BBC EARTH Education Programme

September 2018: Student's Copy / Lower Secondary

Total: 40 marks

(A) Comprehension / Reading Questions (12 marks)

From 'Deep Thought' pg 24

As far as possible, answer in your own words.

1. Rephrasing/ Language Question
Why do people think that fish are not intelligent? (2m)

_____

_____

_____

2. Rephrasing / Language Question
Give one example of social learning as observed in sharks? (2m)

_____

_____

_____

3. Rephrasing / Inferential Question
Why is the 'dot' self-awareness test not ideal for testing self-awareness in fish? (2m)

_____

_____

_____

4. Language/Inferential Question
What is meant by the phrase 'the lab rats of the fish world'? (2m)

_____

_____

5. Inferential/ Rephrasing Question

According to the article, what is the main implication of proving that fish feel pain? (1m)

_____

_____

_____

6. Evaluative Question

Refer to the section entitled, 'They Make Tools'. How convincing is the point about the captive Atlantic cod? Give reasons to support your answer. (3m)

_____

_____

_____

_____

(B) Editing (12 marks)

Adapted from 'So Long, And Thanks For All The Pics' pg 68

Carefully read the text below, the first and last lines are correct.
For each paragraph, there is at least one spelling or grammatical error. Some lines do not contain any errors.

If there is NO error in a line, put a tick ( ) in the space provided.
If the line is incorrect, circle the incorrect word and write the correct word in the space provided.

The correct word you provide must not change the original meaning of the sentence.

In classical mythology, the god Jupiter surrounded himself in clouds to keep his antics hidden by view. Only his wife, Juno, could see through the vale to his true nurture. And so it is with the NASA spacecraft of the same name. The secrets of the formation of the whole Solar System lie below Jupiter's all-encompassing clouds, just waiting to be discovered. Theories for our Solar System formation all begin with a collapse of a giant cloud of gas and dust, otherwise known as a nebula, the majority of whom formed the Sun. Like the Sun, Jupiter is mostly hydrogen and helium, so it to must have form early on, capturing most of the leftover material after our star formed. How this happened, however, is unclear. Did a massive planetary core form first and gravitationally capture all that gas, or did an unstable region collapse inside the nebula, triggered the planet's formation? Once process, the data took by Juno's instruments will give researchers insights on how the planet formed and what the conditions in the early Solar System were like. But it also carries an instrument called JunoCam, which has taken a raft of images that so-call citizen scientists from the general public can process, and submit back to NASA. The results have been spectacular.	

(C) Comprehension / Reading (16 marks)

Adapted from 'The Power Of Thought' pg 62

Read the article below. As you read, answer the questions in the column on the right. Use your own words as far as possible.

The idea that we could run our lives from inside our heads is, obviously, a fantasy, but there are those who are attempting to make it a reality. In 2017, SpaceX and Tesla billionaire Elon Musk announced a new venture, Neuralink. Its aim: to build a high-bandwidth, implantable brain- computer interface that will put us permanently online and allow us to communicate wirelessly with anything that has a computer chip. The device could, theoretically, allow us to have thought conversations with our friends, share memories as if they were smartphone videos and 'know' anything we wanted by simply calling it down from the cloud.	According to the article, what can Neuralink facilitate us doing? (1m)
Meanwhile, earlier this year, the US Defense Advanced Research Projects Agency (DARPA), announced plans to develop next-gen brain-computer interfaces, with the aim of enhancing the abilities of military personnel.	
A recently released document suggested a possible experiment for testing these devices: "a human subject controlling multiple drones in a virtual reality setup, while receiving sensory feedback to portray the status of each drone." In other words, we might one day see soldiers controlling drones with their minds.	In your own words, explain the experiment that could be used for testing these devices. (2m)
It sounds impressive, but is it possible? Primitive versions of brain-machine interfaces have already been used to help paralysed people move prosthetic limbs, but could we really see this technology making the leap to everyday use?	How might brain-machine interfaces be used to help paralysed people move prosthetic limbs? (2m)
Group thinking	
A brain-computer interface is a device that's able to read the electrical impulses coming from the brain's nervecells (neurons) using electrodes and ideally also write to the brain, delivering information to the user by stimulating groups of neurons. Neuralink's ultimate goal is to build an interface that interacts directly with each of the 86 billion neurons in our brains, and the company is apparently in the process of putting together a crack science team for its project. The finer details of exactly how Neuralink plans to do this remain under wraps, however.	Why might the 'finer details' be kept under wraps? (2m)

"I'm still looking for more information on this," says Dr Davide Valeriani, who studies brain-computer interfaces at the University of Essex. "Musk has announced these initiatives and then for a while hasn't said anything else."

Valeriani works with the kind of brain-computer interfaces that you might be more familiar with – electroencephalography (EEG) caps, those ugly skullcaps with all the sensors and wires attached to them. "You can imagine this as a system you can put in a backpack, with electrodes integrated into something we wear already, a hat or hairnet or whatever," says Valeriani. All it takes to get this system working for a particular user is half an hour or so of training, not for the human but for the machine, which has to learn which patterns in the person's brain are associated with certain thoughts.

Valeriani uses these EEG setups for group decision- making tasks. In one experiment from a 2017 study, his team asked groups of people wearing the caps to look at penguins and try to spot a polar bear in each image. Electrodes in the EEG caps monitored their brain signals and a computer delivered a collective answer. The computer learned to recognise signals associated with each person's confidence in their decision and gave more weight to confident responses when coming up with the answer – whether there was or wasn't a polar bear. Perhaps it's not too much of a stretch to imagine similar technology being used by police officers to search for suspects on CCTV footage or by soldiers assessing warfare scenarios, the only downside being the EEG hairnets and backpacks full of electronics they'd need to wear.

Plugged in

The alternative is having electrodes implanted directly in your head, which is what Matthew Nagle did in 2004. Trials of implantable brain-computer interfaces have so far been mostly focused on paralysed people, because for them, the gain in function is worth the surgery and its risks. A quadriplegic, Nagle took the opportunity of a trial to get hooked up to a computer, allowing him, with practice, to control a cursor on a computer screen with his mind, operate a TV and send emails.

Last year, researchers used an updated version of this implanted 'Braingate' interface to give three paralysed people the ability to type up to eight words per minute with their brains. Unfortunately, the current state-of-art for this system requires roughly 100 electrodes and a thick set of cables to be plugged in directly through the top of your skull, risking infection and resembling something out of The Matrix. "That's

---

"I'm still looking for more information on *this*" - What is '*this*' that Dr Valeriani is referring to? (1m)

In your own words, explain what it takes for the system to start working? (2m)

Why would the backpacks full of electronics be a 'downside'? (2m)

In your own words, explain why the trials have focused largely on paralysed people? (2m)

one of the major issues," says Prof Thomas Stieglitz, who's developing brain-computer interfaces for medical applications at the University of Freiburg in Germany. "There are still these ugly connectors that are screwed into the skull and poke through the skin." Scaling up to a whole-brain interface – à la Neuralink – would require millions or billions more electrodes, which currently can't be detached from their connectors.	What are some of the problems that researchers are facing with the medical applications of this sort of interface? (2m)

(D) Research & Writing

Research

What are the pros and cons of artificial intelligence? Do you think it is/will be more helpful or harmful to humanity? What regulations or guidelines, if any, do you think need to be put in place to prevent any potentially detrimental outcomes of artificial intelligence?

Reading & Comprehension

Read the article "**The Power Of Thought'** pg 62-67 in full. Using a graphic organiser, collate the reasons why brain interfacing technology might be beneficial and the reasons why they may be detrimental. Which point of view is more convincing? Can you think of any other reasons not stated in the article?

Classroom Discussion/ Essay Question

You have been asked to write a blog post entitled 'Artificial Intelligence: a liability or an opportunity?' In your blog post, ensure that your opinion on this matter is clearly expressed and defended with strong arguments and good examples.

(E) Useful Tips

It is possible to express your opinions, and express them clearly and strongly, without being biased. Biased writing does not give a balanced view and weakens your argument, so it is important avoid using it in your arguments and equally important to recognise it in others' arguments so that you are not persuaded by a writer's prejudices.

- Biased writers often present a limited view of the topic. This may not be done in an immediately noticeable way and it may not even be premeditated but you'll notice that biased writers tend to avoid giving the full picture.
- Biased writers often over-generalize or over-simplify by making sweeping statements that may not necessarily be true, or by using absolutes (eg: never, always, nothing, everything...).
- They use hyperbole; they exaggerate something that supports their position.
- They avoid addressing obvious rebuttals to their position, or gloss over them.
- They appeal more to emotions than reasonable arguments.