

Please check the examination details below before entering your candidate information

|                                                                                                             |  |  |  |  |                  |  |                |             |  |
|-------------------------------------------------------------------------------------------------------------|--|--|--|--|------------------|--|----------------|-------------|--|
| Candidate surname                                                                                           |  |  |  |  | Other names      |  |                |             |  |
| Centre Number                                                                                               |  |  |  |  | Candidate Number |  |                |             |  |
|                                                                                                             |  |  |  |  |                  |  |                |             |  |
| <b>Pearson Edexcel Level 3 GCE</b>                                                                          |  |  |  |  |                  |  |                |             |  |
| <b>Friday 14 June 2024</b>                                                                                  |  |  |  |  |                  |  |                |             |  |
| Morning (Time: 2 hours)                                                                                     |  |  |  |  | Paper reference  |  | <b>9BN0/02</b> |             |  |
| <b>Biology A (Salters Nuffield)</b><br><b>Advanced</b><br><b>PAPER 2: Energy, Exercise and Coordination</b> |  |  |  |  |                  |  |                |             |  |
| <b>You must have:</b><br>Scientific calculator, pencil, ruler                                               |  |  |  |  |                  |  |                | Total Marks |  |

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- You may use a scientific calculator.
- In question(s) marked with an **asterisk (\*)**, marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**Pearson**

(b) PET, MRI and fMRI are methods for scanning the brain.

PET uses labelled glucose. This glucose can be detected so that PET can be used to identify brain tumours.

- (i) Describe the advantages of using PET and fMRI rather than MRI scans to investigate a possible tumour in the brain.

(2)

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- (ii) The images show brain scans produced from two imaging techniques other than PET.

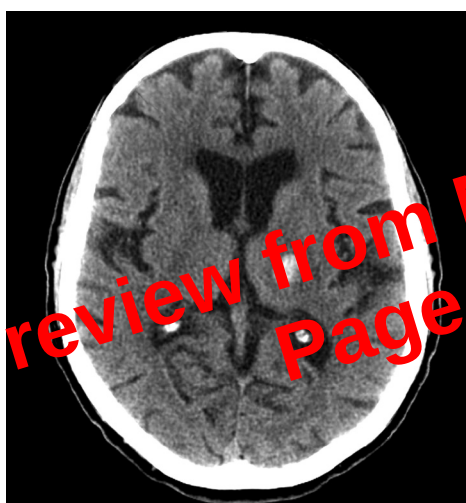


Image 1

(Source: ZEPHYR/SCIENCE PHOTO LIBRARY)

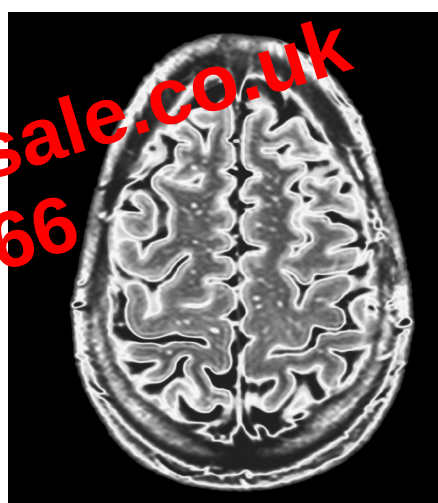


Image 2

(Source: ALFRED PASIEKA/SCIENCE PHOTO LIBRARY)

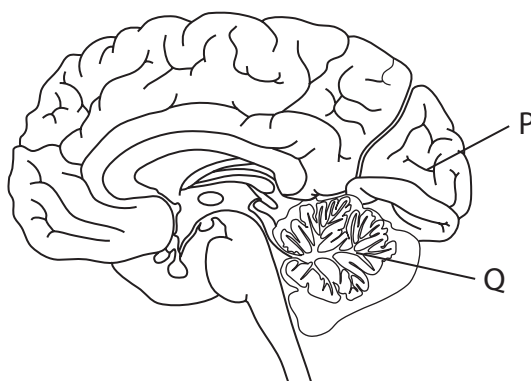
State how image 1 can be identified as being produced by CT and image 2 by MRI.

(1)

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(c) The diagram shows a human brain.



Brain tumours can change brain function.

Describe the possible effects of brain tumours in parts P and Q.

(2)

P.....  
.....

Q.....  
.....

Total for Question 1 = 7 marks)

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- 3 In 2021, there was an accident at a nuclear power station in Spain. There was no radiation leak but carbon dioxide was released.

Some people were taken to hospital showing symptoms of carbon dioxide poisoning after inhaling carbon dioxide.

Their symptoms included rapid breathing and an increased heart rate.

- (a) (i) Explain why rapid breathing is a symptom of carbon dioxide poisoning.

(4)

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- (ii) A person's breathing rate can be calculated from a spirometer trace.

Which of the following calculations would give the rate of breathing as breaths per minute?

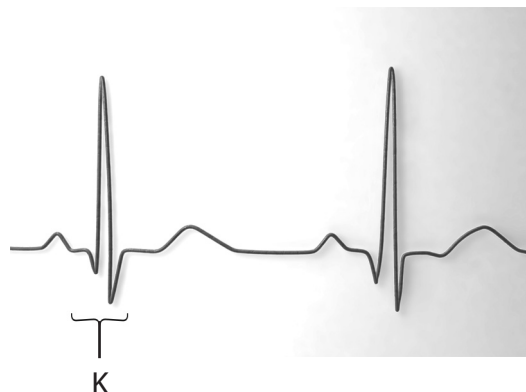
(1)

- ☐ A number of peaks on the trace in 10 seconds divided by 60
- ☐ B number of troughs on the trace in 15 seconds divided by 0.25
- ☐ C tidal volume multiplied by 60
- ☐ D tidal volume multiplied by number of peaks per second



- (b) Electrocardiograms (ECGs) were also recorded for the people with carbon dioxide poisoning.

The diagram shows part of an ECG.



(Source: KATERYNA KON/SCIENCE PHOTO LIBRARY)

Explain the role of the atrioventricular node (AVN) in the events happening at K on the ECG.

(3)

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- (c) Radiation has leaked from accidents at other nuclear power stations. This has led to mutations in the developing embryos of pregnant women.

Prenatal genetic screening can be offered to check for certain mutations.

Give a reason why some pregnant women may choose chorionic villus sampling rather than amniocentesis.

(1)

(Total for Question 3 = 9 marks)

6 In 2018, there were 7340 non-identical twins born in the UK. Each set of twins was the outcome of two egg cells each fertilised by a different sperm cell.

(a) Which of the following shows the probability of a pair of non-identical twins being the same sex?

(1)

- ☐ A 0.00
- ☐ B 0.25
- ☐ C 0.50
- ☐ D 1.00

(b) Explain how a sperm cell is adapted for its role in fertilisation.

(3)

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- (b) At the start of the investigation, each athlete swallowed a small digital thermometer so their core body temperature could be measured. A mean core temperature was calculated.

The athletes carried out warm-up activities for 20 minutes in a chamber set at 16°C.

After warming up, each athlete exercised. The intensity of the exercise was increased at three-minute intervals. Each athlete exercised until they were unable to continue.

The change in body mass of each athlete during the warm-up activities and the exercise was recorded. The mean change in mass was calculated and used as a measure of the sweat produced.

The warm-up and exercise were repeated at a temperature of 32°C.

- (i) Explain why the athletes were not allowed to eat or drink during this investigation.

(3)

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## Mark Scheme (Results)

Summer 2024

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Pearson Edexcel Advanced Level  
In Biology A Salters Nuffield (9BN0)  
Paper 02: Energy, Exercise and  
Coordination

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Additional Guidance                                                                                                                                                                                                                                                                                                                | Mark |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 2(c)            | <p>An answer that makes reference to four of the following:</p> <ul style="list-style-type: none"> <li>• use same volume of solution (for both) / use same { volume / concentration } of DCPIP (for both) (1)</li> <li>• add solution to DCPIP / titration using DCPIP and { vitamin C solution / extract } (1)</li> <li>• until DCPIP decolourises / changes from blue to colourless } (1)</li> <li>• compare volume of the two solutions needed for the DCPIP to decolourise (1)</li> <li>• quantify the results by titration using a vitamin C standard solution (1)</li> </ul> | <p>ALLOW add DCPIP to each solution</p> <p>ALLOW DCPIP becomes colourless in correct context<br/>ALLOW DCPIP added to vitamin C solution until {DCPIP colour remains /DCPIP stays blue / solution becomes blue }</p> <p>ALLOW compare volume of DCPIP needed for the two solutions<br/>ALLOW correct description of comparison</p> | 4    |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Additional Guidance                                                                                                                                                                               | Mark |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 3(a)(i)         | <p>An explanation that makes reference to four of the following:</p> <ul style="list-style-type: none"> <li>raised carbon dioxide (concentration) in blood / reduced blood pH (1)</li> <li>(that is) detected by chemoreceptors (1)</li> <li>(resulting in) impulses sent to the { ventilation centre / medulla (oblongata) } (1)</li> <li>(so) more impulses sent along the motor neurones (to muscles involved in breathing) (1)</li> <li>(so there is an) increase in rate of { diaphragm / intercostal muscle } contraction (and relaxation) (1)</li> </ul> | <p>ALLOW increased carbonic acid in blood</p> <p>ALLOW inspiratory centre</p> <p>ALLOW more impulses along the phrenic nerve</p> <p>ALLOW increased impulses along sympathetic nerve pathways</p> | 4    |

| Question Number | Answer                                                                                                                                                                                                                                                                                                                           | Mark |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 3(a)(ii)        | <p>The only correct answer is B - number of troughs on the trace in 15 seconds divided by 0.25</p> <p>A is incorrect as this equation would not calculate breathing rate</p> <p>C is incorrect as this equation would not calculate breathing rate</p> <p>D is incorrect as this equation would not calculate breathing rate</p> | 1    |