Mixed Revision Questions

1.

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

In a nuclear power station, thermal energy is transferred into electrical energy using

☒ **A** a turbine and a generator

☒ **B** a moderator and a turbine

☒ **C** a moderator and a generator

☒ **D** a turbine and a transformer

(ii) In many nuclear power stations, nuclei of uranium-235 undergo fission.

State **three** different products released in the fission of a uranium-235 nucleus.

(3)

1 .....

2 .....

3 .....

(iii) Describe how the fission of a nucleus of uranium-235 can lead to a chain reaction.

(2)

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(b) Scientists are designing a different type of nuclear power station.

This power station will use the fusion of isotopes of hydrogen to make helium.

Explain why large amounts of energy are needed to make this nuclear fusion reaction take place.

(2)

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2.

A relief organisation drops food parcels by parachute from a helicopter.

(a) Each food parcel has a weight of 80 N.

The gravitational field strength is 10 N/kg.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The mass of one food parcel is

- ☐ **A** 0.8 kg
- ☐ **B** 8.0 kg
- ☐ **C** 80 kg
- ☐ **D** 800 kg

(b) The helicopter is hovering at a constant height above the ground.

It drops a food parcel.

The parcel falls for a few seconds before the parachute starts to open.

Calculate the velocity of the food parcel after falling for 1.2 s.

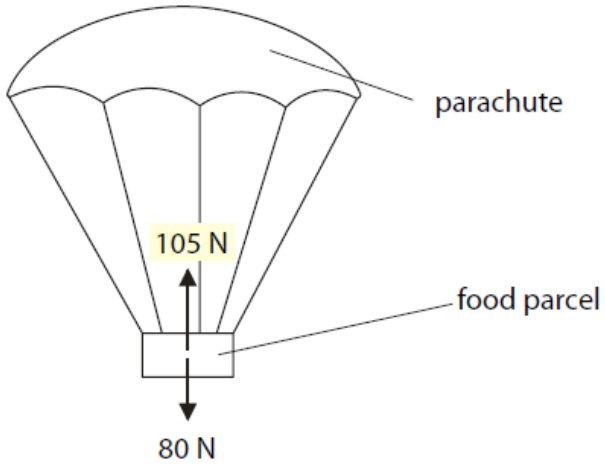
Ignore any air resistance acting on the food parcel.

Acceleration due to gravity, $g = 10$ m/s^2.

(3)

velocity = ... m/s

(c) The diagram shows the forces acting on the food parcel soon after the parachute has opened.



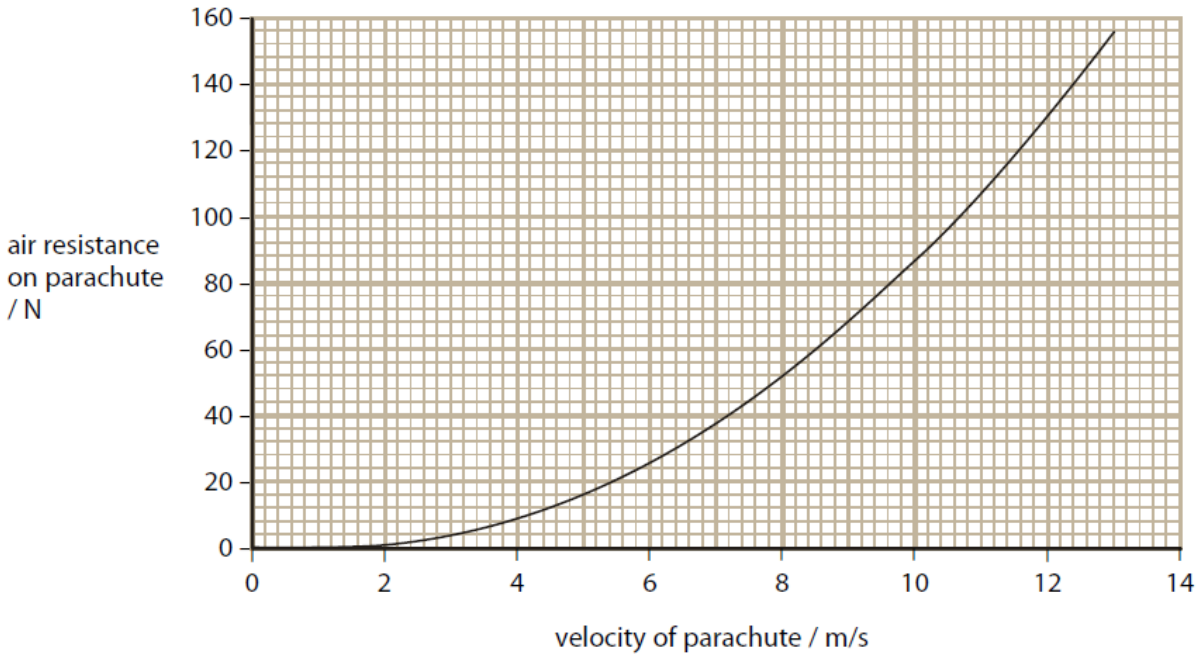
Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The resultant force on the food parcel is

- ☐ **A** 25 N downwards
- ☐ **B** 25 N upwards
- ☐ **C** 185 N downwards
- ☐ **D** 185 N upwards

(d) The graph shows the results of tests on the parachute. It shows how the air resistance acting on the parachute varies with the velocity of the parachute.



(i) Describe the relationship shown by the graph.

(2)

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*(ii) The food parcel, weighing 80 N, falls the last 20 m to the ground at a constant velocity of 9.6 m/s.

Explain how the forces acting on the food parcel change the velocity of the parcel as it falls from the helicopter to the ground.

You may draw a diagram or graph to help with your explanation.

(6)

3.

(a) (i) Thorium is a radioactive element. It has several isotopes.

State what is meant by the term **isotopes**.

(1)

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(ii) One isotope of thorium has a half-life of 1.9 years.
Radium is another radioactive element.
One isotope of radium has a half-life of 3.5 days.

A sample of thorium and a sample of radium start with the same number of atoms.

Compare the initial activities of the samples.

(2)

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(iii) Thorium and radium emit alpha radiation when they decay.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Alpha radiation

☒ **A** can penetrate a few mm of aluminium

☒ **B** is highly ionising

☒ **C** is a type of electromagnetic radiation

☒ **D** has a negative charge

*(ii) An isotope of thorium decays into radium.
Radium is also unstable and decays into radon gas.

This table gives information about these decays.

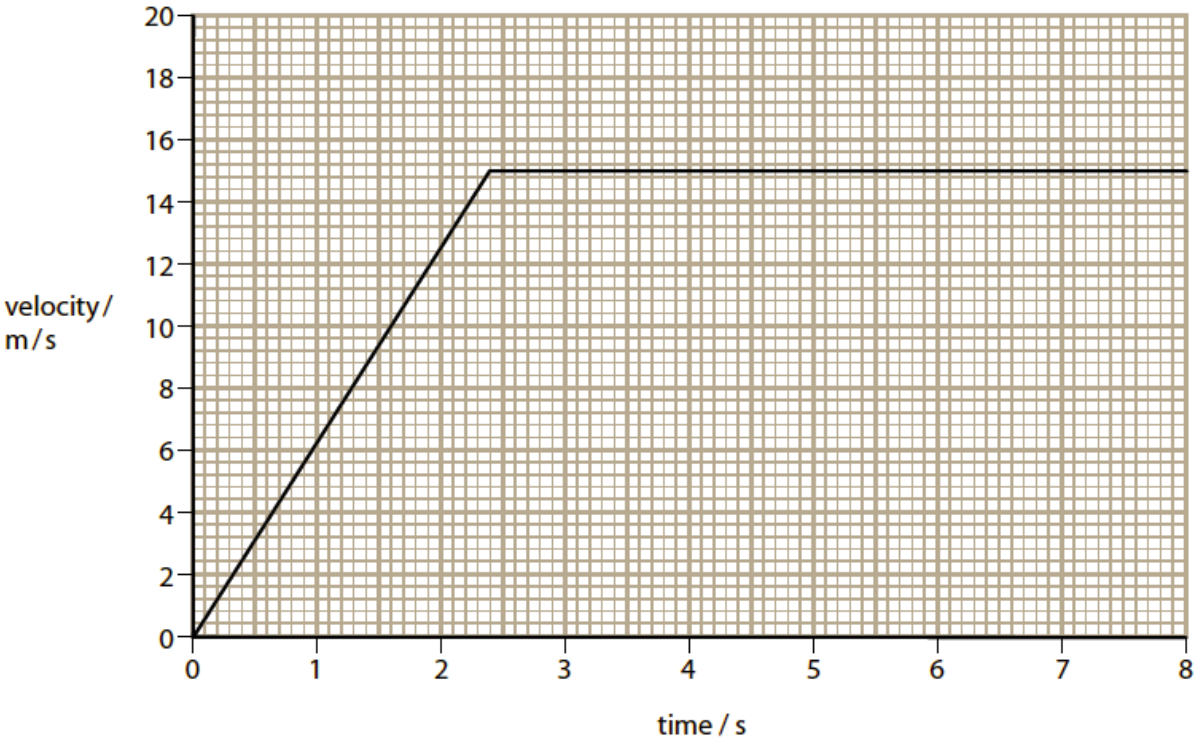
isotope	half-life	radiation emitted	decays into
thorium	1.9 years	alpha	radium
radium	3.6 days	alpha	radon
radon (gas)	55 seconds	alpha	polonium

Discuss how dangerous it would be to use this isotope of thorium in the toothpaste.

(6)

4.

The graph represents the motion of a cyclist at the start of an Olympic race.



(i) Calculate the initial acceleration.

(2)

acceleration = ... m/s^2

(ii) Another cyclist has a smaller initial acceleration but then reaches a constant velocity of 17 m/s.
Draw her motion on the graph above.

(1)

(iii) The cyclists have to keep pedalling to maintain their constant velocity.

Give one reason why they have to keep pedalling to maintain their constant velocity.

(1)

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5.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Momentum is conserved in collisions provided that

☒ **A** no crumpling of objects occurs

☒ **B** no energy is lost as heat or sound

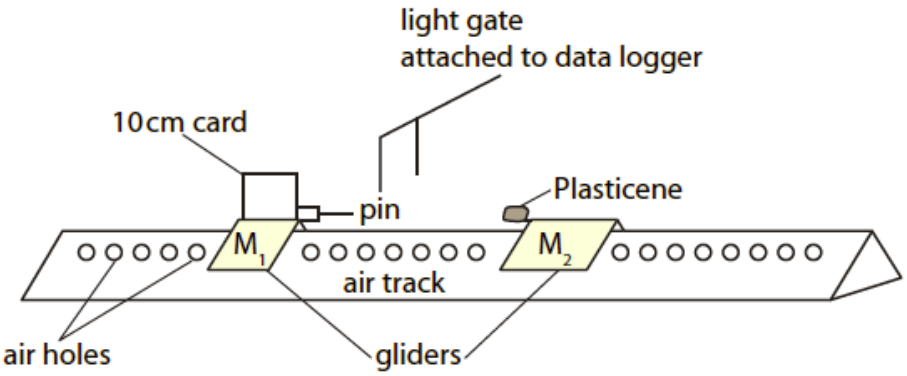
☒ **C** no external forces act

☒ **D** no friction is involved

(b) A student uses a horizontal air track to investigate collisions.

The air track blows air through a series of small holes.

Two small gliders, M_1 and M_2, float on a cushion of air.



The student pushes the first glider M_1 towards glider M_2, which is stationary.

As the glider M_1 goes through the light gate, its velocity is measured.

Glider M_1 hits and sticks to glider M_2 and they move off together.

The student takes the following measurements.

mass of glider M_1	0.21 kg
mass of glider M_2	0.21 kg
velocity measured by the light gate	0.47 m/s

(i) Show that the momentum of glider M_1 before the collision is about 0.10 kg m/s.

(2)

(ii) The total momentum before the collision is equal to the total momentum after the collision.

Calculate the velocity of the two gliders combined after the collision.

(3)

velocity after the collision = ... m/s

(iii) The total kinetic energy before collision = 0.023 J.

The total kinetic energy after collision = 0.012 J.

Discuss whether the collision is elastic or inelastic.

(2)

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