest nine- letter number. Play around with it, and you'll probably come up with ninety- six. It doesn't look like you can get anything above 100 because that would start "one hundred," requiring ten letters and up.

You might wonder why the list doesn't have 100 ("hundred") in place of 70 ("seventy"). "Million" and "billion" have seven letters, too. A reasonable guess is they're using cardinal numbers spelled in correct stylebook English. The way you write out the number 100 is "one hundred."

In the On- Line Encyclopedia of Integer Sequences, you can type in a series of numbers and it tells you what numbers come next. You're not allowed to use it with this interview question, of course, but the website's answer for this sequence is 96. In recent years, companies in all sorts of industries have adopted this question for interviews. Often the interviewer throws it in just to make the poor candidate squirm. At many of these companies, the one and only correct answer is 96.

Not at Google. In Mountain View, 96 is considered to be an acceptable answer. A better response is

10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,00
0,000,000,000,000,000,000,000,000,000,000

A.k.a. "one googol."

That's not the best answer, though. The preferred response is

100,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,0
00,000,000,000,000,000,000,000,000,000,000

Ten googol.

A man pushed his car to a hotel and lost his fortune. What happened? (Lateral thinking puzzle.)

He was playing Monopoly.

You and your neighbor are holding garage sales on the same day. Both of you plan to sell the exact same item. You plan to put your item on sale for £100. The neighbor has informed you that he's going to put his on sale for £40. The items are in identical condition. What do you do, assuming you're not on especially friendly terms with this neighbor?

A better answer is simpler: buy the neighbor's item. Why? First of all, he'll be pleased to sell his item immediately. He's not likely to be offended or to raise the price. You can haggle, like any other buyer, and may get it for less than £40. Why should you want his item? When you put something on sale for £100, you hope to make a decent profit, compensating for the time you've invested in selling it and factoring in the chance that it won't sell. Anything that diminishes the chance of your item's selling in effect costs you a significant fraction of that £100. The numbers in this puzzle were chosen so that the neighbor's price is comparable to the economic damage he's doing to you. By buying the item, you get the right to keep it off the market, when that suits your purposes, plus the right to sell it at any price the market will bear. Anything you get from selling the second item is pure gravy. The best plan is to hide one item until the first one sells. Then put the second item on sale at a reduced price, according to how late in the day it is. ?

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