

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 3 March 2011 – 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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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.**

Ionising radiations

1. Which of these can pass through several centimetres of lead?

- A alpha radiation
- B beta radiation
- C gamma radiation
- D ultraviolet radiation

2. The symbol for an isotope of beryllium is



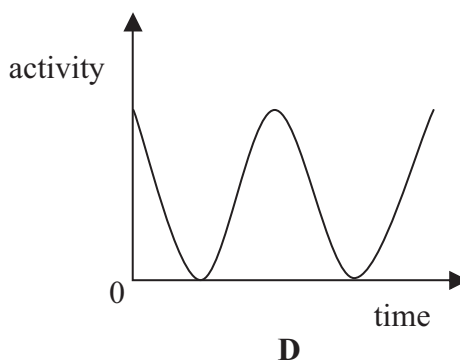
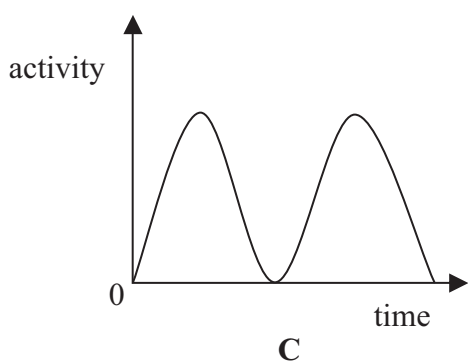
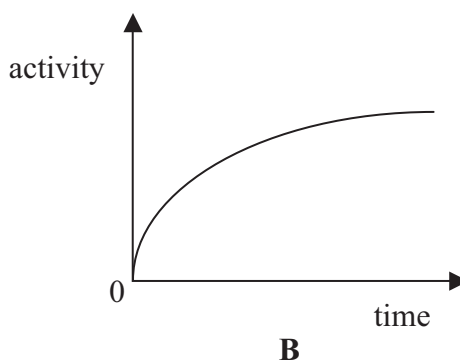
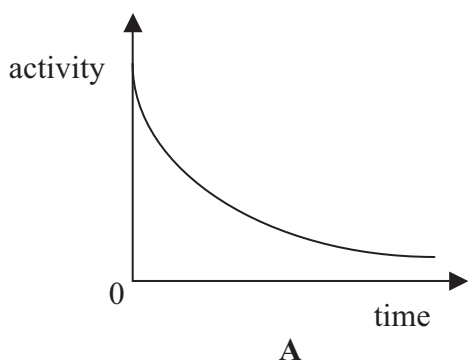
How many protons are in a nucleus of this isotope?

- A 3
- B 4
- C 7
- D 11

3. Alpha particles are used in smoke detectors because

- A they do not burn
- B they are uncharged
- C they emit gamma rays
- D they are strongly ionising

4. The activity of a radioactive source changes with time.
Which of these shows this change?



Nuclear power stations

5. The fuel used in a nuclear power station is

- A** iron
- B** copper
- C** lithium
- D** uranium

6. There are control rods in nuclear reactors to

- A** absorb neutrons
- B** absorb electrons
- C** emit electrons
- D** emit neutrons

7. The waste products from nuclear reactors

- A** have a high voltage
- B** stay radioactive for years
- C** produce greenhouse gases
- D** are safe to handle

8. Compared to a coal-fired power station, using a nuclear power station has the advantage that it
- A produces no thermal (heat) energy
 - B transfers all of the fuel energy into electrical energy
 - C produces no carbon dioxide
 - D has a reactor instead of a turbine and generator

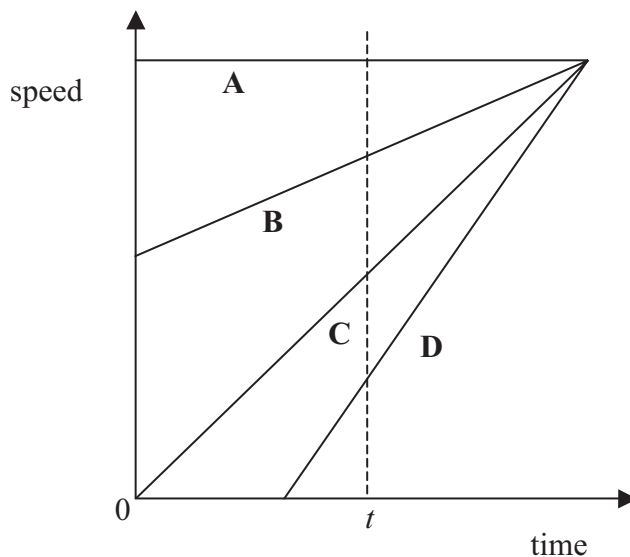
Forces on a car

9. The diagram shows some forces acting on a car.



The resultant of these forces is

- A \longrightarrow 2000 N
 - B \longrightarrow 3500 N
 - C \longrightarrow 5500 N
 - D \longrightarrow 7500 N
10. The graph shows how the speeds of four identical cars change with time. Which line is for the car with the largest kinetic energy at time t ?



11. The stopping distance of a car increases when
- A the driver's reaction time decreases
 - B the speed of the car increases
 - C the brakes on the car are improved
 - D the tyres grip the road better

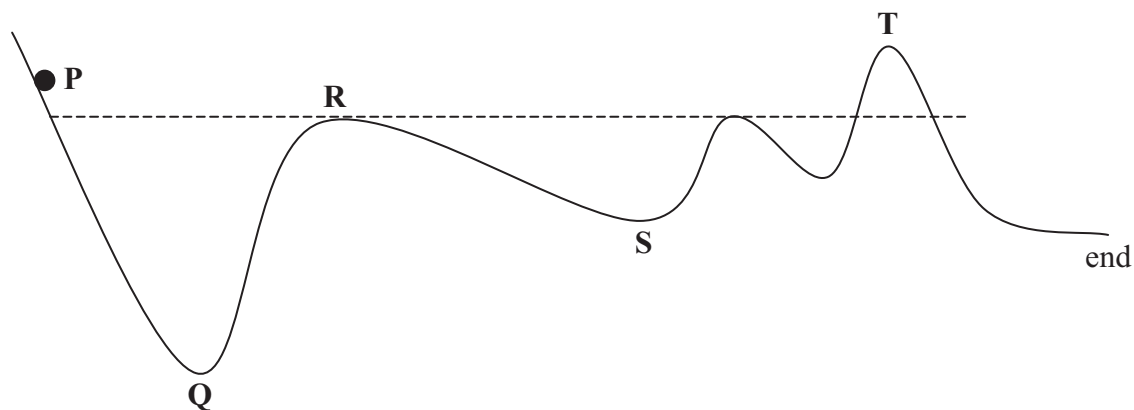
12. A car accelerates at 2 m/s^2 .
The mass of the car is 1000 kg .
The force producing this acceleration is

- A $(2 / 1000) \text{ N}$
- B $(2 + 1000) \text{ N}$
- C $(1000 - 2) \text{ N}$
- D $(1000 \times 2) \text{ N}$

Roller coasters

Use this information to answer questions 13 and 14.

John is trying to make a model roller coaster.
He looks at a piece of curtain track from the side.
This is what he sees.

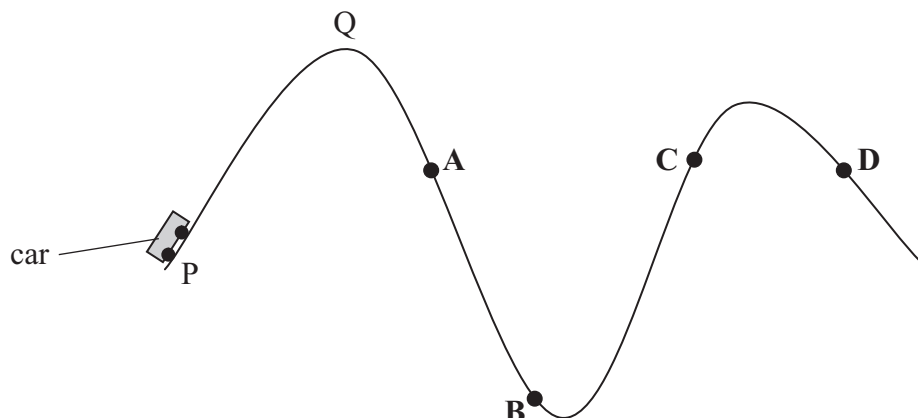


John releases a ball from **P** and it rolls down the track.
Ignore the forces of friction.

13. As the ball rolls down between **P** and **Q** there is a decrease in the ball's
- A kinetic energy
 - B gravitational potential energy
 - C thermal (heat) energy
 - D chemical energy
14. Which of these would help to make sure the ball reaches the end of the track?
- A raise **Q**
 - B lower **R**
 - C raise **S**
 - D lower **T**

Use this information to answer questions 15 and 16.

The diagram shows a roller coaster seen from the side.



A motor pulls the car up from P to Q at constant speed.
The car then rolls down the track towards B.

15. At which point A, B, C or D is kinetic energy changing into gravitational potential energy?

16. The work done to lift the car from P to Q is 120 000 J.
It takes 24 s.
The average power needed for this is

- A (120 000 / 24) W
- B (24 + 120 000) W
- C (24 / 120 000) W
- D (120 000 x 24) W

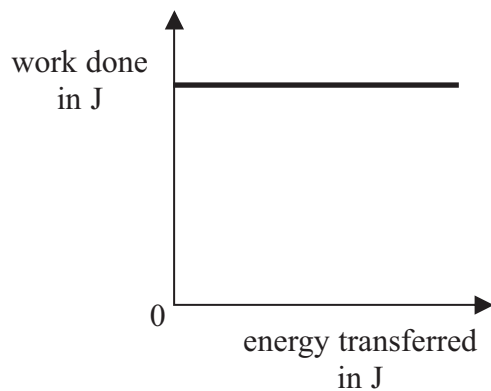
Higher tier candidates start at question 17 and answer questions 17 to 40.
Questions 17 to 24 must be answered by all candidates: Foundation tier and Higher tier.

Funfair rides

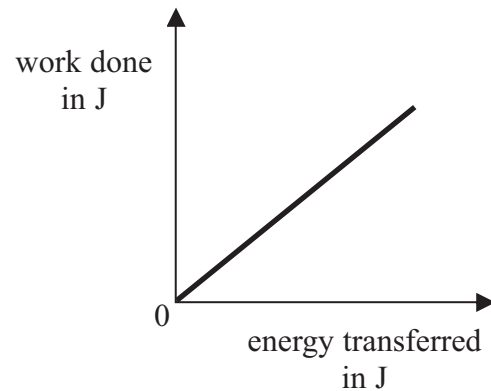
17. Funfair rides use powerful electric motors.
Which of these is a unit of power?

- A joules/second
- B joules/newton
- C volts/second
- D newtons/volt

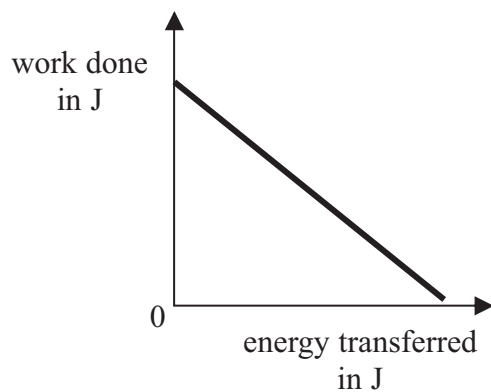
18. Which graph shows the relationship between the work done on a roller coaster car and the energy transferred to it?



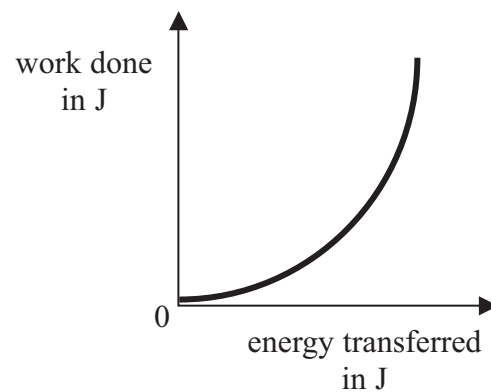
A



B



C



D

Radioactivity

19. Which row of the table is correct for an alpha particle?

	an alpha particle is	an alpha particle is charged
A	an electron	positively
B	a helium nucleus	negatively
C	an electron	negatively
D	a helium nucleus	positively

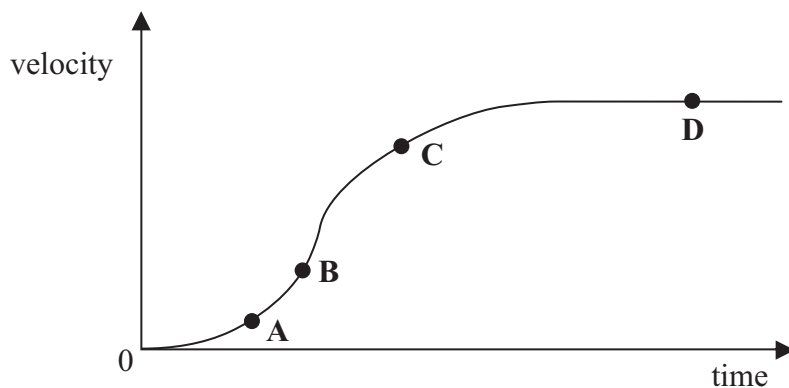
20. In the first few years after its discovery, many scientists died from the effects of radioactivity. This was because
- A** the scientists did not know the dangers at that time
 - B** gamma rays were far more penetrating in those days
 - C** safety materials such as lead had not been discovered then
 - D** life expectancy was shorter in those days

Charges

21. A plastic comb is rubbed with a dry cloth. The comb becomes positively charged. The comb has
- A** lost electrons
 - B** gained electrons
 - C** gained protons
 - D** lost protons
22. Which of these is designed to use electrostatic charge?
- A** an electric heater
 - B** a filament lamp
 - C** a photocopier
 - D** a dynamo

Use this information to answer questions 23 and 24.

The diagram shows how the velocity of a falling object changes with time.



23. At which point **A**, **B**, **C** or **D** is the resultant force on the object zero?
24. At which point **A**, **B**, **C** or **D** on the graph is the acceleration largest?

TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS

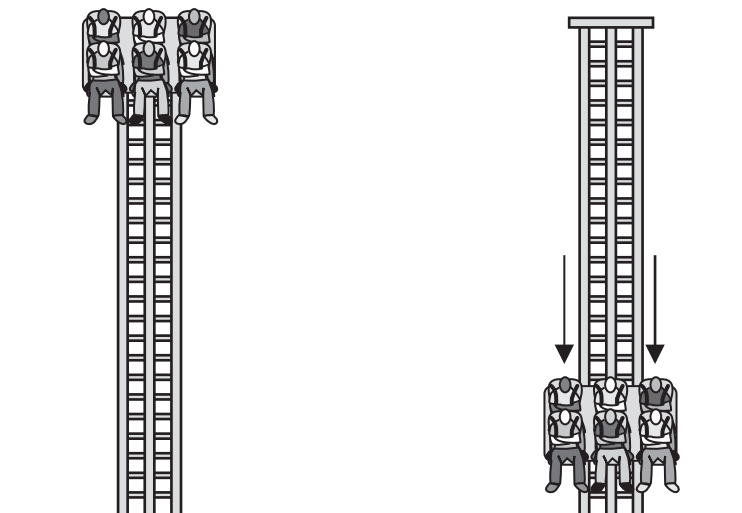
Foundation tier candidates do not answer any more questions after question 24.

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

A vertical fall ride

Use the following information to answer questions 25 to 27.

The diagrams show a vertical fall ride.



The total weight of the car and people is 20 000 N.
An electric motor raises the car through a height of 50 m to the top of the ride.
The car rises at a constant speed of 0.5 m/s.
The gravitational field strength is 10 N/kg.

25. How much work was done to lift the car and people 50 m?

- A 0.0025 J
- B 0.025 J
- C 100 000 J
- D 1 000 000 J

26. What is the total momentum of the car and people as they rise?

- A $(20\,000 / 10) \times 0.5$ kg m/s
- B $(20\,000 \times 10) / 0.5$ kg m/s
- C $20\,000 \times 10 \times 0.5$ kg m/s
- D $20\,000 / (10 \times 0.5)$ kg m/s

27. As the car begins to fall, which of these decreases?

- A momentum
- B kinetic energy
- C thermal energy
- D gravitational potential energy

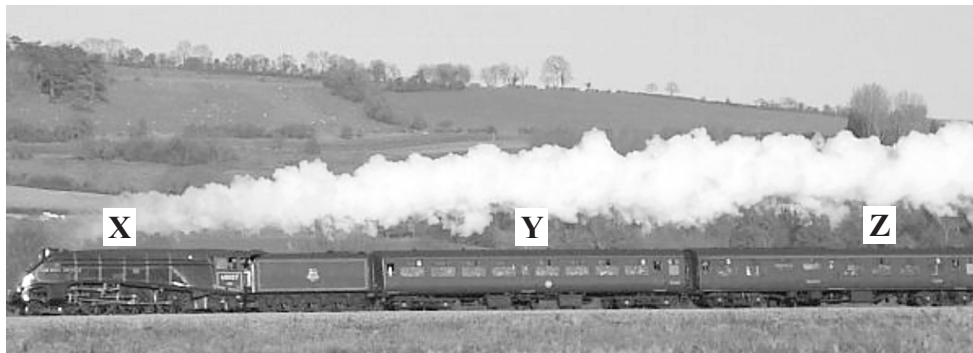
28. Later, the ride has a different number of passengers.
The motor takes 100 s to raise the car.
The energy supplied by the motor is 500 kJ.
The voltage across the motor is 400 V.
What is the current in the motor?

- A 0.0125 A
- B 12.5 A
- C 31.25 A
- D 31 250 A

Steam trains

Use this information to answer questions 29 to 31.

The picture shows a railway engine, X, pulling two coaches Y and Z on a level track.



The mass of the engine is 100 000 kg and of each coach is 25 000 kg.

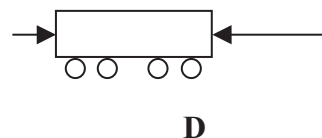
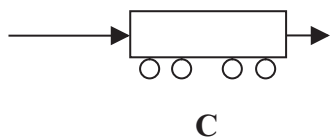
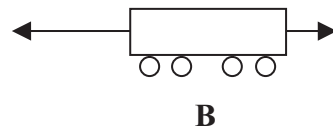
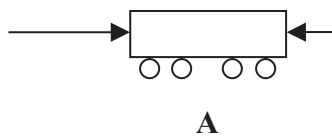
29. When the train travels at constant speed, the engine still has to exert a force on coach Y.
This is because
- A the coach has a large mass
 - B the steam carries away thermal energy
 - C there are frictional forces
 - D gravity always acts at right angles to the train's movement
30. As the engine travels at a constant speed, it pulls on Y with a force of 10 000 N.
Coach Y pulls on the engine with a force of
- A zero
 - B 9 950 N
 - C 10 000 N
 - D 10 050 N

31. As the train sets off, the resultant force on coach Y is 10 000 N.
The acceleration produced by this force is
- A 0.067 m/s²
 - B 0.4 m/s²
 - C 2.5 m/s²
 - D 15 m/s²

32. The photograph shows a miniature train running on a level track.



The engine driver applies the brakes on the engine.
Which diagram shows the horizontal forces acting on the first coach?

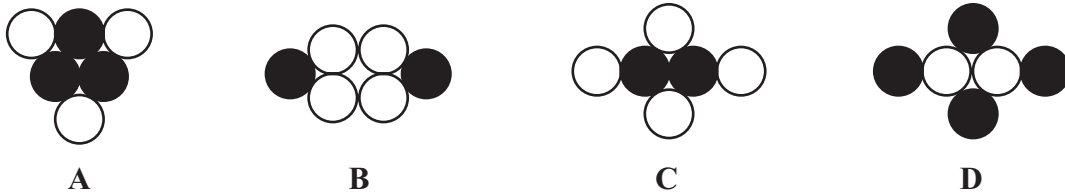


Particles and radioactivity

33. The diagram represents the particles in the nucleus of an atom.



Which of these represents the nucleus of an isotope of the same element?

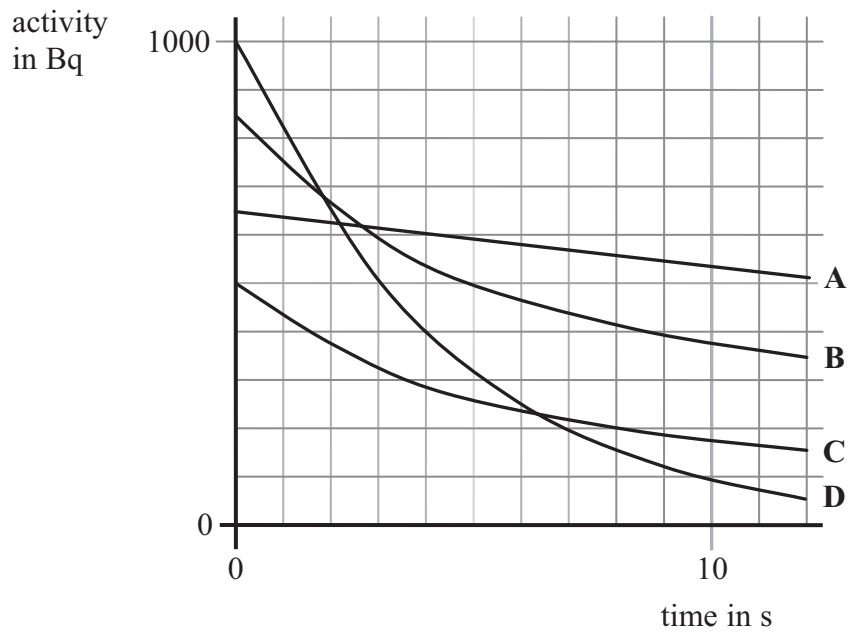


34. John's teacher experiments with a radioactive source.
Her first measurement is the count rate of the radiation from the source.
Then she measures the background count rate.
She subtracts the background count rate from the first measurement.

Which of the following statements is **incorrect**?

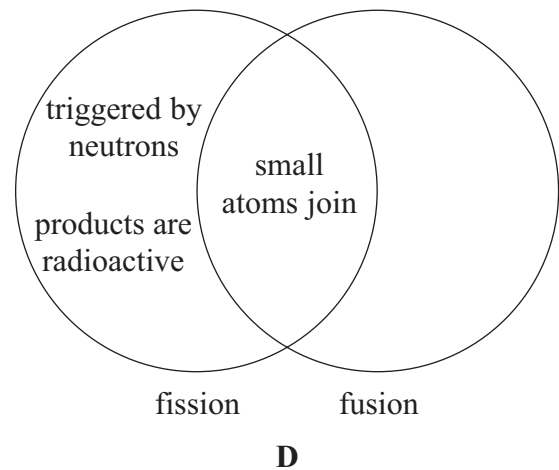
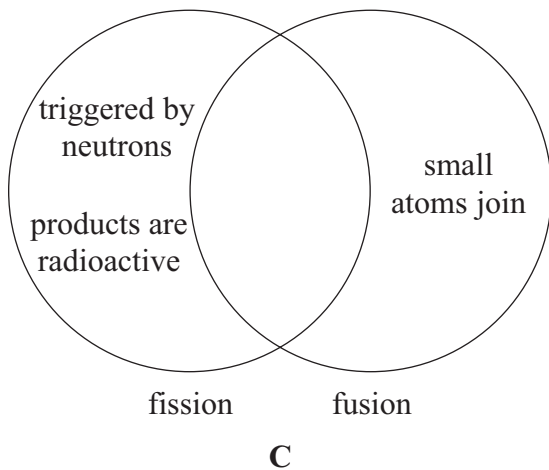
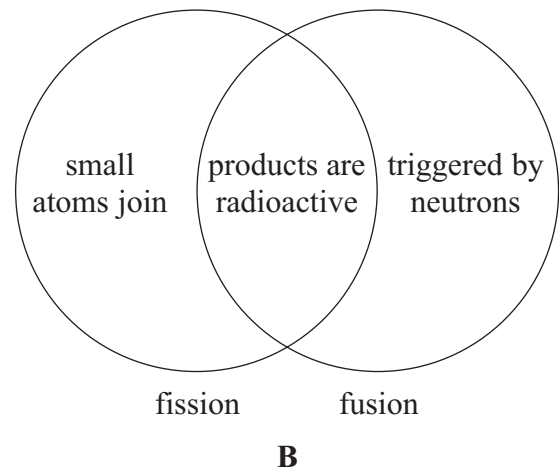
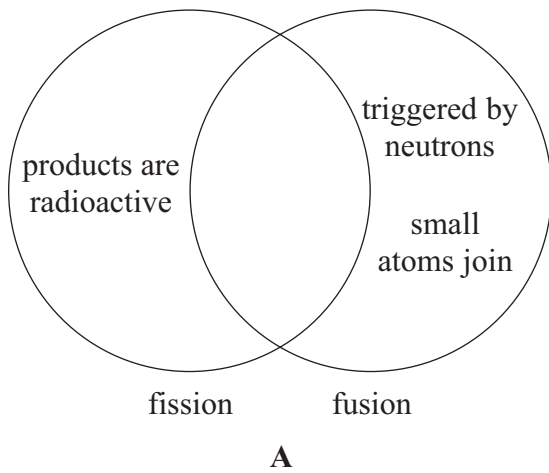
- A** subtracting the background count rate makes the radioactivity more random
 - B** subtracting the background count rate makes the experiment more valid
 - C** the background count rate is uncertain because radioactive decay is random
 - D** the count rate from the source cannot be accurately predicted because radioactive decay is random
35. Which of these is a correct description of half-life?
Half-life is
- A** the time it takes half a radioactive atom from the sample to decay
 - B** the time it takes half the radioactive atoms in a sample to decay
 - C** half the time it takes a radioactive nucleus to decay
 - D** half the life-time of a radioactive sample

36. The graphs show how four radioactive substances decay. Which of these substances has the shortest half-life?



Fission and fusion

37. Some properties of nuclear fission and nuclear fusion are shown in the diagrams below. Which diagram correctly classifies the properties?

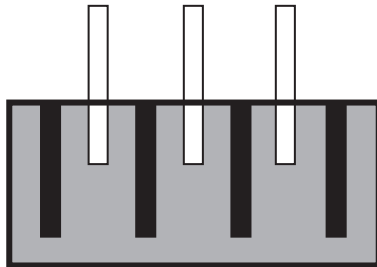


38. The nucleus ${}_{39}^{99}\text{Y}$ of the element yttrium decays into a zirconium nucleus ${}_{40}^{99}\text{Zr}$.

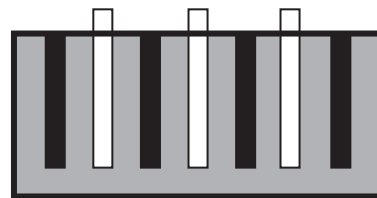
Which row of the table is correct for this decay?

	atomic number	mass number
A	increases	stays the same
B	stays the same	increases
C	increases	increases
D	stays the same	stays the same

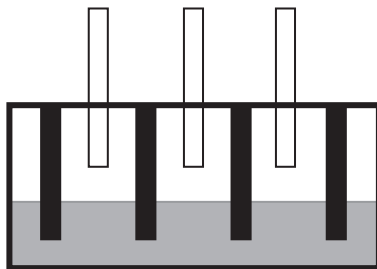
39. The diagrams show four arrangements of control rods, fuel rods and moderator in a nuclear reactor.
Which arrangement would produce energy at the fastest rate?



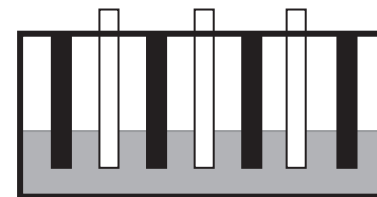
A



B



C



D

40. It is difficult to produce nuclear fusion because

- A the particles involved are too small to see
- B the high temperature needed has not been reached
- C the particles involved have the same charge
- D the particles involved are radioactive

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

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