Introduction

The game can be played by groups of two - five players. Where there is an odd number in the group then one student could be the question master.

The question cards can be used in a number of different ways e.g. for revision, class quiz, bingo etc.

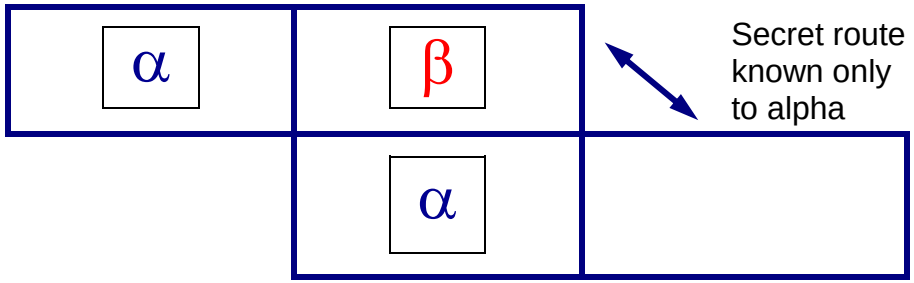
Strategy game instructions

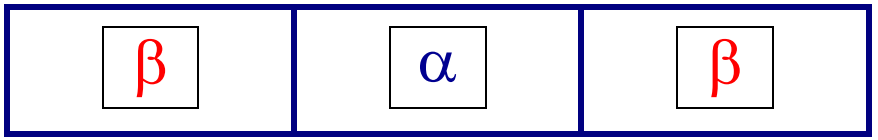
Preparation

Photocopy the board onto and perhaps stick onto card.
You will require 4 counters, two for each team.
Photocopy the question cards and cut out. It's worth checking that the pupils will know all the answers and this is a time to differentiate by adding or subtracting according to the group's ability.

Aim

The winner is the team who traps the opposite particle. A trap is achieved when this happens:

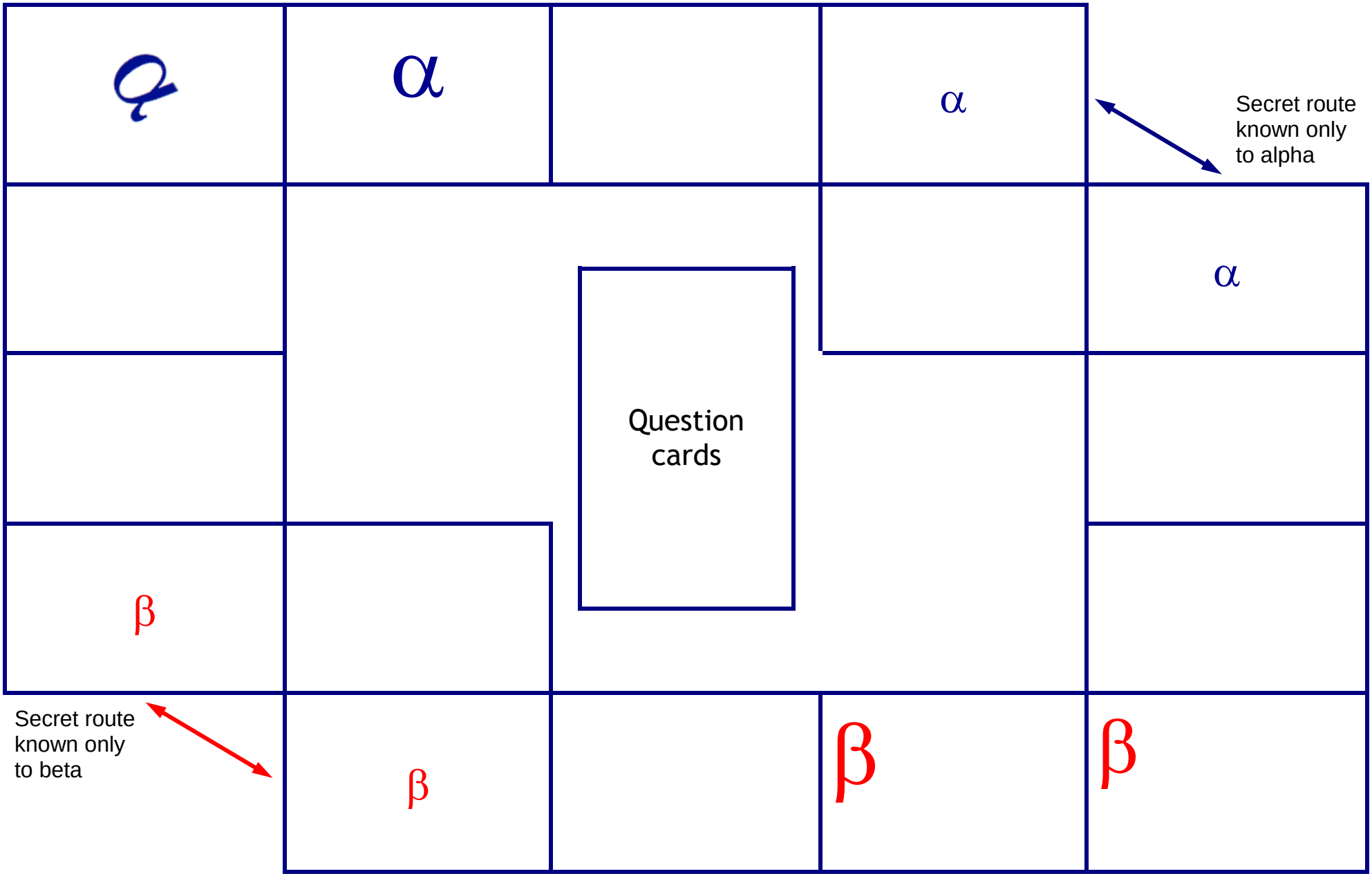




A team has also won if they trap both particles.

How to play

Set up board. Cards face down on central box. Counters placed on large Alpha and Beta tiles.
Decide who is Alpha and who is Beta.
Alpha goes first. Beta picks up the top card and reads out the question. Alpha has to answer it. If correct, Alpha is allowed to move one counter one space. If the answer is wrong Alpha is not allowed to move. Card is returned to bottom of pile.
Play passes to the Beta team. All moves are along the track except when the secret routes are in use.


α
α
α
Secret route known only to alpha
Question cards
β
Secret route known only to beta
β
β
β

Q. Which type of radiation consists of 2 protons and 2 neutrons? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Alpha radiation*	Q. Why has an atom no net charge? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. It has the same number of positive protons as negative electrons.*	Q. The atomic number of an element refers to what? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. The number of protons in the nucleus of the atom of that element.*	Q. What is the relative mass and charge of a proton? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. 1, positive*
Q. What happens to the nucleus when an alpha or beta particle leave an atom? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. It becomes a new element.*	Q. What is an ion? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. A charged particle.*	Q. Some elements have forms that have different mass numbers. What do we call these forms? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Isotopes.*	Q. The nuclei of some isotopes are unstable. What do they emit? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Radiation, which is energy, in the form of particles or rays.*
Q. Which type of radiation is an electromagnetic wave? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Gamma radiation*	Q. What is the relative mass and charge of an electron? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. 0 mass, negative*	Q. Which type of radiation is an electron of very high energy? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Beta radiation*	Q. What is the relative mass and charge of a neutron? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. 1, no charge (neutral)*
Q. Carbon is usually a stable atom but it has an unstable isotope. Which? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. carbon -14 is unstable (carbon – 12 is stable)*	Q. Which 2 types of radiation have a charge? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Alpha and beta radiation*	Q. Which type of radiation is only stopped by a thick block of lead? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Gamma radiation*	Q. Which particle is formed in the nucleus when a neutron changes to a proton? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. A beta particle*

Q. How far, on average can an alpha particle penetrate into the skin? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. A fraction of a millimeter.*	Q. How far, on average can a beta particle penetrate into the skin? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. 0.1 mm*	Q. How far, on average, can gamma rays penetrate the skin? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. A few centimetres.*	Q. What is the ionising effect of alpha particles? Very high, high or low. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Very high.*
Q. What is the ionising effect of beta particles? Very high, high or low. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. High.*	Q. What is the ionising effect of gamma rays? Very high, high or low. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Low.*	Q. Why do electric and magnetic fields deflect alpha and beta particles? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Because both alpha and beta particles have a charge.*	Q. Why are gamma rays **not** deflected by electric and magnetic fields? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Gamma rays have no charge.*
Q. What effect do alpha particles have on cells? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Severe, if inside the body.*	Q. What effect do beta particles have on cells? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Cause moderate damage.*	Q. What effect do gamma rays have on cells? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. In a low dose, causes little damage.*	Q. What effect can radiation have on DNA? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. It can cause mutations.*
Q. Radiation can destroy parts of the body. Which parts in particular? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Cells and tissues.*	Q. Radiation can cause skin burns as well as which other serious condition? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Cancer*	Q. Inside the body, alpha particles cause serious damage. Why is the damage less when outside the body? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. They have low skin penetration levels.*	Q. Which is more dangerous – beta particles or gamma rays? Why? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Beta particles. They are more likely to be absorbed and cause damage because they have a high ionising effect.*

Q. How does a radioactive form of carbon get into the food chain? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Carbon–14 is made in the atmosphere and absorbed by all plants.*	Q. Which rock type emits a radioactive gas? What's the gas called? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Granite, radon.*	Q. What do we mean by **half-life**? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. The half-life of a radioisotope is the average time it takes for half of its atoms to decay.*	Q. Why is long term exposure to radiation so harmful? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. It causes radiation sickness – the cells of the body die and cannot be replaced.*
Q. Which type of radiation is used to sterilise surgical instruments? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Gamma radiation.*	Q. Which type of radiation is used in paper mills to control the thickness of the paper? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Beta radiation, (Remember, the particles can penetrate paper but be partly absorbed by thick card)*	Q. Which type of radiation is used in radiotherapy? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Gamma radiation.*	Q. Which type of radiation is used in a smoke detector? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Alpha radiation.*
Q. If a radioactive tracer has a half–life of 6 hours what fraction will remain after 12 hours? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A.*	Q. What precaution do workers using radiation sources need to take? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Wear protective clothing and a monitoring badge that lets them know how much radiation they have received.*	Q. Carbon -14 is created after another isotope has been bombarded by cosmic rays in space. What is this other isotope? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Nitrogen - 14*	Q. What is meant by the term "radioisotope"? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. An isotope that emits radiation.*
Q. Do all radiation sources carry the same amount of nuclear energy? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. No it depends on the source.*	Q. What do we call the radiation that is all around us? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Background radiation.*	Q. Name 2 sources of man made radiation. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. Examples are: fallout from nuclear weapon testing, air travel, medical x-rays, from nuclear power industry, from users of radioactive materials*	Q. Alpha radiation is used in smoke alarms. Why is this not a risk to people? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ *A. The particles cannot penetrate the plastic case of the smoke alarm.*