Section A

You **must** answer question one.

1 Science and uncertainty go hand in hand. But what happens when misinterpretations of that uncertainty go public? It can cause all sorts of problems. Take the early days of the coronavirus pandemic, for example. When COVID-19 first came to the United States, many people chose to ignore warnings and failed to engage in proper social distancing. They were likely interpreting uncertainty in data about risk and contraction to mean that the coronavirus wasn't something that needed to be taken seriously. This is a common mistake that people make when they expect certainty from science and fail to appreciate that legitimate science always has uncertainties.

But why can't science ever be 100% certain?

To understand this, we need to remember that the aim of science is to explain, predict and control natural phenomena. Yet science's so-called 'laws' of nature are merely highly probabilistic claims that can never be proven to be true. This is because such claims are only ever contingent, that is, not necessary. This seems highly unintuitive when we first think about it. After all, the sun has to rise from the east tomorrow, right? It surely cannot be the case that it rises from the west. But unlike mathematical claims like "2+2=4", scientific claims can always be otherwise – a world where the sun rises from the west is unlikely, yes, but there is nothing to stop it from doing so. Perhaps, in this unlikely possible world, an alien race decides to change the direction of Earth's orbit through some electromagnetic wizardry.

On top of this, we need to consider what the Scottish philosopher, David Hume, called the Problem of Induction. We are constrained by the limits of experience – there is only so much that we can experience, even with vast amounts of money spent on scientific research each year to try and expand our ability to observe an increasing number of things in nature. This means that in advancing a scientific claim, we have to infer, from a finite number of observations, that this is exactly how Nature works – not just now, not just in the past, but also in the future. But to make such a claim is to essentially claim that the future will resemble the past. And how do we know that the future will resemble the past? Because in the past, the future had resembled the past! This, as philosophers pointed out, is disingenuous.

And contrary to popular perception, Science isn't as objective as it's made out to be. Confirmation bias, even to the point of making up false data so as to 'prove' one's theory, is unfortunately all too common. Evidence, that so-called objective arbiter that was supposed to help us choose the right theory, actually cannot fulfil such a function. In fact, we can't even be sure that evidence itself is objective – the very act of observation can be so 'contaminated' by theory that scientists see things that aren't even there! This lack of objectivity also contributes to the uncertainty of Science.

All this is not to say that Science is totally uncertain; to believe so and to totally disregard what it says would be irrational. Let us not forget the wonderful contributions that Science has given us – this very computer that I am typing this piece on for example. Science is not 100% certain, yes, but that it works is something that we cannot dispute. And that means that it is at least reasonably certain. Factor in the rigorous system of checks and balances that Science has that allowed us to identify and correct experimental errors or, worse, cases of scientific fraud, we would be ill-advised to act against the best scientific advice of our day. One only needs to recall incidents of those who downed bottles of disinfectant in a futile bid to ward off COVID-19.

Adapted from "A philosopher explains how to balance rationality, scientific uncertainty in coronavirus claims" by Haley Herfurth

Critically evaluate the above argument with reference to the nature and construction of scientific knowledge. Respond with your own critical comments to support or challenge the author's position.

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Section B

Answer **one** question.

2 "While science might be less certain than mathematics, it is nonetheless more useful." Discuss.
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3 Critically assess the view that science will eventually be able to tell us exactly how the world works.
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4 "The truths of mathematics are discovered through reason alone." Discuss.
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5 Critically assess the view that a knowledge claim has to be justified by empirical evidence. Discuss with reference to science and/or mathematics.
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