

The Rock Cycle game

1. You start the game at any one of the 6 action stations.
2. You are given an Actions sheet to fill in as you travel around the rock cycle
3. Each action station has an actions instruction sheet and a pack of playing cards.
4. Choose a card randomly from the pack.
5. Find the instruction corresponding to the card.
6. Follow these actions and write the actions and the time score for the action on your sheet.
Note 'Ma' is standard notion for 'million years' in many geology publications.
For each process use one of the following phrases
 - Weathering and erosion
 - Transport and deposition
 - Compaction and lithification
 - Heat and pressure
 - Melting and cooling
 - Tectonism / uplift
7. Continue around the rock cycle until you either travel through each action station at least once or until you are told to stop.
8. When you finish add up your time scores to find out how long you have been travelling the rock cycle.

My Actions

Station	Process and Action	Time
Example: <i>Sedimentary rocks</i>	<i>Pressure and heat Go to Metamorphic rocks</i>	<i>99 Ma</i>
Total time score:		

Additional tasks and questions

From your rock cycle travels answer the following:

1. What rock type does mantle material always produce?
2. What rock type does weathering and erosion always lead to?
3. What rock type does melting and cooling always produce?
4. What rock type does heat and pressure (but no melting) always create?
5. Which rock types can be changed in Metamorphic rocks and by what process?
6. Which rock types can be changed into Igneous rocks and by what process?
7. Which rock types can be changed into Sedimentary rocks and by what processes?
8. Using your information about the rock cycle you can now complete the rock cycle diagram you have been supplied with.
9. Your action station pages contained some geological words and phrases you may not be very familiar with. Make a list of these words and research a definition or explanation for each. Some suggestions are:

basalt lava
cement
collision zone
craton
gabbro
graben
Horst
humic acid
kimberlite
magma
mantle

mantle convection
mantle plume
pillow basalt
rift
sea-floor spreading
subducting slab
subduction zone
tectonics
thrust fault
turbidite

10. What was your total time score? Based on this result and the fact that the Earth is about 4500 Ma old write a brief description of the rock cycle. Note its key components and processes taking the time it takes to 'cycle' into account. Would you describe it as a simple cycle? If not, how would you describe it?
11. Expand and improve the Rock Cycle game by creating more action station instructions to cover the difference between Intrusive and Extrusive Igneous rocks etc.

Igneous Rocks Action Station

Card	Action	Time
Diamonds 2-10	You are on a section of rock that has been take into a subduction zone by tectonic activity. About 800km down your rock melts and forms a magma that intrudes into the overlying slab. STAY where you are and take another card	31 Ma
Ace of Diamonds	Local tectonic activity faults your rock and uplifts your part of the rock to form a fault scarp that diverts a major river channel. GO TO Weathering and Erosion	8 Ma
All royal Diamonds	You are on a section of rock that has been take into a subduction zone by tectonic activity. Your rock is peeled off the subducting slab and is subjected to intense pressure and heat as it is folded and faulted against the adjacent slab. GO TO Metamorphic rocks	51 Ma
Hearts 2-10	You are uplifted by tectonic activity and become part of a mountain range. GO TO Weathering and Erosion	44 Ma
Ace of Hearts	You are intruded by a massive magma mass and heated until your minerals almost melt. GO TO Metamorphic rocks	5 Ma
All royal Hearts	You become part of a tectonic rift that down faults and forms a deep basin and you are further buried by glacial sediments and cold water limestones. STAY where you are and take another card	70 Ma
Spade 1-10	You are on a section of rock that has been take into a subduction zone by tectonic activity. Your rock is peeled off the subducting slab and is subjected to moderate pressures and moderate heat as it is folded and faulted against the adjacent slab. GO TO Metamorphic rocks	99 Ma
All royal Spades	You are now part of a rock sequence that has been locked away inside a trailing edge of a continental slab well away from major tectonic activity. Nothing happens to your rock for a long time. STAY where you are and take a new card	992 Ma
Clubs 1-10	You are on a section of rock that has been part of a tectonic collision zone between two continental slabs. Your rock has been folded and faulted as it formed part of a massive mountain range. GO TO Metamorphic rocks	65 Ma
All royal Clubs	You are on a section of rock that has been take into a subduction zone by tectonic activity. Your rock is part of the fast moving subducting slab that continues on into and becomes part of the mantle. GO TO Mantle	123 Ma

Sedimentary Rocks Action Station

Card	Action	Time
Diamonds 2-10	You are uplifted by tectonic activity and become part of a mountain range. GO TO Weathering and Erosion	33 Ma
Ace of Diamonds	You are intruded by a granitic magma and heated until your minerals begin to change. GO TO Metamorphic rocks	11 Ma
All royal Diamonds	You become part of a tectonic rift that down faults and forms a deep basin and you are further buried by sediments and volcanics. STAY where you are and take another card	51 Ma
Hearts 2-10	You are on a section of rock that has been take into a subduction zone by tectonic activity. About 800km down your rock melts and forms a magma that intrudes into the overlying slab. GO TO Igneous rocks	37 Ma
Ace of Hearts	Local tectonic activity faults your rock and uplifts your part of the rock to form the flanks of a Horst and Graben valley. GO TO Weathering and Erosion	3 Ma
All royal Hearts	You are on a section of rock that has been taken into a subduction zone by tectonic activity. Your rock is peeled off the subducting slab and is subjected to intense pressure and heat as it is folded and faulted against the adjacent slab. GO TO Metamorphic rocks	62 Ma
Spade 1-10	You are on a section of rock that has been take into a subduction zone by tectonic activity. Your rock is peeled off the subducting slab and is subjected to moderate pressures and moderate heat as it is folded and faulted against the adjacent slab. GO TO Metamorphic rocks	99 Ma
All royal Spades	You are on a section of rock that has been take into a subduction zone by tectonic activity. Your rock is part of the subducting slab that continues on into and becomes part of the mantle. GO TO Mantle	100 Ma
Clubs 1-10	You are on a section of rock that has been part of a tectonic collision zone between two continental slabs. Your rock has been folded and faulted as it forms part of a massive mountain range. GO TO Metamorphic rocks	65 Ma
All royal Clubs	You are now part of a rock sequence that has been locked away inside a stable craton well away from major tectonic activity. Nothing happens to your rock for a long time. STAY where you are and take a new card	1100 Ma

Metamorphic Rocks Action Station

Card	Action	Time
Diamonds 2-10	You are on a section of rock that has been taken into a subduction zone by tectonic activity. Your rock is peeled off the subducting slab and is subjected to heat and pressures that alter the mineral assemblages STAY where you are and take another card	25 Ma
Ace of Diamonds	You are intruded by a massive magma mass and heated until your minerals almost melt. STAY where you are and take another card	7 Ma
All royal Diamonds	You are on a section of rock that has been taken into a subduction zone by tectonic activity. Your rock is subjected to intense pressure and heat and eventually melts to form a massive amount of magma that intrudes the crustal rocks above the subducting slab. GO TO Igneous rocks	51 Ma
Hearts 2-10	You are on a section of rock that has been taken into a subduction zone by tectonic activity. Your rock slowly continues on into and becomes part of the mantle. GO TO Mantle	300 Ma
Ace of Hearts	Your rock slowly cools and has some pressure reduced. Minerals that formed under higher pressures and temperatures undergo more changes to form minerals stable at the lower pressures and temperatures. STAY where you are and take another card	221 Ma
All royal Hearts	You become part of a tectonic rift that opens a deep basin as two new continents are ripped part. Sediments fill this basin and you remain buried under even more pressure. STAY where you are and take another card	216 Ma
Spades 1-10	You are on a section of rock that has been taken into a subduction zone by tectonic activity. Some of the minerals in the rock melt – you are one of them. This partial melt is a magma that eventually erupts in a volcanic explosion on the overlying slab. GO TO Igneous rocks	111 Ma
All royal Spades	Your rock formed the central parts of a vast mountain chain that has taken a very long time to wear down. You remain unchanged for almost as long. STAY where you are and take a new card	992 Ma
Clubs 2-10	You are uplifted by tectonic activity and become part of a mountain range. GO TO Weathering and Erosion	66 Ma
Ace of Clubs	Major tectonic activity faults your rock and thrusts your part of the rock to form a major fault scarp. GO TO Weathering and Erosion	9 Ma
All royal Clubs	Your rock has been folded and faulted as it is thrust up and over another slab to form a major mountain belt. GO TO Weathering and erosions	143 Ma

Sediments Action Station

Card	Action	Time
Diamonds 1-10	You are deeply buried by more sediments and begin to compact. Your grains are packed together and you grow new minerals that cement the sedimentary minerals together. GO TO Sedimentary rocks	40 Ma
All royal Diamonds	You are shallow buried by a few more more sediments and begin to compact. Your grains are packed together more but you are still unconsolidated. STAY where you are and take another card	1 Ma
Hearts 1-10	You are deeply buried by more sediments and begin to compact. Your grains are packed together and stick together forming a solid rock. GO TO Sedimentary rocks	20 Ma
All royal Hearts	You are buried by more sediments and begin to compact. Organic materials in surrounding rocks start to turn to oil and gas and fill your pore spaces. Your grains stick to each other and you become a solid rock. GO TO Sedimentary rocks	88 Ma
Spades 2-10 TAKE another card if weathering and erosion deposited you in the sea.	If on land you are shallow buried by a few more sediments and begin to compact. Your grains are packed together more but you are still unconsolidated. Local weather events reinvigorate rivers and you begin to erode away and are relocated to another position in the landscape. STAY at this station and take another card	6 Ma
Ace of Spades TAKE another card if weathering and erosion deposited you in the sea.	If on land, you are covered by a basalt lava flow that changes the way the landscape evolves and you are no longer in a position to be buried by more sediments. You can only be relocated to another position once the basalt weathers and erodes to expose you to further erosion. STAY where you are and take another card	17 Ma
All royal Spades TAKE another card if weathering and erosion deposited you on land.	If in the sea, you form a deposit on the edge of a continental shelf. This becomes unstable and rushes down to the edge of the shelf to form a turbidite deposit on the floor of the abyssal plain. Here you are covered by more turbidites and mud layers, compacted and form solid rock. GO TO Sedimentary rocks.	3 Ma
Clubs 1-10 TAKE another card if weathering and erosion deposited you on land.	If in the sea, you form a deposit on the continental shelf. Here you are covered by more sand and mud layers, compact and form solid rock. GO TO Sedimentary rocks.	9 Ma
All royal Clubs	You are deeply buried by more sediments and begin to compact. Some minerals dissolve under the slight pressure and their place is taken by new minerals growing as cements. GO TO Sedimentary rocks	21 Ma

Weathering and Erosion Action Station

Card	Action	Time
Diamonds 1-10	You are exposed in a very hot dry climate. Weathering and erosion are both very slow. You eventually get blown away as dust that lands on another continent. GO TO Sediments	75 Ma
All royal Diamonds	You are exposed to a very seasonal climate – hot & dry and hot, humid & wet. You turn to clay and sand and eventually get washed away in a cyclonic downpour and end up tumbling around on a delta. GO TO Sediments	20 Ma
Hearts 1-10	You are exposed to a very tropical humid climate and are covered in rainforest. You are turned to clay deep underground by humic acid rich water but have to wait a long time before you are eroded by a tropical river and get washed out to sea. GO TO Sediments	7 Ma
All royal Hearts	You are exposed to a temperate climate. Weathering turns you to clays and sand. You get eroded by a creek and washed into a giant inland river and lake system. GO TO Sediments	32 Ma
Spades 2-10	You are pushed up into a very high mountain chain and exposed to snow and ice. You are broken apart by ice crystals forming after a thaw let water into your fractures. You tumble onto the top of a glacier and get carried down to the base of the mountains. GO TO Sediments	15 Ma
Ace of Spades	You are covered by a volcanic ash eruption that protects you from weathering and erosion. STAY where you are and take another card	5 Ma
All royal spades	You are covered by a thick sheet of glacial ice that grinds you to rock flour and carries you frozen inside the ice to the sea where you float away in an iceberg. GO TO Sediments	12 Ma
Clubs 2-10	You are uplifted to the edge of a continent where you are constantly washed over by ocean waves. Salt crystals grow between your mineral grains and crack you apart. Waves wash bits of you away and out to the continental shelf. GO TO Sediments	6 Ma
Ace of Clubs	You are covered by a basalt lava flow that protects you from weathering and erosion. STAY where you are and take another card.	34 Ma
All royal Clubs	You are uplifted into the deep heart of a giant mountain range in what becomes one of the most stable cratons on earth. Weathering and erosion proceed at various rates as climates come and go and you are finally exposed in a windy desert. You blow away and become sand in a dune. GO TO Sediments	1500 Ma

Mantle Action Station

Card	Action	Time
Ace of Diamonds	You become part of a diamond bearing magma. You erupt to near the surface in a violent volcanic event making a kimberlite pipe that cools to form a diamond bearing rock. GO TO Igneous rocks	450 Ma
All Hearts	Mantle convection takes you around the world until you are magma pushing up into a fissure in the crust. You erupt at a sea-floor spreading site as lava cooling to form pillow basalt. GO TO Igneous rocks	500 Ma
Diamonds other than the Ace	You are caught up in a giant mantle plume and form magma pushing up into a hot spot volcano. You erupt as lava on the flanks of a giant shield volcano cooling to form basalt. GO TO Igneous rocks	700 Ma
All Spades and Clubs 1-10	Mantle convection takes you around the world until you are magma pushing up into a fissure in the crust. You intrude into a sea-floor spreading site and cool slowly as gabbro. GO TO Igneous rocks	600 Ma
All royal Clubs	Mantle convection takes you around the world but you remain as part of the mantle. STAY in the Mantle – and take another card	1000 Ma

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