

Weathering, erosion and deposition: the types, the agents and the landforms

Word	What happens	Movement?	Example
Weathering	rock broken down or changed where it is	no	frost cracks a boulder; limestone dissolves
Erosion	loosened rock and soil worn away and carried off	yes	a river carries sand; wind blows soil
Deposition	the carried material is dropped as the agent slows	the end of it	a delta; a dune; a beach

Weathering

Type	Processes	Where it is fastest
Physical (mechanical)	freeze-thaw (water expands 9% as it freezes); exfoliation (heat and cool, onion skins); salt crystal growth; abrasion; pressure release	cold mountains, deserts, coasts
Chemical	carbonation (carbonic acid dissolves limestone: caves, pavements, sinkholes); oxidation (iron rusts, red rock); hydrolysis (feldspar to clay); solution (salt, gypsum)	hot, wet climates
Biological	roots widen cracks; burrowing animals; lichens, mosses and bacteria release acids; people	wherever life is

The five agents of erosion

Agent	How it erodes	Erosion landforms	Deposition landforms
Running water	hydraulic action, abrasion, attrition, solution	V-shaped valleys, gorges, waterfalls, meanders (outer bank), gullies	floodplains, levees, deltas, alluvial fans, point bars
Wind	deflation, abrasion (sandblasting)	desert pavement, mushroom rocks, yardangs	dunes (barchans, seifs), loess
Ice (glaciers)	plucking, abrasion	U-shaped valleys, corries, arêtes, pyramidal peaks, hanging valleys, fjords, striations	moraines, drumlins, erratics, outwash plains
Gravity (mass movement)	the pull on weathered material, often after rain	rockfalls, landslides, mudflows, slumps, soil creep	scree, landslide debris
Waves	hydraulic action, abrasion, attrition, solution	cliffs, wave-cut platforms, headlands and bays, caves, arches, stacks, stumps	beaches, spits, bars, tombolos, salt marshes

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Soil erosion and its prevention, the rates, and a practice set

Soil forms at about 1 cm per 100 to 400 years and can be lost in one storm once bare. Causes: deforestation, overgrazing, ploughing up and down slopes, bare fields between crops, construction, drought (the 1930s Dust Bowl; Australia's 2009 and 2019 dust storms).

Method	How it works	Where
Contour ploughing	furrows follow the contours and hold water	sloping fields
Terracing	steps turn a slope into flat fields	hillsides
Cover crops, stubble	roots hold soil; leaves break the rain	arable land
No-till	seed drilled into last year's residue; soil never bared	grain farming
Mulching	straw or bark covers bare soil	gardens, orchards
Windbreaks, shelterbelts	tree rows slow the wind	open farmland
Buffer strips	grass or trees by streams trap run-off	riverbanks
Reforestation	roots and canopy restore cover	degraded slopes
Marram grass, fencing, boardwalks	roots bind sand; people kept off	dunes
Groynes, sea walls, rock armour, gabions	trap beach sand; absorb wave energy	coasts

Process	Typical rate
Soil loss from a bare ploughed slope	10-100 tonnes per hectare a year
Soil formation	about 1 cm per 100-400 years
Niagara Falls retreating	about 30 cm a year (over 1 m before flow control)
Holderness coast cliffs, England	1-2 m a year
The Grand Canyon	1.8 km deep, cut in about 5-6 million years

Curriculum	Where
Australia	Year 4 AC9S4U02 weathering and erosion; Year 8 rock cycle; Years 9-10 Geography
US NGSS	Grade 2 2-ESS1-1, 2-ESS2-1; Grade 4 4-ESS2-1; MS-ESS2-2
England	KS3 rock cycle; KS3 and GCSE Geography rivers and coasts
CBSE	Class 7 Our Changing Earth; Class 9-10 soil conservation
Ontario	Grade 7 Earth's crust

Practice

1. Explain the difference between weathering and erosion with one example of each.
2. Classify as physical, chemical or biological weathering: a root cracking a pavement; a gravestone's letters fading; a boulder splitting after a frosty winter; red stains on sandstone.
3. Name the four ways a river erodes its channel.
4. Match landform to agent: U-shaped valley; sand dune; arch and stack; delta; landslide.
5. A sloping field loses soil every rainy season. Suggest three measures and say how each works.
6. Why is soil erosion a bigger problem than its slow rate suggests?

Answers

1. Weathering breaks rock in place (frost shattering); erosion carries the pieces away (a river moving gravel).
2. Biological; chemical (carbonation); physical (freeze-thaw); chemical (oxidation).
3. Hydraulic action, abrasion, attrition, solution.
4. Ice; wind; waves; running water (deposition); gravity.
5. Contour ploughing holds water on the slope; cover crops bind the soil and break the rain's impact; a buffer strip or terrace slows run-off (any three with reasons).
6. Soil forms far more slowly than it is lost, so losses are effectively permanent and food production depends on it.