Ethereum Basics
Summary Notes

At-a-glance (1 minute review)

- **Ethereum** = decentralized, **programmable** blockchain (not just payments).
- **Smart contracts** run on the **EVM** and are executed by all nodes.
- Smart contracts are written mainly in **Solidity**.
- Native currency: **ETH** (pays fees: *gas*).
- Consensus today: **Proof of Stake (PoS)** (since Sept 2022).

Ethereum Basics – Summary Notes

1. What is Ethereum?

Ethereum is a decentralized, general-purpose blockchain platform. Unlike Bitcoin, which mainly supports transferring its native token, Ethereum supports **smart contracts** and **decentralized applications (dApps)**.

- Supports programmable logic on-chain
- Enables applications beyond simple payments
- Global state includes balances *and* smart contract state

2. dApps and Smart Contracts

dApps are applications that run on Ethereum without centralized servers.
Smart contracts are small programs deployed on Ethereum that:

- Are replicated across network nodes
- Execute automatically based on code logic
- Do not require a central coordinator

Key fact: Smart contracts on Ethereum mainnet are processed by all participating nodes.

3. Ethereum Virtual Machine (EVM)

The **EVM** is the runtime environment where smart contracts execute.

- Same rules on every node (deterministic execution)
- Makes Ethereum a shared global compute layer

4. Programming Language

Ethereum smart contracts are written primarily in **Solidity**, a high-level, Turing-complete language designed for on-chain execution.

5. Consensus Mechanism

Ethereum currently uses **Proof of Stake (PoS)** for consensus.

- Validators are selected based on staked ETH
- More energy-efficient than Proof of Work

Historical note: In September 2022 (The Merge / Serenity upgrade), Ethereum transitioned from **PoW** to **PoS**.

6. Proof of Work (PoW)

PoW is a consensus mechanism where miners compete to solve computational puzzles. The first to solve earns the right to add the next block.

7. Ether (ETH)

ETH is Ethereum's native currency.

- Pays transaction fees (**gas**)
- Required to execute smart contracts

8. Brief History

Proposed in 2013 by Vitalik Buterin; publicly announced in 2014; funded via ICO. The Ethereum Foundation (Switzerland) supported early open-source development.

9. Token Standards

ERC-20 (Fungible tokens)

- Tokens implemented as smart contracts
- Standard interface enables broad wallet support
- Can be created without permission

ERC-721 / ERC-1155 (NFT standards)

- Non-fungible / semi-fungible token standards
- Standardize ownership and transfer of unique assets

10. Quick Comparison

Property	Answer
Block time is shorter	Ethereum
Block size is bigger (as taught here)	Ethereum

11. Key Exam Takeaways (Checklist)

- Ethereum = programmable blockchain for dApps + smart contracts
- Smart contracts execute on the **EVM**
- Main language: **Solidity**
- Native currency: **ETH** (gas fees)
- Current consensus: **Proof of Stake**
- Token standards: **ERC-20** (fungible), **ERC-721/1155** (NFTs)

Tip: Print this as a 1-page handout; keep the "At-a-glance" box for quick revision.