Quick-Start Guide:

Accessing a Blockchain for Teaching & Learning

Below are the easiest, free (or low-cost) ways to explore a live blockchain, run your own node, or use sandbox environments. Choose the option that matches the depth you need for a lesson, a lab, or a semester-long course.

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1 Use a Public "Read-Only" API (no node to run)

Platform	What you get	Free tier	How to start
Infura (Ethereum, Polygon, Optimism, Arbitrum)	JSON-RPC endpoint, WebSocket, archive data (historical blocks, logs)	100 k requests/day (enough for most demos)	1. Sign up at https://infura.io 2. Create a project → copy the HTTPS URL (e.g., https://mainnet.infura.io/v3/<PROJECT_ID>).
Alchemy (Ethereum & L2s)	Same as Infura + dashboards, enhanced analytics	300 k compute units/mo (≈ 1 M RPC calls)	1. Register at https://alchemy.com 2. Choose "Ethereum → Mainnet" (or a testnet).
QuickNode	Multi-chain RPC (Ethereum, BSC, Solana, Avalanche…)	300 k requests/mo	Sign up → pick a chain → copy the endpoint.
BlockCypher (Bitcoin, Litecoin, Dogecoin)	REST API for blocks, txs, address balances	200 req/min (free)	https://api.blockcypher.com/v1/btc/main etc.
Moralis (EVM + Solana)	Unified SDK, real-time webhooks, NFT & token metadata	30 k "Moralis Units"/mo	Register → use the "Speedy Nodes" endpoint.

Why use these?

- **No software install, no syncing time.**

- **Instantly pull a block, transaction, or balance for a demo.**
- **Perfect for short classroom scripts or live coding.**

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2 Connect to a Testnet (sandbox, no real money)

Testnet	Chain	Typical use	How to connect
Goerli / Sepolia (Ethereum)	EVM-compatible	Deploy simple Solidity contracts, experiment with gas, Metamask integration.	Use Infura/Alchemy endpoint https://goerli.infura.io/v3/... or https://eth-sepolia.alchemyapi.io/v2/....
Polygon Mumbai	Polygon L2	Low-cost ERC-20/721 demos.	Same providers, just select "Polygon Mumbai".
Binance Smart Chain Testnet	BSC	BEP-20 token labs.	Endpoint: https://data-seed-prebsc-1-s1.binance.org:8545/.
Bitcoin Testnet	Bitcoin	Raw transaction building, segwit scripts.	Public nodes: https://testnet.blockchain.info/ or use btc-testnet.public.blastapi.io.
Solana Devnet	Solana	Rust/Anchor smart-contract tutorials.	RPC: https://api.devnet.solana.com.

Tip: Always use a wallet on the testnet (MetaMask, Phantom, etc.) and request faucet funds (e.g., Goerli faucet → https://goerlifaucet.com). No real value is at stake, so students can experiment freely.

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3 Run a Lightweight Local Node (full control, no external API)

Blockchain	Light client option	Setup steps (≈10 min)
Ethereum	Geth (fast-sync) or Netherm	1. Install via brew install ethereum (macOS) or download

Blockchain	Light client option	Setup steps (≈10 min)
	ind	binaries. 2. Run geth --http --http.api eth,net,web3,personal. 3. Sync (fast-sync) finishes in <30 min for testnet, a few hours for mainnet.
Bitcoin	Bitcoin Core (pruned mode)	1. Download from bitcoin.org. 2. Launch with -prune=550 to keep only ~550 MB of data. 3. RPC enabled via bitcoin.conf (server=1, rpcuser, rpcpassword).
Solana	Solana Test Validator	solana-test-validator spins up a local devnet in seconds.
Hyperledger Fabric	Fabric Samples (Docker-Compose)	`curl -sSL https://bit.ly/2ysbOFE

Why run locally?

- No reliance on third-party services (great for privacy-focused labs).
- You can modify the client code (e.g., change consensus parameters) for advanced courses.
- Full control over RPC ports, logging, and data directories.

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4 Interactive Development Environments (no install)

Platform	Languages	What you can do
Remix IDE (https://remix.ethereum.org)	Solidity	Write, compile, and deploy contracts directly to a testnet or a local Ganache node.
Truffle Develop (via browser)	Solidity, JavaScript	Scaffold projects, run migrations, test with Mocha/Chai.
Hardhat (online via Gitpod)	Solidity, TypeScript	Fast local Ethereum network, debugging, forking mainnet.
CryptoZombies (https://cryptozombies.io)	Solidity	Gamified tutorial that walks students through ERC-721 token creation.
Solidity	Solidity	One-page editor + compile

Platform	Languages	What you can do
Playground (https://playground.soliditylang.org)		button; great for quick demos.
Blockstack Studio (https://studio.blockstack.org)	JavaScript, Clarity (Stacks)	Build dApps on the Stacks blockchain (Bitcoin-anchored).

These platforms let you show code and results instantly on a projector or shared screen—perfect for a 30-minute lecture.

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5 Sample Code Snippets (Python & JavaScript)

Python – Pull latest Ethereum block (Infura)

```python
import requests, json

INFURA_PROJECT_ID = "YOUR_PROJECT_ID"
url = f"https://mainnet.infura.io/v3/{INFURA_PROJECT_ID}"
payload = {
   "jsonrpc":"2.0",
   "method":"eth_getBlockByNumber",
   "params":["latest", True],
   "id":1
}
resp = requests.post(url, json=payload).json()
block = resp["result"]
print(f"Block #{int(block['number'],16)}")
print(f"Tx count: {len(block['transactions'])}")
print(f"Miner: {block['miner']}")
```

JavaScript – Query a Bitcoin address balance (BlockCypher)

```javascript
fetch('https://api.blockcypher.com/v1/btc/main/addrs/1A1zP1eP5QGefi2DMPTfTL5SLmv7DivfNa')
  .then(r => r.json())
  .then(data => {
    console.log(`Balance: ${data.final_balance} satoshis`);
    console.log(`Total TXs: ${data.n_tx}`);
```

```
})
.catch(console.error);
```

Both scripts run in a few seconds on any laptop—ideal for a live "show the data" demo.

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6 Curriculum-Friendly Lab Ideas

Topic	Suggested Lab	Tools
Block anatomy	**Print a block's header (hash, parent-hash, merkle-root) and verify the hash locally.**	**Python hashlib, any public RPC.**
Transaction creation	**Build, sign, and broadcast a simple ETH transfer on Goerli.**	**MetaMask + Remix + Goerli faucet.**
Smart-contract deployment	**Deploy an ERC-20 token, mint tokens, and query balances.**	**Remix + Infura Goerli endpoint.**
UTXO model	**Construct a Bitcoin transaction using bitcoinlib (Python) on testnet.**	**Bitcoin Core testnet RPC.**
Consensus simulation	**Run two local Geth nodes with different genesis files; observe fork resolution.**	**Geth, two terminals.**
Data indexing	**Use The Graph (hosted service) to index events from a contract and query via GraphQL.**	**The Graph Explorer, simple React front-end.**
Privacy	**Compare a regular transaction vs. a Tornado Cash (or similar) mixer on a testnet.**	**Remix + Goerli.**

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7 Safety & Ethics Checklist (for instructors)

1. **Never ask students to use real funds on mainnet unless it's a controlled, small-amount exercise.**
2. **Warn about phishing – only use official faucet URLs and official wallet extensions (MetaMask, Phantom).**
3. **Explain rate limits of free API tiers; encourage caching results for repeated queries.**
4. **Cover privacy – public blockchains expose all transaction data; discuss why testnets are safer for experimentation.**

5. **Encourage reproducibility – store API keys in environment variables (.env files) and share a template, not the actual keys.**

TL;DR – One-Minute Action Plan

1. **Create a free Infura (or Alchemy) account → get an HTTPS endpoint for Ethereum.**
2. **Open Remix IDE in your browser → connect it to the Goerli testnet via that endpoint.**
3. **Deploy a simple Solidity contract (e.g., "HelloWorld") and interact with it live.**
4. **Optional: Spin up a local Geth node (geth --goerli --http) to show how a full node works.**
5. **Use the Python snippet above to pull block data and demonstrate how the blockchain can be queried programmatically.**

With those five minutes you have everything needed to show a live blockchain, write code, and let students experiment without any costly infrastructure. Happy teaching!