

Surname	Initial(s)
Signature	

Paper Reference(s)

**5019 5047**

# Edexcel GCSE

## Additional Science (5019)

## Physics (5047)

P2 – Topics 9 to 12

### Foundation and Higher Tier

Thursday 4 March 2010 – Morning

Time: 20 minutes

**Materials required for examination**

Multiple Choice Answer Sheet  
HB pencil, eraser and calculator

**Items included with question papers**

Nil

**Instructions to Candidates**

Use an HB pencil. Do not open this booklet until you are told to do so.  
Mark your answers on the separate answer sheet.

**Foundation tier candidates:** answer questions 1 – 24.

**Higher tier candidates:** answer questions 17 – 40.

All candidates are to answer questions 17 – 24.

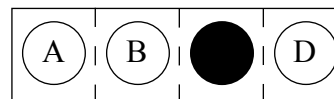
**Before the test begins:**

Check that the answer sheet is for the correct test and that it contains your candidate details.

**How to answer the test:**

For each question, choose the right answer, A, B, C or D  
and mark it in HB pencil on the answer sheet.

For example, the answer C would be marked as shown.



Mark only **one** answer for each question. If you change your mind about an answer, rub out the first mark **thoroughly**, then mark your new answer.

Do any necessary calculations and rough work in this booklet. You may use a calculator if you wish.

You must not take this booklet or the answer sheet out of the examination room.

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*Turn over*

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## FORMULAE

You may find the following formulae useful.

$$\text{average velocity} = \frac{\text{displacement}}{\text{time}}$$

$$v = \frac{s}{t}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$a = \frac{(v-u)}{t}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$F = m \times a$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$p = m \times v$$

$$\text{change in potential energy} = \text{mass} \times \text{gravitational field strength} \times \text{change in height}$$

$$PE = m \times g \times h$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times (\text{velocity})^2$$

$$KE = \frac{1}{2} \times m \times v^2$$

$$\text{electrical energy} = \text{voltage} \times \text{current} \times \text{time}$$

$$E = V \times I \times t$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

$$P = \frac{W}{t}$$

$$\text{work done} = \text{force} \times \text{distance moved in the direction of the force}$$

$$W = F \times s$$

Questions 1 to 16 must be answered by Foundation tier candidates only.  
Higher tier candidates start at question 17.

**Radioactivity and its uses**

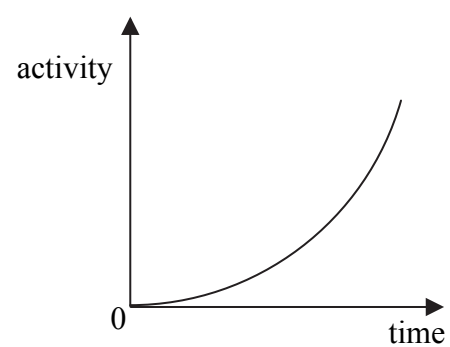
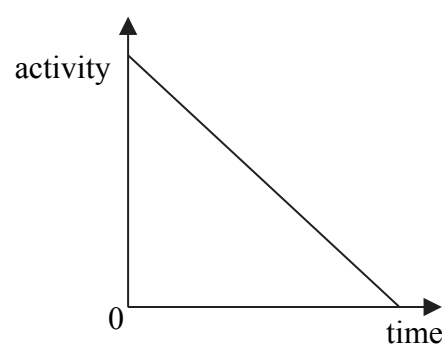
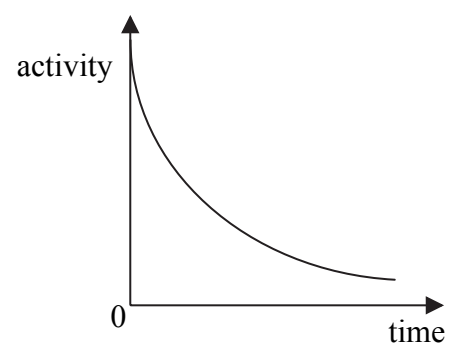
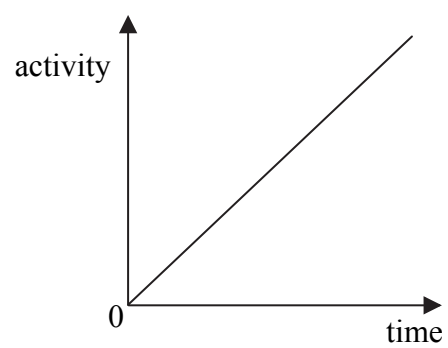
1. Which of these can pass through a thick block of lead?

- A alpha particles
- B beta particles
- C electrons
- D gamma rays

2. The radiation used in smoke alarms is

- A alpha particles
- B beta particles
- C neutrons
- D protons

3. Which of these shows the decay of a radioactive isotope?



**On your bike**

4. Nicole is an Olympic cyclist  
She is travelling at 12 m/s.

How far will she travel in 3 s at this speed?

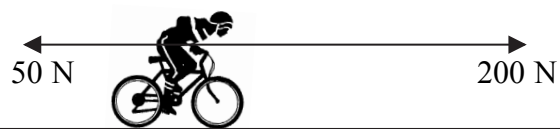
- A 0.25 m
- B 4 m
- C 15 m
- D 36 m



5. Nicole's stopping distance will become shorter if

- A it starts to rain
- B she starts to go up a hill
- C her reaction time increases
- D she is travelling faster

6. John rides a different type of bike.  
The diagram shows the horizontal forces acting.



The resultant horizontal force is

- A 150 N to the left
  - B 150 N to the right
  - C 250 N to the left
  - D 250 N to the right
7. John and his bike have a mass of 60 kg.  
He accelerates at  $3 \text{ m/s}^2$ .  
The accelerating force is

- A 0.05 N
- B 20 N
- C 60 N
- D 180 N

### Refuelling aircraft

Care is taken when an aircraft is refuelled.

8. Which row of the table is correct during the refuelling of an aircraft?

	aircraft is connected to earth by	particles which flow are
A	a conductor	positive electrons
B	an insulator	positive electrons
C	a conductor	negative electrons
D	an insulator	negative electrons

9. Connecting the aircraft to earth

- A prevents it from moving
- B stops its engines turning
- C reduces the chance of a fire
- D helps to recharge its batteries

### Fusion and fission

10. One of the products of fusion is

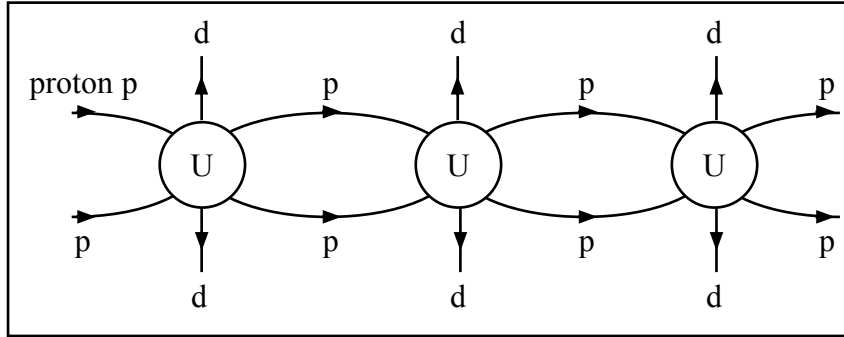


How many protons does this nucleus contain?

- A 3
  - B 4
  - C 7
  - D 10
11. In a nuclear reactor, the control rods work by
- A absorbing neutrons
  - B absorbing electrons
  - C speeding up neutrons
  - D speeding up electrons

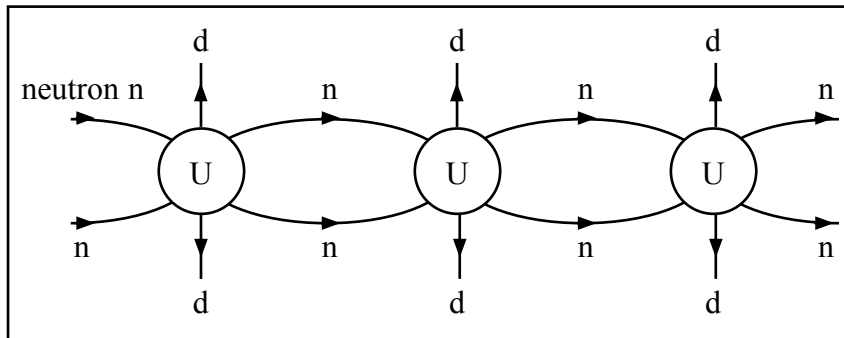
12. Which of these best represents a chain reaction in Uranium (U)?

A

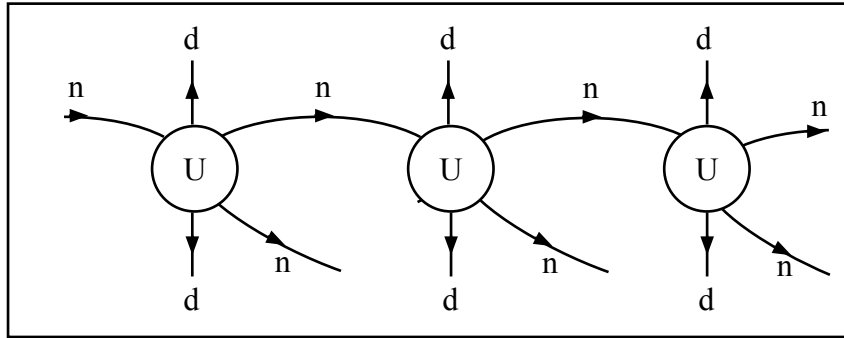


**key**  
d – daughter  
n – neutron  
p – proton

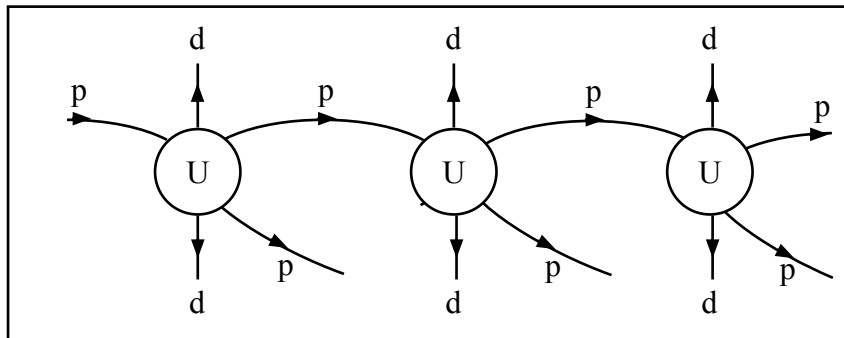
B



C



D



### Cranes

A crane lifts a box.

- The box weighs 300 N.
- The crane lifts the box through a height of 20 m.

13. What type of energy has the box gained by the change in position?

- A chemical
- B kinetic
- C gravitational potential
- D thermal (heat)

14. How much work does the crane do on the box?

- A 15 J
- B 600 J
- C 6 000 J
- D 90 000 J

15. The work done in lifting the box is equal to

- A the energy created
- B the energy transferred
- C the power created
- D the power destroyed

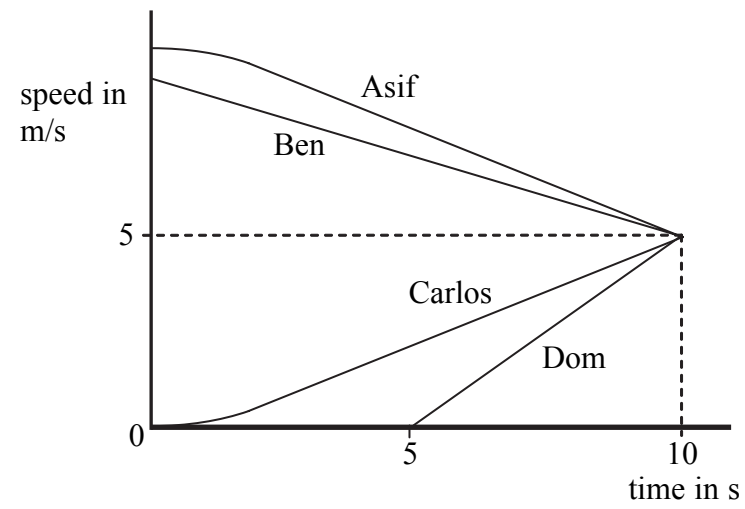
16. The crane does 10 000 J of work in 20 s.  
The power is

- A 0.002 W
- B 0.5 W
- C 500 W
- D 200 000 W

Higher tier candidates start at question 17 and answer questions 17 to 40.  
Questions 17 to 24 must be answered by all candidates: Foundation tier and Higher tier

### Movement

The graph shows how the speeds of four people change with time.



17. Who has the highest acceleration?

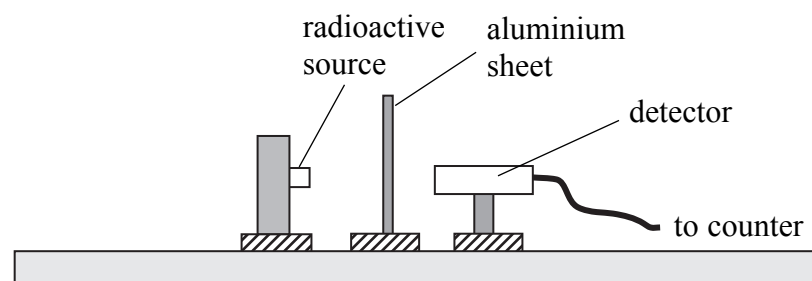
- A Asif
- B Ben
- C Carlos
- D Dom

18. What is Dom's acceleration?

- A  $0.5 \text{ m/s}^2$
- B  $1.0 \text{ m/s}^2$
- C  $25 \text{ m/s}^2$
- D  $50 \text{ m/s}^2$

### Investigating radioactive absorption

A scientist set up an experiment like this.



19. He measured the count rate using four different sources.  
Which of these sources is likely to emit only alpha particles?

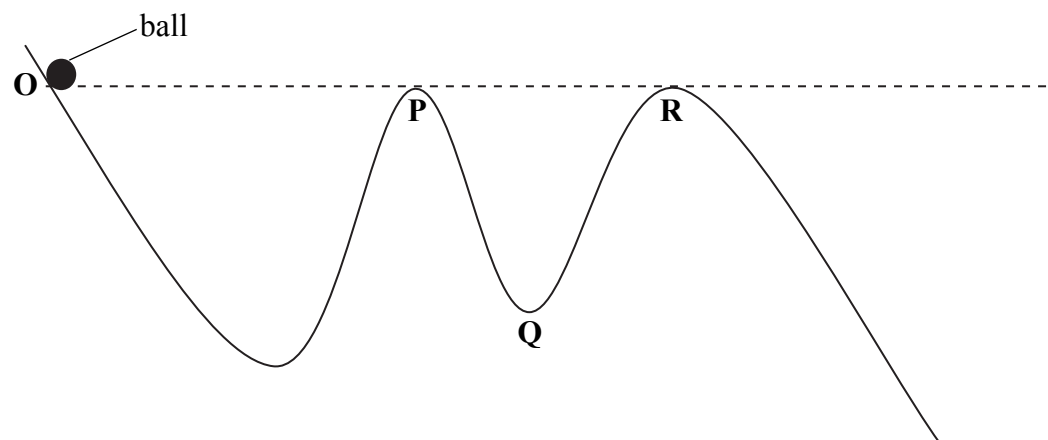
source	count rate without aluminium sheet (counts per minute)	count rate with aluminium sheet (counts per minute)
A	2945	26
B	2836	933
C	3104	1512
D	3065	2705

20. The scientist investigates the effect of changing the thickness of the aluminium.  
The dependent variable is

- A the distance from the aluminium to the detector
- B the distance from the source to the aluminium
- C the thickness of aluminium
- D the count rate

### Roller coasters

21. The diagram shows the screen of a computer roller coaster simulator. You can experiment with a simulator and find out “What if...?” A ball rolls down the track, starting from **O**.



Friction acts on the ball.  
You want the ball to finally stop at **Q**.

Which of these must you do before you let the ball go?

- A** lower **O**
  - B** lower **P**
  - C** raise **Q**
  - D** lower **R**
22. To answer question 21 you carried out
- A** a fair test
  - B** a controlled experiment
  - C** a thought experiment
  - D** a precise measurement

**Fission**

23. The daughter nuclei from nuclear fission can
- A fuse
  - B decay
  - C form new Uranium nuclei
  - D produce further fission
24. The fission of one nucleus of U-235 produces one daughter with 90 particles (protons and neutrons) in its nucleus.  
The other daughter is likely to have a nucleus with
- A 103 particles
  - B 133 particles
  - C 137 particles
  - D 143 particles

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**TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS**

**Foundation tier candidates do not answer any more questions after question 24.**

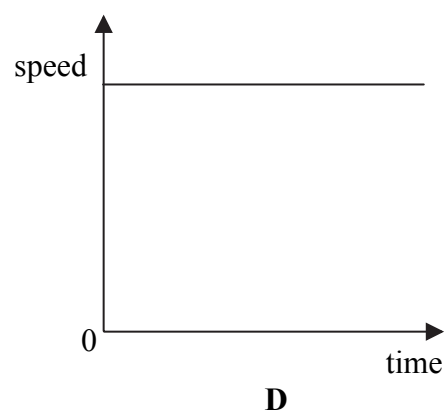
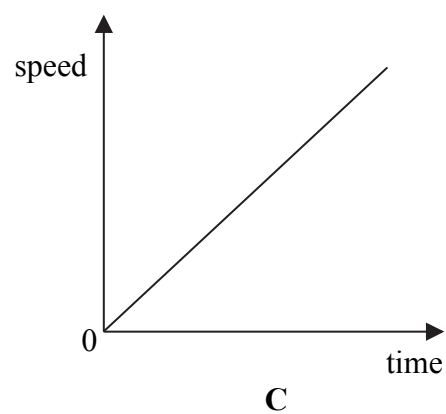
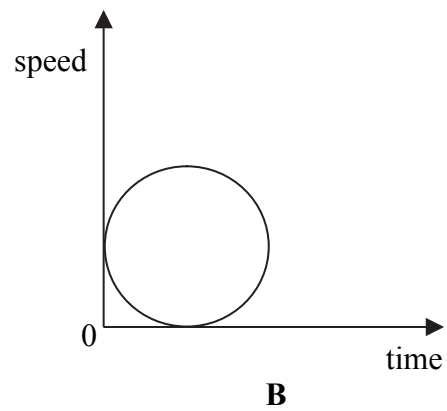
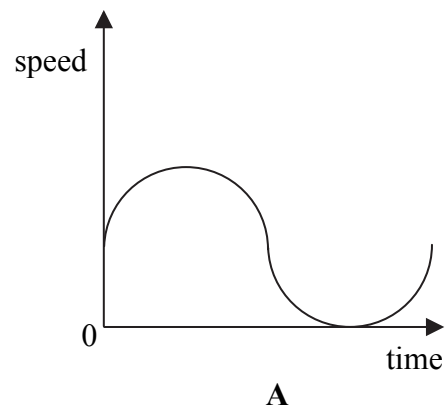
Questions 25 to 40 must be answered by Higher tier candidates only.  
Foundation tier candidates do not answer questions 25 to 40.

**Motions**

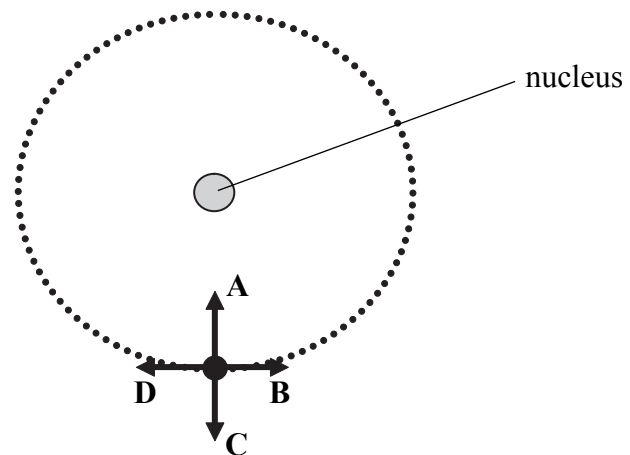
25. Which of the following can stay the same when a car goes round a bend?

- A the speed
- B the velocity
- C the direction
- D the acceleration

26. A car travels equal distances in equal times as it goes round a circular track.  
Which of these graphs is correct?



27. The diagram shows the path of an electron going round the nucleus of an atom.



In which direction does the electrostatic force on the electron act?

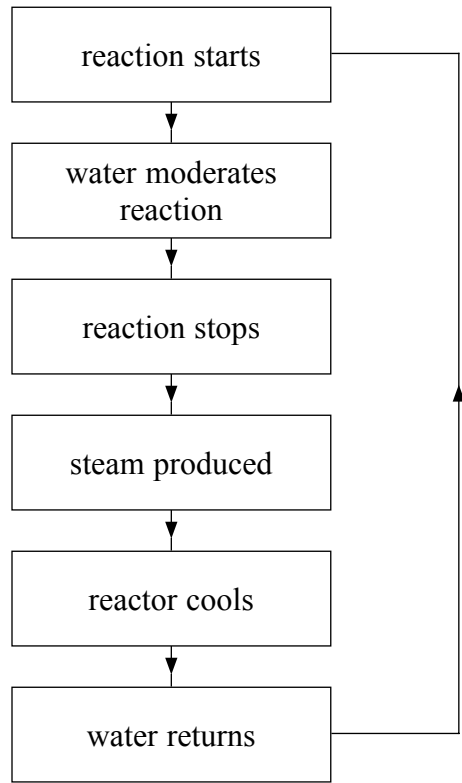
28. A car accelerates along a straight track at a rate of  $3 \text{ m/s}^2$ .  
It was initially travelling at  $10 \text{ m/s}$ .  
What is its speed after  $6 \text{ s}$ ?
- A 12 m/s
  - B 18 m/s
  - C 19 m/s
  - D 28 m/s
29. Some of the dangerous radiation from space does not reach us.  
This is because we are protected by the Earth's
- A atmosphere and gravity
  - B atmosphere and magnetic field
  - C magnetic field and electric charge
  - D gravity and electric charge

### Natural nuclear reactor at Oklo

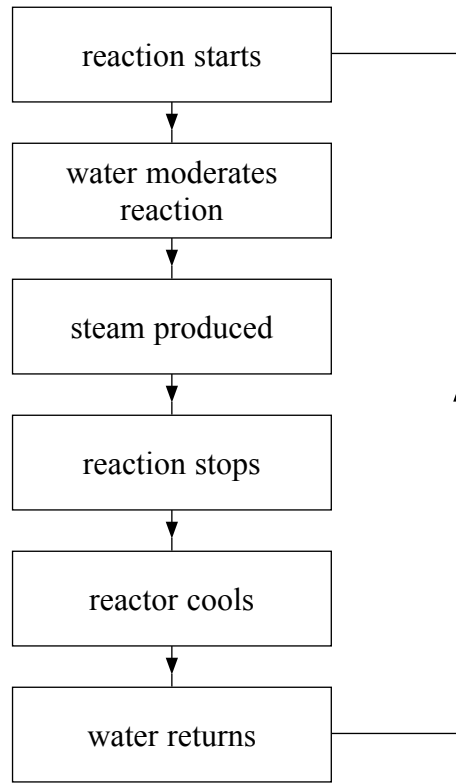
Scientists found evidence of a natural reactor in a uranium mine at Oklo. Neutrons from U-235 fission have too much energy for chain reactions. But water moderated these neutrons and the reactor started. The reactor heated up and the water boiled away. This stopped the chain reaction. The reactor cooled and water came back, so the reactor started again. This went on for more than a million years, until there was not enough U-235 left.

30. When the neutrons are moderated they are
- A emitted
  - B absorbed
  - C speeded up
  - D slowed down
31. The neutrons released from U-235 fission have
- A chemical energy
  - B nuclear energy
  - C kinetic energy
  - D electrical energy

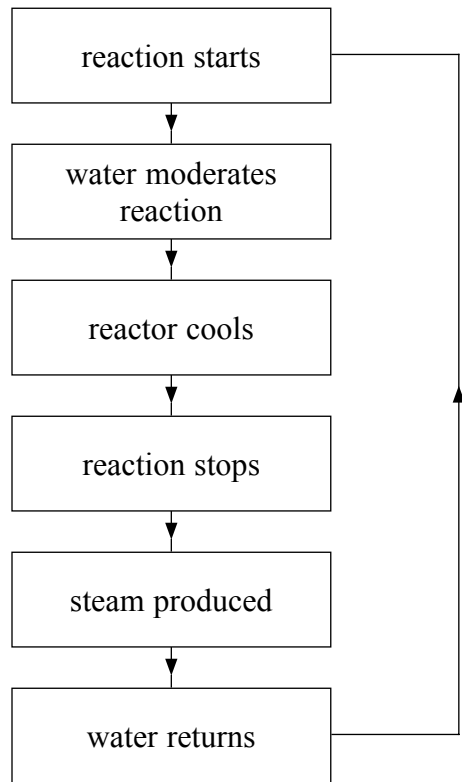
32. Which of these shows the cycle involved at Oklo?



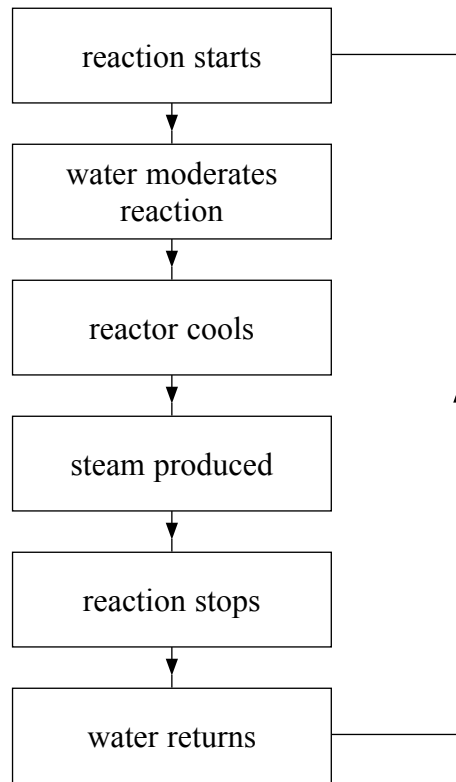
**A**



**B**



**C**



**D**

### Radioactivity in hospitals

Technetium-99 (Tc-99) is used for many purposes in hospitals. Molybdenum-99 (Mo-99) is used as a source of technetium-99. Here is some data about these two isotopes.

isotope	atomic number	half-life
molybdenum-99	42	66 hours
technetium-99	43	6 hours

33. A technetium sample contains 20 mg of technetium-99. How much technetium-99 will be left after 12 hours?
- A none
  - B 2.5 mg
  - C 5.0 mg
  - D 10 mg
34. Tc-99 is used as a tracer because it decays by gamma emission. This is useful because gamma radiation
- A is harmless
  - B is absorbed by the skin
  - C does not cause any ionisation
  - D can be detected outside the body

35. John and Anne discuss the possible use of gamma rays and X-rays in sterilising equipment.

Both X-rays and gamma rays have the properties needed to sterilise the equipment.

John

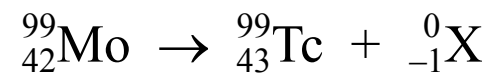
Gamma rays don't need a high voltage machine to make them.

Anne

Who is correct?

- A John only
- B Anne only
- C both John and Anne
- D neither

36. Mo-99 decays into Tc-99 as shown in the equation below.



X is

- A a neutron
- B an alpha particle
- C a beta particle
- D a gamma ray

#### Ultracold neutrons

Neutrons that have a very low energy are called ultracold neutrons. Their energy is similar to that of low temperature atoms. Ultracold neutrons have speeds less than 7.5 m/s. The mass of a neutron is  $1.7 \times 10^{-27}$  kg.

37. The maximum momentum of an ultracold neutron is about

- A  $4.41 \times 10^{-27}$  kg m/s
- B  $1.28 \times 10^{-26}$  kg m/s
- C  $4.41 \times 10^{27}$  kg m/s
- D  $1.28 \times 10^{26}$  kg m/s

*Use this information to help you answer questions 38 and 39.*

Ultracold neutrons can be reflected by a surface without losing any of their energy. They can hit the surface at any angle and still be reflected at the same speed.

38. After reflection an ultracold neutron will have the same speed as before. Which row of the table shows what will happen to its velocity and momentum after reflection?

	velocity will be	momentum will be
A	the same	the same
B	different	the same
C	the same	different
D	different	different

39. This reflection of ultracold neutrons could be used for

- A storing neutrons
- B cooling surfaces
- C making surfaces shiny
- D controlling a fusion reaction

- 40.** An ultracold neutron is moving vertically upwards at 7.5 m/s.  
It is quickly stopped by the force of gravity.

Gravitational field strength = 10 N/kg

The height to which it rose before stopping is about

- A**      2.8 m
- B**      5.6 m
- C**      28 m
- D**      56 m

**TOTAL FOR HIGHER TIER PAPER: 24 MARKS**

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