

# COMPUTE THE TRANSACTION FEE

## BLOCKCHAIN DEVELOPMENT

**Time:** 60 mins

### Introduction

In this class, the student/s will compute the transaction fee based on the transaction speed, gas price and currency conversions.

### New Commands Introduced

- `web3.eth.gas_price` Gets the gas price from the api.
- `web3.from_wei(1, 'gwei')` Converts 1 Wei to Gwei
- `web3.from_wei(1, 'ether')` Converts 1 Wei to Ether

### Vocabulary

- Transaction speed is used to calculate the transaction fee and gas price. Transaction fee increases with increase in speed of transaction.

### Learning Objectives

Student/s should be able to:

- **Recall** how to calculate the transaction fee and explain calculations for different transaction speeds.
- **Explain** the currency conversions for Wei, Gwei, Ether and dollars.
- **Demonstrate** calculating the transaction fee using gas price and gas limit and display the prices.

### Activities

#### 1. Class Narrative: (3 mins)

- Brief the student/s the reason behind miners mining the block and explain the benefits of transaction fee in cryptocurrency.
  - Incentivize miners: Transaction fees incentivize miners, along with the standard block reward.

- Mitigate Spam Attacks: Spam attacks from individuals attempting to overload the network are mitigated when transactions include a fee.
- Data Size Based Fee Calculation: The fee is determined automatically based on the amount of data being transferred, not the dollar amount of the transaction.
- Reduced Wait Time: By not including a nominal fee, the user runs the risk of significantly prolonging wait times from mere minutes to several days.
- Fee Exemptions: Fees are not required for transactions with a data size less than 1000 bytes and a spend value higher than 0.01 BTC.
- Miners Set their Fee: Miners can choose to set their fee amount higher or lower than the standard amount defined by the protocol.
- Inform the student/s that in stage 2 of the Art Guard project they would compute the transaction fee that the miners will receive.
- Ask the student/s to observe the time taken by the chefs and the amount received by them. Inform them that the transaction fee is calculated in a similar way.

## **2. Concept Introduction Activity: (4 mins)**

- Let the student/s undertake the explore-activity to observe that the transaction fee varies for different transaction speeds.
- Explain how the transaction fee affects the mining.
- Using the slides, explain that the student/s will learn:
  - to calculate the gas price
  - to convert the gas price
  - To display the transaction fee

## **3. Activity 1: Calculate the Gas Price (14 mins)**

### **Teacher Activity: (7 mins)**

- Explain how transaction fee is charged as per the priority of the task by letting users select the speed and Infura api is used to fetch live value of the ether.
- Explain how to calculate the percentages of the gas price using the table.
- Demonstrate how to calculate and set the gas price for different transaction speeds by defining a function to calculate the gas prices as the percentage of the standard gas price.

### **Student Activity: (7 mins)**

- Guide the student/s to define a function to calculate and set the gas price for different transaction speeds.

#### **4. Activity 2: Convert the Gas Price (12 mins)**

##### **Teacher Activity: (6 mins)**

- Explain why and how the gas price is converted in different denominations including Wei, Gwei, Ether, dollar.
- Demonstrate converting the gas price from Wei to Ether and Dollar using web3 library.
  - Note: The conversion rate of ether to dollar changes as per market value, the conversion rate used in the activity was taken when the project was created.
- Explain how converting the gas price to Gwei is similar to converting to Ether.

##### **Student Activity: (6 mins)**

- Guide the student/s to convert the gas price from Wei to Gwei and Dollar using web3 library.

#### **5. Activity 3: Display the Transaction Fee (12 mins)**

##### **Teacher Activity: (6 mins)**

- Recall the formula to calculate the gas fee and inform that the transaction fee is calculated using the same formula.
- Demonstrate how to calculate and display the transaction fee based on the transaction speed selected on the web page.

##### **Student Activity: (6 mins)**

- Guide the students to calculate and display the transaction fee based on the transaction speed selected on the web page.

#### **6. Introduce the Post class project: (2 min)**

- Compute the transaction fee based on the transaction speed and display it on the transaction for the Real Estate Tracker System.

#### **7. Test and Summarize the class learnings: (5 mins)**

- Check for understanding through quizzes and summarize learning after respective missions.
- Summarize the overall class learning towards the end of the class.

#### **8. Additional activities:**

- Encourage the student/s to convert the gas price to Euro.
- Encourage the student/s to display the transaction fee in Euro.

#### **9. State the Next Class Objective: (1 min)**

- In the next class, student/s will learn to set a difficulty level to generate hash for miners.

## U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	Activity Name	Link
Class Presentation	Compute the Transaction Fee	<a href="https://s3-whjr-curriculum-uploads.whjr.online/71d1d5da-f995-40ed-9731-7abd2506a937.html">https://s3-whjr-curriculum-uploads.whjr.online/71d1d5da-f995-40ed-9731-7abd2506a937.html</a>
Explore Activity	Compute the Transaction Fee	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP</a>
Teacher Activity 1	Calculate the Gas Price	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS-BP</a>
Teacher Reference: Teacher Activity 1 Solution	Calculate the Gas Price	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS">https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS</a>
Student Activity 1	Calculate the Gas Price	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP</a>
Teacher Reference: Student Activity 1 Solution	Calculate the Gas Price	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS</a>
Teacher Activity 2	Convert the Gas Price	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-TAS-BP</a>
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Teacher Reference: Student Activity 3 Solution	Display the Transaction Fee	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS</a>
Student's Additional Activity 1	Convert the Gas Price to Euro	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP</a>
Teacher Reference: Student's Additional Activity 1 Solution	Convert the Gas Price to Euro	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS</a>

Student's Additional Activity 2	Display the Transaction Fee in Euro	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS-BP</a>
Teacher Reference: Student's Additional Activity 2 Solution	Display the Transaction Fee in Euro	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS">https://github.com/Tynker-Blockchain/TNK-M12-C90-SAS</a>
Post Class Project	Compute the Transaction Fee for the Real Estate Tracker System	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-PCP-BP">https://github.com/Tynker-Blockchain/TNK-M12-C90-PCP-BP</a>
Teacher Reference: Post Class Project Solution	Compute the Transaction Fee for the Real Estate Tracker System	<a href="https://github.com/Tynker-Blockchain/TNK-M12-C90-PCP">https://github.com/Tynker-Blockchain/TNK-M12-C90-PCP</a>