

Write your answer A/B/C/D in the box provided:

Questions 38 to 45 are based on the following passage.

- 1 After Darth Vader lopped off Luke Skywalker's hand in the Star Wars movie "The Empire Strikes Back," Rebel Alliance doctors installed a prosthetic that immediately moves and feels just like a human hand. Science fiction is coming closer to reality. At Johns Hopkins University, researchers recently adapted a brain mapping technology to enable a patient to independently move individual fingers on a prosthetic arm just by thinking about it. 5
- 2 While such technology is years from practical application in patients, the breakthrough by biomedical engineers and physicians from Johns Hopkins University and its School of Medicine is the latest advancement in a growing field of research into mind-controlled movement of artificial limbs. The Johns Hopkins researchers said their work, published this month in the *Journal of Neural Engineering*, is the first to accomplish such precise, individualised motion of the fingers and shows promise for one day providing amputees with prosthetics that more closely mimic the movements of real hands and arms. While prosthetics have improved in recent years, they still can be bulky and hard to manoeuvre. The fingers on existing prosthetics move as one unit, or in unison, opening and closing together, like when grasping a soda can. 10 15
- 3 "We still have a bit of a way to go before we get this in a practical clinical setting fully restoring the natural dexterity of people — but I think that day is coming," said Guy Hotson, an electrical and computer engineering graduate student at Johns Hopkins who was lead author on the study. 20
- 4 Funded by the National Institute of Neurological Disorders and Stroke, the experiment used a modular prosthetic arm developed by Johns Hopkins Applied Physics Laboratory. Considered the world's most sophisticated upper-extremity prosthesis, the arm can perform almost all of the same movements as a human arm and hand. 25
- 5 The lab's research and development of the arm itself was funded under the Revolutionising Prosthetics programme of Defense Advanced Research Projects Agency with the intent of restoring limb function to wounded military members.
- 6 While building such a mechanically sophisticated prosthesis is possible, how to control it remains an open question. That's where the Johns Hopkins researchers thought that brain-mapping technology could be used. But they needed a subject to whom they could apply sensitive electrodes directly to the brain. Because the study involved opening the brain, the researchers needed to find someone already getting surgery for something else, so they recruited a young epileptic man undergoing brain surgery to stop seizures not controlled by medicine. As part of the procedure, doctors placed electrodes on the patient's brain to help determine where his seizure originated, and then removed those parts of his brain. 30 35
- 7 The surgeons applied the same brain mapping technique to determine which parts of his brain controlled finger movement. A set of 128 electrodes sitting on a film the size of a credit card were placed on the parts of the brain that control hand and arm movement. Each sensor measured a millimeter of brain tissue. 40

- 8 The researchers then asked the patient, who was awake throughout the surgery, to move individual fingers. The computer programme developed by Johns Hopkins engineers recorded the parts of the brain that were activated through electrical signals detected by the sensors as he moved each finger. Using the data collected from the patient's brain, the prosthetic arm was programmed to move particular fingers when corresponding parts of the brain were activated. 45
- 9 "It will be interesting to see how and if they are able to bring any of this technology to market; that's always a challenge," Gondo said. "It could be years before mind-controlled prosthetics are even ready for commercialisation", the Johns Hopkins researcher said. 50

(Adapted from <http://www.baltimoresun.com/2016>)

38 **Science fiction is coming closer to reality (lines 3 and 4).**

This means that

- A science fiction reflects modern life
 - B modern inventions evolve from scientific ideas
 - C fictitious ideas in movies are becoming true in life
 - D the ideas in the movies inspire scientific inventions
- 39 What is the main idea in paragraph 1?
- A Using a human-like prosthetic arm in combat
 - B Learning from science fiction in developing prosthetics
 - C Possibility of the mind controlling the use of a prosthetic arm
 - D Introduction of brain mapping technology at Johns Hopkins University
- 40 Which of the following words has the same meaning as *mimic* (line 14)?
- A Mirror
 - B Extend
 - C Restore
 - D Replace
- 41 The following are disadvantages associated with the use of prosthetics **except**
- A it is cumbersome
 - B it is difficult to control
 - C it takes a long time to develop
 - D it does not allow easy finger movement

- 42 The development of the prosthetic arm was the result of
- A a joint effort among agencies
 - B a graduate engineering project
 - C an initiative by the defense agency
 - D massive funding by Johns Hopkins University
- 43 The subject for the study on mind map technology was selected because
- A he was not on medication
 - B he was a Johns Hopkins' patient
 - C he was scheduled for brain surgery
 - D he needed to use electrodes for his treatment
- 44 The purpose of the experiment is
- A to track the patient's finger movements
 - B to obtain information for programming
 - C to test the operation of the prosthetic arm
 - D to observe how the patient responded to specific instructions
- 45 In the last paragraph, the researcher sounded
- A cautious
 - B sceptical
 - C optimistic
 - D unconvinced