Javascript data types			
Type	**typeof value**	**Get real type**	**Subtypes (possible values)**
undefined	"undefined"	typeof value === "undefined"	undefined
		const isUndefined=(value)=>typeof value==="undefined";	
null	***"object"***	value === null	null
		const isNull=(value)=>value===null;	
boolean	"boolean"	typeof value === "boolean"	true, false
		const isBoolean=(value)=>typeof value==="boolean";	
number	"number"	typeof value === "number"	integer (-4, 4), float (-3.14, 3.14), 0, -0, Infinity, -Infinity, NaN
		const isNumber=(value)=>typeof value==="number";	
bigint	"bigint"	typeof value === "bigint"	bigint (-4n, 0n, 4n)
		const isBigInt=(value)=>typeof value==="bigint";	
string	"string"	typeof value === "string"	text, example: "hello world"
		const isString=(value)=>typeof value==="string";	
symbol	"symbol"	typeof value === "symbol"	symbol
		const isSymbol=(value)=>typeof value==="symbol";	
function	"function"	typeof value === "function"	Function, AsyncFunction, GeneratorFunction, AsyncGeneratorFunction, ArrowFunction
		const isFunction=(value)=>typeof value==="function";	
object	***"object"***	value !== null && typeof value === "object"	Object and Standard built-in objects
		const isObject=(value)=>value!==null&&typeof value==="object";	
Array	***"object"***	Array.isArray(value)	
		value instanceof Array	
Error	***"object"***	Error.isError(value)	Error, EvalError, RangeError, ReferenceError, SyntaxError, TypeError, URIError
		value instanceof Error	
Other classes	***"object"***	value instanceof CurrentClass	Standard built-in objects: Map, Set, Iterator, etc.

Type helper functions from Celestra	Details
`const typeOf=(value)=>value===null?"null":typeof value;`	Returns the real type of the value as a string.
`const isNullish=(value)=>value==null;`	Checks if the value is null or undefined.
`const isNonNullable=(value)=>value!=null;`	Checks if the value is not null or undefined.
`const isPrimitive=(value)=>value==null||(typeof value!=="object"&&typeof value!=="function");`	Checks if the value is not an object or function.
`const isNonNullablePrimitive=(value)=>value!=null&&typeof value!=="object"&&typeof value!=="function";`	Checks if the value is not null, undefined, object or function.
`const isPlainObject=(value)=>value!=null&& typeof value==="object"&& (Object.getPrototypeOf(value) ===Object.prototype|| object.getPrototypeOf(value)===null);`	Check if the value has been created from the Object constructor or null.
`const isAsyncFunction=(value)=>Object.getPrototypeOf(value).constructor===Object.getPrototypeOf(async function(){}).constructor;`	Checks if the value is an AsyncFunction.
`const isGeneratorFunction=(value)=>Object.getPrototypeOf(value).constructor===Object.getPrototypeOf(function*(){}).constructor;`	Checks if the value is a GeneratorFunction.
`const isAsyncGeneratorFunction=(value)=>Object.getPrototypeOf(value).constructor===Object.getPrototypeOf(async function*(){}).constructor;`	Checks if the value is an AsyncGeneratorFunction.
`function isArrowFunction(value){if(typeof value!=="function"||("prototype" in value&&value.prototype!==undefined)||!(value.toString().includes("=>"))){return false;}try{new value();return false;}catch(error){return true;}}`	Checks if the value is an ArrowFunction.
`const isTypedArray=(value)=>ArrayBuffer.isView(value)&&!(value instanceof DataView);`	Checks if the value is a TypedArray.
`const isIterable=(value)=>value!=null&&typeof value[Symbol.iterator]==="function";`	Checks if the value is an Iterable.
`const isAsyncIterable=(value)=>value!=null&&typeof value[Symbol.asyncIterator]==="function";`	Checks if the value is an Async Iterable.
`const isIterator=(value)=>value instanceof Iterator;`	Checks if the value is an Iterator.
`const isAsyncIterator=(value)=>value!= null&&typeof value.next==="function"&&typeof value[Symbol.asyncIterator]==="function";`	Checks if the value is an AsyncIterator.
`const isPropertyKey=(value)=>typeof value==="string"||typeof value==="symbol";`	Checks if the value is a valid property key (string or symbol).
`const isRegexp=(value)=>value instanceof RegExp;`	Checks if the value is a RegExp.
`const isSameType=(value1,value2)=>(value1==null||value2==null)?(value1===value2):(typeof value1===typeof value2);`	Checks if the values are the same type values.
`const isSameInstance=(value1,value2,Constructor)=>value1 instanceof Constructor&&value2 instanceof Constructor;`	Checks if the values have been created from the same constructor.

Web Storage api and JSON	element.dataset & data-* attributes	TypedArray
IE8+ **localStorage:** localStorage.length; localStorage.key(index); localStorage.getItem(key); localStorage.setItem(key, data); localStorage.removeItem(key); localStorage.clear(); **sessionStorage:** sessionStorage.length; sessionStorage.key(index); sessionStorage.getItem(key); sessionStorage.setItem(key, data); sessionStorage.removeItem(key); sessionStorage.clear(); **hasItem:** localStorage.getItem(key) !== null sessionStorage.getItem(key) !== null **setJSON:** localStorage.setItem(key, JSON.stringify(object)); sessionStorage.setItem(key, JSON.stringify(object)); **getJSON:** JSON.parse(localStorage.getItem(key)); JSON.parse(sessionStorage.getItem(key));	- IE11 compatible - element data-* attributes - no methods and events **camelcase:** element.data-name -> element.dataset.name element.data-first-second -> element.dataset.firstSecond **set:** element.dataset.name = "value"; element.dataset["name"] = "value"; element.setAttribute("data-name", "value"); element["data-name"] = "value"; **get:** element.dataset.name; element.dataset["name"]; element.getAttribute("data-name"); element["data-name"]; **remove:** element.removeAttribute("data- name"); **check:** element.hasAttribute("data-name");	new <TypedArray>(); *ES2017* new <TypedArray>(length); new <TypedArray>(typedArray); new <TypedArray>(object); new <TypedArray>(buffer[,byteOffset[,len]]); <TypedArray>.from(arrayLike, mapFn); <TypedArray>.of(element1, /*…,*/ elementN); **Int8Array();** -128 to 127, 1 byte, int8_t, Shortint **Uint8Array();** 0 to 255, 1 byte, uint8_t, Byte **Uint8ClampedArray();** 0 to 255, 1 byte, uint8_t, Byte **Int16Array();** -32768 to 32767, 2 byte, int16_t, Smallint **Uint16Array();** 0 to 65535, 2 byte, uint16_t, Word **Int32Array();** -2147483648 to 2147483647, 4 byte, int32_t **Uint32Array();** 0 to 4294967295, 4 byte, uint32_t, Longword **BigInt64Array();** -2**63 to 2**63-1, 8 byte, int64_t, Int64 **BigUint64Array();** 0 to 2**64-1, 8 byte, uint64_t, Qword **Float16Array();** -65504 to 65504, 2 byte **Float32Array();** 1.2x10-38 to 3.4x1038, 4 byte, float, Real **Float64Array();** 5.0x10-324 to 1.8x10308, 8 byte, Double
DOM events		
target.addEventListener(<type>,<listener>[,useCapture]); *or* target.addEventListener(<type>,<listener>[,options]); target.removeEventListener(<type>,<listener>[,useCapture]); *or* target.removeEventListener(<type>,<listener>[,options]); target.dispatchEvent(<event>); *and* target.type(); *or* target["type"]();		

element.classList	JSON
IE10+IE11 don't have support for classList on SVG or MathML elements. **element.classList.add(String[,String]);** IE10+11: yes (except the multiple arguments) **element.classList.remove(String[,String]);** IE10+11: yes (except the multiple arguments) - Removing a class that does not exist, does NOT throw an error. **element.classList.contains(String);** IE10+11: yes **element.classList.toggle(String[,force]);** IE10+11: yes (except the second argument) - When only one argument is present: Toggle class value; if class exists then remove it and return false, if not, then add it and return true. - When a second argument is present: If the second argument evaluates to true, add specified class value, and if it evaluates to false, remove it. **element.classList.item(Number);** IE10+11: yes **element.classList.length;** IE10+11: yes **element.classList.replace(oldClass, newClass);** IE10+11: No and the method isn't compatible with the Safari and mobile browsers too. **Remove all classes:** element.className = "";	IE8+ **Valid Data Types** - string - number - object (containing valid JSON values) - array - boolean - date - null **Invalid Data Types** - function - Symbol - NaN, Infinity, undefined – *will be "null"* - an object with method(s) (functions) - Map, Set, WeakMap, WeakSet – *fix: convert to array* - BigInt - *fixed in Celestra – BigInt.prototype.toJSON();* **JSON.stringify(value[,replacer[,space]]);** Convert a JavaScript object to a JSON string. JSON.stringify({ a: 1, b: "2", c: true }); *// -> "{\"a\":1,\"b\":\"2\",\"c\":true}"* JSON.stringify([1, 2, 3, 4, 5]); *// -> "[1,2,3,4,5]"* **JSON.parse(text[,reviver]);** Parses a JSON string and returns a JavaScript object. JSON.parse(JSON.stringify({a: 1, b: "2", c: true})); *// -> Object { a: 1, b: "2", c: true }* JSON.parse(JSON.stringify([1, 2, 3, 4, 5])); *// -> Array(5) [1, 2, 3, 4, 5]*

DOMParser

```
IE9: XML support
IE10+IE11: XML, SVG and HTML support

var parser = new DOMParser();
var doc = parser.parseFromString("sourceStr", "application/xml");
Returns a Document, but not a SVGDocument nor a HTMLDocument.

var parser = new DOMParser();
var doc = parser.parseFromString(sourceStr, "image/svg+xml");
Returns a SVGDocument, which also is a Document.

var parser = new DOMParser();
var doc = parser.parseFromString(sourceStr, "text/html");
Returns a HTML document.
```

DOMParser sample function

```
function parseHTML (str) {
  return Array.from(
    (new DOMParser())
      .parseFromString(str, "text/html")
      .childNodes[0]
      .childNodes[1]
      .childNodes
  );
}

parseHTML(
  "<div>1<p>2</p><p>3</p></div>"
  + "<div>4<p>5</p><p>6</p></div>"
  + "<div>7</div>"
  + "<p>8</p>"
);
// -> Array(4) [ div, div, div, p ]
// Tested in IE11, Edge, Firefox and Chrome.
```

BigInt (Int64)

```
let theBiggestInt = 9007199254740991n;
let alsoHuge = BigInt(9007199254740991);
let hugeString = BigInt("9007199254740991");
let hugeHex = BigInt("0x1fffffffffffff");
let hugeBin =
BigInt("0b11111111111111111111111111111111111111111111111
1111111");
// all -> 9007199254740991n

typeof 1n;          // -> "bigint"
typeof BigInt("1"); // -> "bigint"

Operators: +, *, -, **, %, Bitwise operators (e.g.: >>>)

!0n      // -> true
!1n      // -> false

4n / 2n  // -> 2n
5n / 2n  // -> 2n, not 2.5n -> rounded

1n < 2   // -> true
2n > 1   // -> true
2n > 2   // -> false
2n >= 2  // -> true

let mixed = [4n, 6, -12n, 10, 4, 0, 0n];
mixed.sort();// -> [-12n, 0, 0n, 4n, 4, 6, 10]

Methods
BigInt.asIntN();
  - BigInt value to a signed integer
BigInt.asUintN();
  - BigInt value to an unsigned integer
BigInt.prototype.toLocaleString();
BigInt.prototype.toString();
BigInt.prototype.valueOf();
```

Fetch	Fetch POST
Firefox, Firefox for Android 39 Chrome, Chrome Android, WebView Android 42 Edge 14 Opera 29 Safari 10.1, Safari on iOS 10.3 Samsung Internet 4.0 Deno 1, Node.js 18 *// Example GET method implementation with TEXT:* fetch("https://api.coindesk.com/v1/bpi/currentprice.json") .then(response => response.text()) .then(data => console.log(data)) .catch(error => console.log(error)); *// Example GET method implementation with JSON:* fetch("https://api.coindesk.com/v1/bpi/currentprice.json") .then(response => response.json()) .then(data => console.log(data.bpi.USD.rate)) .catch(error => console.log(error)); *// Example GET method implementation with TEXT and JSON:* fetch("https://api.coindesk.com/v1/bpi/currentprice.json") .then(response => response.text()) .then(text => console.log(JSON.parse(text).bpi.USD.rate+"\n"+text)) .catch(error => console.log(error)); *// Example POST method implementation with upload JSON data:* const data = { username: "example" }; fetch("https://example.com/profile", { method: "POST", // or "PUT" headers: { "Content-Type": "application/json", }, body: JSON.stringify(data), }) .then(response => response.json()) .then(data => { console.log("Success:", data); }) .catch((error) => { console.error("Error:", error); });	*// Example POST method implementation:* *// Default options are marked with ** async function postData(url = "url", data = {}) { const response = await fetch(url, { method: "POST", *// *GET, POST, PUT, DELETE, etc.* mode: "cors", *// no-cors, *cors, same-origin* cache: "no-cache", *// *default, no-cache, reload, force-cache, only-if-cached* credentials: "same-origin", *// include, *same-origin, omit* headers: {"Content-Type": "application/json"}, *// "Content-Type": "application/x-www-form-urlencoded"* redirect: "follow", *// manual, *follow, error* referrerPolicy: "no-referrer", *// no-referrer, *no-referrer-when-downgrade, origin, origin-when-cross-origin, same-origin, strict-origin, strict-origin-when-cross-origin, unsafe-url* body: JSON.stringify(data) *// body data type must match "Content-Type" header* }); return response.json(); *// parses JSON response into native JavaScript objects* } postData("https://example.com/answer", { answer: 42 }) .then(data => { console.log(data); }); *// JSON data parsed by `data.json()` call*

Nullish coalescing operator **x ?? y**	**Logical nullish assignment** **x ??= y**	**Logical AND assignment** **x &&= y**	**Logical OR assignment** **x ||= y**
FF 72, Chrome and Edge 80, Safari 13.1, Safari on iOS 13.4, Samsung Internet 13	FF 79, Chrome and Edge 85, Safari 14, Samsung Internet 14		
The nullish coalescing operator (??) is a logical operator that **returns its right-hand side operand when its left-hand side operand is null or undefined, and otherwise returns its left-hand side operand.**	The logical nullish assignment operator **only assigns if x is nullish (null or undefined).**	The logical AND assignment operator **only assigns if x is truthy.**	The logical OR assignment operator **only assigns if x is falsy.** (false, 0, -0, 0n, "", '', ``, null, undefined, NaN)
`const nullValue = null;` `const emptyText = ""; // falsy` `const someNumber = 42;` `const valA = nullValue ?? "defaultA";` `// "defaultA"` `const valB = emptyText ?? "default B";` `// "" (empty string is not null or undefined)` `const valC = someNumber ?? 0;` `// 42`	`function config (options) {` `  options.duration ??= 100;` `  options.speed ??= 25;` `  return options;` `}` `config({duration: 125});` `// {duration: 125, speed: 25}` `config({});` `// {duration: 100, speed: 25}`	`let x = 0;` `let y = 1;` `x &&= 0; // 0` `x &&= 1; // 0` `y &&= 1; // 1` `y &&= 0; // 0`	`const a = {` `  duration: 50,` `  title: ""` `};` `a.duration ||= 10;` `// 5` `a.title ||= "title is empty.";` `// "title is empty"`
`let count = 0;` `let text = "";` `let qty = count || 42; // 42` `let message = text || "hi!"; // "hi!"`	`const a = { duration: 50 };` `a.duration ??= 10; // 50` `a.speed ??= 25;  // 25`	`let a = 1;` `let b = 0;` `a &&= 2; // 2` `b &&= 2; // 0`	

		equivalent	**not equivalent**
Nullish coalescing operator (??)	**x ?? y**	`(x != null) ? x : y`	
Logical nullish assignment (??=)	**x ??= y**	`x ?? (x = y);`	`x = x ?? y;`
Logical AND assignment (&&=)	**x &&= y**	`x && (x = y);`	`x = x && y;`
Logical OR assignment (||=)	**x ||= y**	`x || (x = y);`	`x = x || y;`

Reflect object		
ES6, no IE11 support - FF 42, Chrome 49, Edge 12, Safari 10, Safari on iOS 10, Samsung Internet 5.0		
Function	**Description**	**equivalent**
`Reflect.apply(target, thisArgument, argumentsList);`	Calls a target function with arguments as specified by the argumentsList parameter.	`Function.prototype.apply.call(target, thisArgument, argumentsList);`
`Reflect.construct(target,argumentsList [,newTarget]);`	The new operator as a function.	`new target(...argumentsList);`
`Reflect.defineProperty(target,propertyKey, attributes);`	Similar to Object.defineProperty(). Returns a boolean that is true if the property was successfully defined.	`Object.defineProperty(target, propertyKey,attributes);`
`Reflect.deleteProperty(target,propertyKey);`	The delete operator as a function.	`delete target[propertyKey];`
`Reflect.get(target,propertyKey[,receiver]);`	Returns the value of the property of the object.	`target[propertyKey];`
`Reflect.getOwnPropertyDescriptor(target, propertyKey);`	Returns a property descriptor of the given property if it exists on the object, undefined otherwise.	`Object.getOwnPropertyDescriptor(target, propertyKey);`
`Reflect.getPrototypeOf(target);`	Object.getPrototypeOf(target);	`Object.getPrototypeOf(target);`
`Reflect.has(target,propertyKey);`	Returns a boolean whether the target has the property.	`propertyKey in target;`
`Reflect.isExtensible(target);`	Returns a boolean that is true if the target is extensible.	`Object.isExtensible(target);`
`Reflect.ownKeys(target);`	Returns an array of the target object's own (not inherited) property keys.	`Object.getOwnPropertyNames(target).concat( Object.getOwnPropertySymbols(target));`
`Reflect.preventExtensions(target);`	Prevents new properties from ever being added to an object. Similar to Object.preventExtensions().	`Object.preventExtensions(target);`
`Reflect.set(target,propertyKey,value [,receiver]);`	Assigns values to properties. Returns a boolean that is true if the update was successful.	`target[propertyKey] = value;`
`Reflect.setPrototypeOf(target,prototype);`	Sets the prototype of an object. Returns a boolean that is true if the update was successful.	`Object.setPrototypeOf(target,prototype);`

Map Object

```
var myMap = new Map([iterable]);

// The Map objects are iterable.
for (let [key, value] of myMap) {
  console.log(`${key} = ${value}`);
}

var cloneMap = new Map(myMap);
Map.prototype.size;
Map.prototype.get(<key>); -> value/undefines
Map.prototype.set(<key>,<value>); -> Map object
Map.prototype.has(<key>); -> boolean
Map.prototype.delete(<key>); -> boolean
Map.prototype.clear(); -> undefined

Map.prototype.forEach(function (value,key,map)); -> undefined
Map.prototype.keys(); -> iterator of keys
Map.prototype.values(); -> iterator of values
Map.prototype.entries(); -> iterator of [key, value]
```

Set Object

```
var mySet = new Set([iterable]);

// The Set objects are iterable.
for (const item of mySet) { console.log(item); }

var cloneSet = new Set(mySet);
Set.prototype.size;
Set.prototype.add(<value>); -> Set object
Set.prototype.has(<value>); -> boolean
Set.prototype.delete(<value>); -> boolean
Set.prototype.clear(); -> undefined

Set.prototype.forEach(function (value,value,set)); -> undefined
Set.prototype.keys(); -> iterator of values
Set.prototype.values(); -> iterator of values
Set.prototype.entries(); -> iterator of [value, value]
```

Set Object helper functions

```
function isSuperset(set, subset) {
  for (const elem of subset) {
    if (!set.has(elem)) { return false; }
  }
  return true;
}

function union(setA, setB) {
  const _union = new Set(setA);
  for (const elem of setB) { _union.add(elem); }
  return _union;
}
function intersection(setA, setB) {
  const _intersection = new Set();
  for (const elem of setB) {
    if (setA.has(elem)) { _intersection.add(elem); }
  }
  return _intersection;
}

function difference(setA, setB) {
  const _difference = new Set(setA);
  for (const elem of setB) { _difference.delete(elem); }
  return _difference;
}
function symmetricDifference(setA, setB) {
  const _d = new Set(setA);
  for (const e of setB) {
    if (_d.has(e)) { _d.delete(e); } else { _d.add(e); }
  }
  return _d;
}

const setA = new Set([1,2,3,4]), setB = new Set([2, 3]),
setC = new Set([3, 4, 5, 6])
isSuperset(setA, setB);          // true
union(setA, setC);               // Set {1, 2, 3, 4, 5, 6}
intersection(setA, setC);        // Set {3, 4}
difference(setA, setC);          // Set {1, 2}
symmetricDifference(setA, setC); // Set {1, 2, 5, 6}
```

Array.fromAsync();

```
Array.fromAsync(<object>[,mapFn[,thisArg]])
  .then((resultArray) => /* todo with resultArray */);
```

Object types: async iterable, iterable (Array, Map, Set, NodeList, etc.), array-like

mapfn parameters: element, index

```
async function* asyncIterable () {
  for (let i = 0; i < 5; i++) { await new
Promise((resolve)=> setTimeout(resolve,50*i)); yield i; }
}

Array.fromAsync(asyncIterable())
  .then((res) => console.log("asyncIterable1: "+res));
// asyncIterable1: 0,1,2,3,4
Array.fromAsync(asyncIterable(), (x) => x*2)
  .then((res) => console.log("asyncIterable2: "+res));
// asyncIterable2: 0,2,4,6,8

Array.fromAsync([4,5,6,7,8])
  .then((res) => console.log("[4,5,6,7,8]: "+res));
// [4,5,6,7,8]: 4,5,6,7,8
Array.fromAsync([4,5,6,7,8], (x) => x*2)
  .then((res) => console.log("[4,5,6,7,8] + fn: "+res));
// [4,5,6,7,8] + fn: 8,10,12,14,16

Array.fromAsync(new Set([4,5,6,6,10]))
  .then((res) => console.log("Set: "+res));
// Set: 4,5,6,10

Array.fromAsync(new Set([4,5,6,6,10]), (x) => x*2)
  .then((res) => console.log("Set + fn: "+res));
// Set + fn: 8,10,12,20

Array.fromAsync({"0": 3, "1": 4, "2": 5, length: 3})
  .then((res) => console.log("arraylike: "+res));
// arraylike: 3,4,5

Array.fromAsync({"0": 3, "1": 4, "2": 5, length: 3}, (x) =>
x*2).then((res) => console.log("arraylike + fn: "+res));
// arraylike + fn: 6,8,10
```

Set methods

```
Chrome, Chrome Android, Edge, WebView Android v122
Firefox, Firefox for Android v127
Safari, Safari on iOS, WebView on iOS v17
Opera v108, Opera Android v81
Samsung Internet v26.0
Deno 1.42, Node.js 22.0.0

Set.prototype.intersection(other): Set
Set.prototype.union(other): Set
Set.prototype.difference(other): Set
Set.prototype.symmetricDifference(other): Set
Set.prototype.isSubsetOf(other): Boolean
Set.prototype.isSupersetOf(other): Boolean
Set.prototype.isDisjointFrom(other): Boolean

var setA = new Set([1]);
var setB = new Set([1,2]);
var setC = new Set([2,3]);

console.log( setB.intersection(setC) );
// Set [ 2 ]
console.log( setB.union(setC) );
// Set(3) [ 1, 2, 3 ]
console.log( setB.difference(setC) );
// Set [ 1 ]
console.log( setB.symmetricDifference(setC) );
// Set [ 1, 3 ]

console.log( setB.isSupersetOf(setA) );
// true
console.log( setA.isSupersetOf(setC) );
// false
console.log( setA.isSubsetOf(setB) );
// true
console.log( setA.isSubsetOf(setC) );
// false

console.log( setA.isDisjointFrom(setC) );
// true - there are no common elements
console.log( setA.isDisjointFrom(setB) );
// false - there are common elements
```

Javascript Equality comparisons and sameness					
X	Y	loose equality	strict equality	Same-value	Same-value-zero
		X == Y	X === Y	Object.is(X, Y)	[X].includes(Y)
					X === Y || (X !== X && Y !== Y)
undefined	undefined	✅ true	✅ true	✅ true	✅ true
null	null	✅ true	✅ true	✅ true	✅ true
true	true	✅ true	✅ true	✅ true	✅ true
false	false	✅ true	✅ true	✅ true	✅ true
"foo"	"foo"	✅ true	✅ true	✅ true	✅ true
0	0	✅ true	✅ true	✅ true	✅ true
+0	-0	✅ true	✅ true	❌ false	✅ true
+0	0	✅ true	✅ true	✅ true	✅ true
-0	0	✅ true	✅ true	❌ false	✅ true
0n	-0n	✅ true	✅ true	✅ true	✅ true
0	false	✅ true	❌ false	❌ false	❌ false
""	false	✅ true	❌ false	❌ false	❌ false
""	0	✅ true	❌ false	❌ false	❌ false
"0"	0	✅ true	❌ false	❌ false	❌ false
"17"	17	✅ true	❌ false	❌ false	❌ false
[1, 2]	"1,2"	✅ true	❌ false	❌ false	❌ false
new String("foo")	"foo"	✅ true	❌ false	❌ false	❌ false
null	undefined	✅ true	❌ false	❌ false	❌ false
null	false	❌ false	❌ false	❌ false	❌ false
undefined	false	❌ false	❌ false	❌ false	❌ false
{foo: "bar"}	{foo: "bar"}	❌ false	❌ false	❌ false	❌ false
new String("foo")	new String("foo")	❌ false	❌ false	❌ false	❌ false
0	null	❌ false	❌ false	❌ false	❌ false
0	NaN	❌ false	❌ false	❌ false	❌ false
"foo"	NaN	❌ false	❌ false	❌ false	❌ false
NaN	NaN	❌ false	❌ false	✅ true	✅ true

StructuredClone();

Firefox, Firefox for Android 94
Chrome, Chrome Android, WebView Android 98
Edge 98
Opera 84
Opera Android 68
Safari, Safari for iOS, WebView on iOS 15.4
Samsung Internet 18
Deno 1.14, Node.js 17
Supported in all major browsers.

The structuredClone() function creates a deep clone of a given value using the structured clone algorithm.

Usage:

```
structuredClone(value)
structuredClone(value, options)
```

Options:
  transfer: An array of transferable objects that will be moved rather than cloned to the returned object.

Example:

```
let x = { "a": [1, 2], "b": "lorem ipsum" };
let y = structuredClone(x);
console.log(x      === y);      // false
console.log(x.a    === y.a);    // false
console.log(x.a[0] === y.a[0]); // true
console.log(x.a[1] === y.a[1]); // true
console.log(x.b    === y.b);    // true
```

StructuredClone(); Supported types

Primitive types, except Symbol:

Null
Undefined
Boolean
Number
BigInt
String

Object types:

Array
ArrayBuffer
Boolean
DataView
Date
Map
Number
Object objects: but only plain objects (e.g., from object literals).
RegExp (lastIndex is not preserved)
Set
String
TypedArray

Error objects:

AggregateError (cloning not supported in every JS interpreter)
Error
EvalError
RangeError
ReferenceError
SyntaxError
TypeError
URIError

Web/API types:

AudioData
Blob
CropTarget
CryptoKey
DOMException: browsers must serialize the properties name and message. Other attributes may also be serialized/cloned.
DOMMatrix
DOMMatrixReadOnly
DOMPoint
DOMPointReadOnly
DOMQuad
DOMRect
DOMRectReadOnly
EncodedAudioChunk
EncodedVideoChunk
FencedFrameConfig
File
FileList
FileSystemDirectoryHandle
FileSystemFileHandle
FileSystemHandle
GPUCompilationInfo
GPUCompilationMessage
GPUPipelineError
ImageBitmap
ImageData
RTCCertificate
RTCEncodedAudioFrame
RTCEncodedVideoFrame
VideoFrame
WebTransportError

Map.prototype.getOrInsert(key, defaultValue);	WeakMap.prototype.getOrInsert(key, defaultValue);
`const map1 = new Map([["DNA", "42"]]);` `console.log(map1.getOrInsert("DNA", "54"));` `// 42` `console.log(map1.getOrInsert("DNA2", "default"));` `// "default"` `console.log(map1.get("DNA2"));` `// "default"`	`const wm1 = new WeakMap();` `const obj1 = {};` `console.log(wm1.get(obj1));` `// undefined` `console.log(wm1.getOrInsert(obj1, 42));` `// 42` `console.log(wm1.get(obj1));` `// 42` `console.log(wm1.getOrInsert(obj1, "default"));` `// 42` `console.log(wm1.get(obj1));` `// 42`
Map.prototype.getOrInsertComputed(key, callback);	**WeakMap.prototype.getOrInsertComputed(key, callback);**
`const map1 = new Map([["DNA", 42]]);` `const helperFN1 = (prop) => 54;` `console.log(map1.get("DNA"));` `// 42` `console.log(map1.getOrInsertComputed("DNA", helperFN1));` `// 42` `console.log(map1.get("DNA"));` `// 42` `console.log(map1.getOrInsert("DNA2", helperFN1("DNA2")));` `// 54` `console.log(map1.getOrInsertComputed("DNA2", helperFN1));` `// 54` `console.log(map1.get("DNA2"));` `// 54`	`const weakmap1 = new WeakMap();` `const obj1 = {};` `const obj2 = {};` `const helperFN1 = (prop) => 54;` `console.log(weakmap1.get(obj1));` `// undefined` `console.log(weakmap1.getOrInsert(obj1, 42));` `// 42` `console.log(weakmap1.getOrInsertComputed(obj1, helperFN1));` `// 42` `console.log(weakmap1.get(obj1));` `// 42` `console.log(weakmap1.get(obj2));` `// undefined` `console.log(weakmap1.getOrInsertComputed(obj2, helperFN1));` `// 54` `console.log(weakmap1.get(obj2));` `// 54`

Iterator methods	Iterator methods samples
Firefox, Firefox for Android 131 Chrome, Edge, Webview Android 122 *and* Opera 108 Safari, Safari in iOS, Webview on iOS 18.4 Samsung Internet 26.0 *and* Node.js 22 *and* Deno 1.42	`const A1 = [ 1, 2, 3, 4 ];` `const A2 = [ 5, 6, 7, 8 ];`
`Iterator.from(object);`	`Iterator.from(A1); // Iterator<any> { 1, 2, 3, 4 }`
`Iterator.concat(it1, it2, /* …, */ itN);`	`Iterator.concat( A1.values(), A2.values() );` `// Iterator<any> { 1, 2, 3, 4, 5, 6, 7, 8 }`
`Iterator.zip(iterables[, options object]);` *options object:* *"mode": "shortest" (default), "longest", "strict"* *"padding": padding[i] (iterator converting to array)*	`Iterator.zip( [ A1.values(), A2.values() ] );` `// Iterator<Array> { [1, 5], [ 2, 6 ], [ 3, 7 ], [ 4, 8 ] }`
`Iterator.zipKeyed(iterables[, options object]);` *options object: same as Iterator.zip(); options object*	`Iterator.zipKeyed( [ A1.values(), A2.values() ] );` `// Iterator<Object> {{0:1, 1:5}, {0:2, 1:6}, {0:3,1:7}, {0:4,1:8}}`
`Iterator.prototype.drop(limit);`	`A1.values().drop(2); // Iterator<any> { 3, 4 }`
`Iterator.prototype.every(callbackFn(Element, index));`	`A1.values().every( (x) => x > 0 ); // true`
`Iterator.prototype.filter(callbackFn(Element, index));`	`A1.values().filter( (x) => x > 2 ); // Iterator<any> { 3, 4 }`
`Iterator.prototype.find(callbackFn(Element, index));`	`A1.values().find( (x) => x > 2 ); // 3`
`Iterator.prototype.flatMap(callbackFn(Element, index));`	`[A1, A2].values().flatMap((x) => x); // Iterator {1,2,3,4,5,6,7,8}` `new Map([` `  new Map([ ["a", 1], ["b", 2] ]), new Map([ [ "c", 3], ["d", 4]])` `].values().flatMap( (x) => x) );` `// Map(4) { a → 1, b → 2, c → 3, d → 4 }`
`Iterator.prototype.forEach(callbackFn(Element, index));`	`A1.values().forEach( (e) => console.log(e) ); // 1 2 3 4`
`Iterator.prototype.map(callbackFn(Element, index));`	`A1.values().map( (x) => x * 2 ); // Iterator<any> { 2, 4, 6, 8 }`
`Iterator.prototype.reduce(callbackFn(accumulator,` `  currentValue, currentIndex), initialValue: Optional);`	`A1.values().reduce( (ac, it) => (ac + it), 0 ); // 10`
`Iterator.prototype.some(callbackFn(Element, index));`	`A1.values().some( (x) => x > 2 ); // true`
`Iterator.prototype.take(limit);`	`A1.values().take(2); // Iterator<any> { 1, 2 }`
`Iterator.prototype.toArray();` Same as `Array.from(iterator);` and `[...iterator];`	`A1.values().toArray(); // Array(4) [ 1, 2, 3, 4 ]`
`Iterator.prototype[Symbol.dispose]();`	
`Iterator.prototype[Symbol.iterator]();`	