

The science behind superheroes' powers

adapted from an article by Dick Ahlstrom



- 1 Spider-Man flies across the city on his spider silk, one of a number of special powers acquired after the bite of a radioactive arachnid. Tony Stark has no superhuman powers, but when he dons his Iron Man suit, advanced technology enables him to perform like a superhero. These and many other superheroes make for great entertainment, 12.
- 2 Dr Barry Fitzgerald uses these comic-book characters and the films they inspire to provide a powerful method for teaching complex science. His book, *Secrets of Superhero Science*, demonstrates the science behind their superpowers, but also highlights when the reality of science cannot keep up with the cinematic powers of computer-generated imagery (CGI).
- 3 Fitzgerald is based at Eindhoven University of Technology in the Netherlands, where he is a postdoctoral researcher in the department of chemical engineering and chemistry. "I am a huge fan of superheroes, always have been. I saw my first Superman film in 1978 and once I saw that, that was it." Science and science-fiction first merged for him when he started to run a science learning centre for undergraduates at the University of Limerick and realised the educational potential of superheroes.
- 4 He began giving talks at universities and, in January 2015, gave 25 talks for secondary school students in one week. "I had one slide on the character Hawkeye and got so much enthusiasm about him I wrote a full chapter about Hawkeye," he says.

- 5 Hawkeye, a Marvel character, has no superhuman powers, but he does have exceptional eyesight, far better than normal vision and akin to what a hawk would see. This in turn allowed Fitzgerald to talk about the structure of the eye and photo receptor cells and the science behind Hawkeye's vision. "It boils down to him having more photo receptor cells than we do," says Fitzgerald. "He could have as many as a hawk, allowing him to see a rabbit during the day from 2km away." He also talks about a company developing bionic lenses that could bring our vision up to better than 20-20.
- 6 Iron Man, another popular character he discusses, wears a metal suit that includes a propulsion system. So he can fly, but this makes the suit very, very hot. "The only way I can see him dealing with that is the introduction of materials that convert waste thermal energy into electrical energy," Fitzgerald says. "These materials do exist and are being used in car exhaust systems to convert heat to energy, which can be used to power on-board computer control systems."
- 7 As far as Spider-Man's powers go, scientists are now working to use spider silk – one of the toughest substances on the planet – to create bullet-proof technologies and lightweight but strong parachutes.
- 8 There are bound to be scientists who 15 Fitzgerald's approach, which takes fictional science and treats it as real, but no one has challenged him on it yet. "The primary aim is to encourage students to take up a career in science," he says. "All the science in the book is completely accurate. It may kick-start an interest in a career choice they had not considered. If I convince one person to do science, I have already won."

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Tekst 6

- 1p 12 Kies bij 12 in alinea 1 het juiste antwoord uit de gegeven mogelijkheden.
- A but can their powers be controlled so that the whole world can benefit from them?
 - B but could they also be used to explain physics, engineering and graphene to students?
 - C but do we need scientists doing research to find out why the public likes them?
- 1p 13 'His book, *Secrets of Superhero Science*' (paragraph 2)
How can this book best be described, judging from paragraphs 2, 3 and 4?
- A It explains why the amusement industry needs scientific support.
 - B It introduces scientific innovations developed by superheroes.
 - C It presents serious scientific information in a different but effective way.
 - D It shows how recent scientific research is made popular by certain films.
- 2p 14 In dit artikel wordt informatie gegeven over het boek *Secrets of Superhero Science* en de schrijver van dit boek.
→ **Vanaf** welke alinea beginnen de volgende delen?
Schrijf het nummer van de alinea achter de letter in de uitwerkbijlage.
- a aanleiding dat een wetenschapper een film kan gebruiken als hulpmiddel
 - b concrete voorbeelden van mogelijke toepassingen van 'krachten' van superhelden
 - c verdediging tegen kritiek dat de aanpak niet deugt
- 1p 15 Kies bij 15 in alinea 8 het juiste antwoord uit de gegeven mogelijkheden.
- A are supporters of
 - B do not agree with
 - C try to ignore
 - D would like to copy
- 1p 16 'The science behind superheroes' powers' (titel)
→ In welke alinea wordt duidelijk dat sommige in de films getoonde krachten **niet** wetenschappelijk te onderbouwen zijn?
Noteer het nummer van deze alinea in de uitwerkbijlage.

Bronvermelding

Een opsomming van de in dit examen gebruikte bronnen, zoals teksten en afbeeldingen, is te vinden in het bij dit examen behorende correctievoorschrift, dat na afloop van het examen wordt gepubliceerd.