



## Physical Natural Sciences

### **Question**

*How will quantum technology have changed our world by 2100?*

### **Background**

The transistor is by far the most wide-ranging and revolutionary invention to emanate from the field of condensed matter physics, the development of which has in turn invented entirely new fields within computer and materials sciences. Today the silicon-based economy, ranging from physical chip manufacturing through to software development, is a global ecosystem worth trillions of dollars annually.

However, the transistor is but the first quantum-inspired discovery. Recent advances in quantum computers, topological insulators, superconducting devices, and other systems, have led many people to predict that the computing revolution of the 20<sup>th</sup> century may be dwarfed by a much more impactful quantum revolution in the 21<sup>st</sup>. What is the current state of these technologies? How far are we from realising new breakthroughs? How will this affect life as we know it?

### **Guidance**

Recently, there has been an increasing amount of excited news surrounding the potential of these new technologies – particularly quantum computing.<sup>1</sup> Your task is to sort what prospects look most promising from those that are perhaps merely overhyped. The scope of this is very broad – you are encouraged to focus on whatever aspect of this extensive umbrella-field that you find most interesting. You could choose to focus on the mathematics involved in producing algorithms for quantum computers, or instead on the industrial limitations of scaling up to produce new technologies, or anything in between these two extremes. You could choose to specifically focus on one aspect/technology or to do a broad appraisal of the entire field, the choice is yours – all that is required is that the question is somehow answered by what you choose to focus on.

Also provided are some review articles from prominent academic journals that give a good overview of where the field currently is, and where it may be heading. (For copyright reasons you need to [sign up here](#) in order to access these. Signing up is not a commitment to sending us a piece of work!) While much of the content may be advanced even for an undergraduate reader, the abstracts and introductions should be accessible, and give you an indication of what to explore. Science news webpages, such as this one,<sup>2</sup> are probably another good place to start, as they typically explain the concepts in much simpler language.

### **Presentation**

Feel free to be creative as you like in your presentation: you may choose to write an essay, but you may prefer to record a video or prepare a powerpoint (with notes).

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<sup>1</sup> [www.nature.com/articles/d41586-019-03213-z](http://www.nature.com/articles/d41586-019-03213-z)

<https://news.harvard.edu/gazette/story/2019/10/harvard-weighs-in-on-googles-quantum-supremacy/>

<sup>2</sup> <https://www.quantamagazine.org/like-magic-physicists-conjure-curious-quasiparticles-20210324/>