

# GooAQ: Open Question Answering with Diverse Answer Types

Daniel Khashabi, Amos Ng, Tushar Khot, Ashish Sabharwal

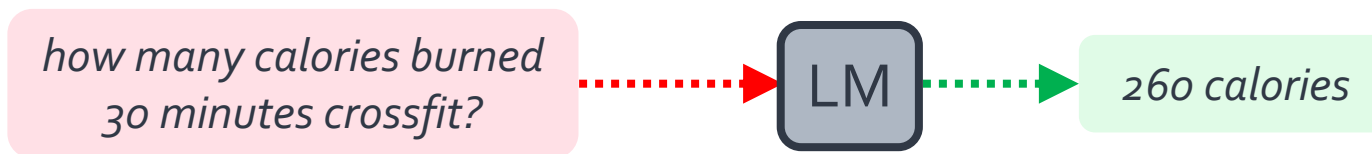
Hannaneh Hajishirzi, Chris Callison-Burch



EMNLP-Fingings'21

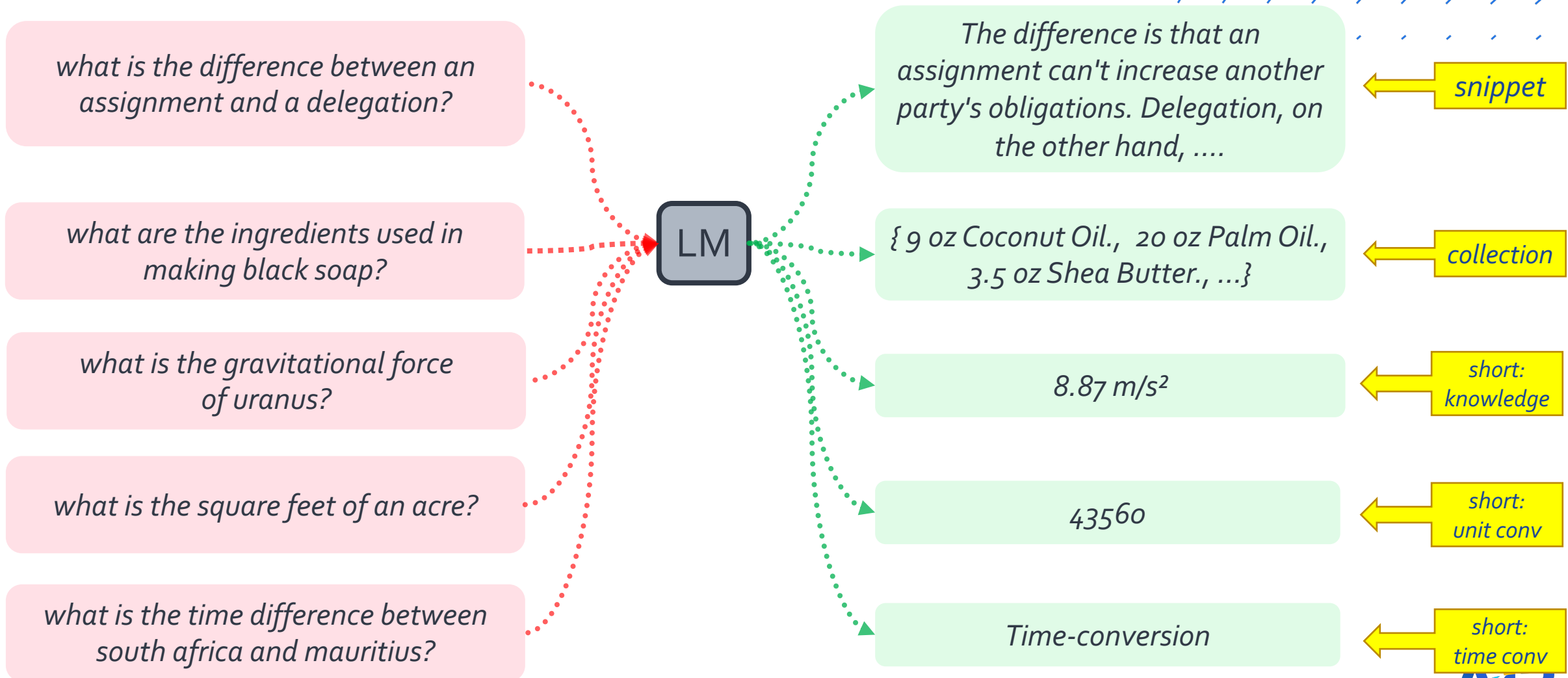
# State of “Open” Question Answering

- “Open” question answering [Roberts et al., 2020; Lewis et al., 2021]
  - Also referred to as open-response, open-domain, or direct answer QA



- Existing work
    - Built datasets and models for answering questions without specified context
      - NQ-open [Lee et al., 2019]
      - TriviaQA [Joshi et al., 2017]
      - ARC-DA [Bhakthavatsalam et al., 2021]
      - ELI5 [Fan et al., 2019]
- A diagram showing a blue bracket on the right side of the list items above, with a blue dashed arrow pointing to the text "short answers". Below this, a blue dashed arrow points from the "ELI5" item to the text "long answers".

# Open QA: Diversity of Answers



# GooAQ: Overview

- Introducing **GooAQ** 🥑
  - Open QA benchmark
  - Contains 3 million questions
  - Questions with a variety of types
  - All collected using a coherent process

| Answer types      | Count       |
|-------------------|-------------|
| Short answers     | 275k        |
| ↳ unit conversion | 45k         |
| ↳ time conversion | 2.5k        |
| ↳ knowledge       | 32k         |
| ↳ snippet (short) | 196k        |
| Snippet           | 2.7M        |
| Collection        | 329k        |
| <b>Overall</b>    | <b>3.1M</b> |

# GooAQ: Overview

- Introducing GooAQ 



what are the ingredients

- what are the ingredients in the covid vaccine
- what are the ingredients in relief factor
- what are the ingredients in the covid 19 vaccine
- what are the ingredients in prevagen
- what are the ingredients in relaxium
- what are the ingredients to make slime
- what are the ingredients in the flu vaccine
- what are the ingredients for tuna salad
- what are the ingredients for alfredo sauce
- what are the ingredients in spam

Google Search I'm Feeling Lucky

Report inappropriate predictions



## (a) Question Extraction

similar to Berant et al. 2013



what is the difference between an assignment and a delegation

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About 46,100,000 results (0.58 seconds)

The difference between assignment and delegation is that an assignment can't increase another party's obligations. Delegation, on the other hand, is a method of using a contract to transfer one party's obligations to another party. Assigning rights is usually easier than delegating, and fewer restrictions are in place.

<https://www.upcounsel.com/difference-between-assignm...>

[What Is the Difference Between Assignment and Delegation?](#)

About featured snippets Feedback

People also ask

What is the difference between an assignment and a delegation provide example?

What do the terms assigning and delegation mean who can delegate?

What is delegation in a contract?

What are assignments and delegation of contracts and what rights and obligations do they confer?

Feedback

<https://www.upcounsel.com/delegation-vs-assignment>

[Delegation vs Assignment | UpCounsel 2021](#)

Delegation is not concerned with the transfer of contractual rights. An assignment occurs when the original party to a contract transfers the rights and duties ...

<https://assignments.uslegal.com/distinction-between-as...>

[Distinction Between Assignment And Delegation](#)

An assignment is the process of transferring responsibility and accountability.[1] Delegation is the process by which responsibility and authority for ...

<https://study.com/Courses/Business/Courses>

[What is Delegation? - Definition, Parties & Duties - Study.com](#)

Sep 2, 2021 — An assignment occurs when an original party to the contract transfers the rights and duties of the contract to another party. A party can assign ...

## (b) Answer Extraction

# GooAQ: Overview

- Introducing **GooAQ** 🥑
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Differences across  
different  
answer types?



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# Questions: Answer Type Behavior

Whether different answer types:

*(Q<sub>1</sub>) benefit similarly from **pre-training**?*

*(Q<sub>2</sub>) benefit similarly from **labeled data**?*

*(Q<sub>3</sub>) benefit similarly from **larger models**?*

Differences across  
different  
answer types?



# Empirical Findings: Summary

Whether different answer types:



(Q1) benefit similarly  
from *pre-training*?

(Q2) benefit similarly  
from *labeled data*?

(Q3) benefit similarly  
from *larger models*?

short



snippet



collection



**Pre-training** is surprisingly effective on the snippet and collection answers.

**Labeled data** is more helpful for short answer questions.

**Model size** is more helpful for snippet & collection answers.

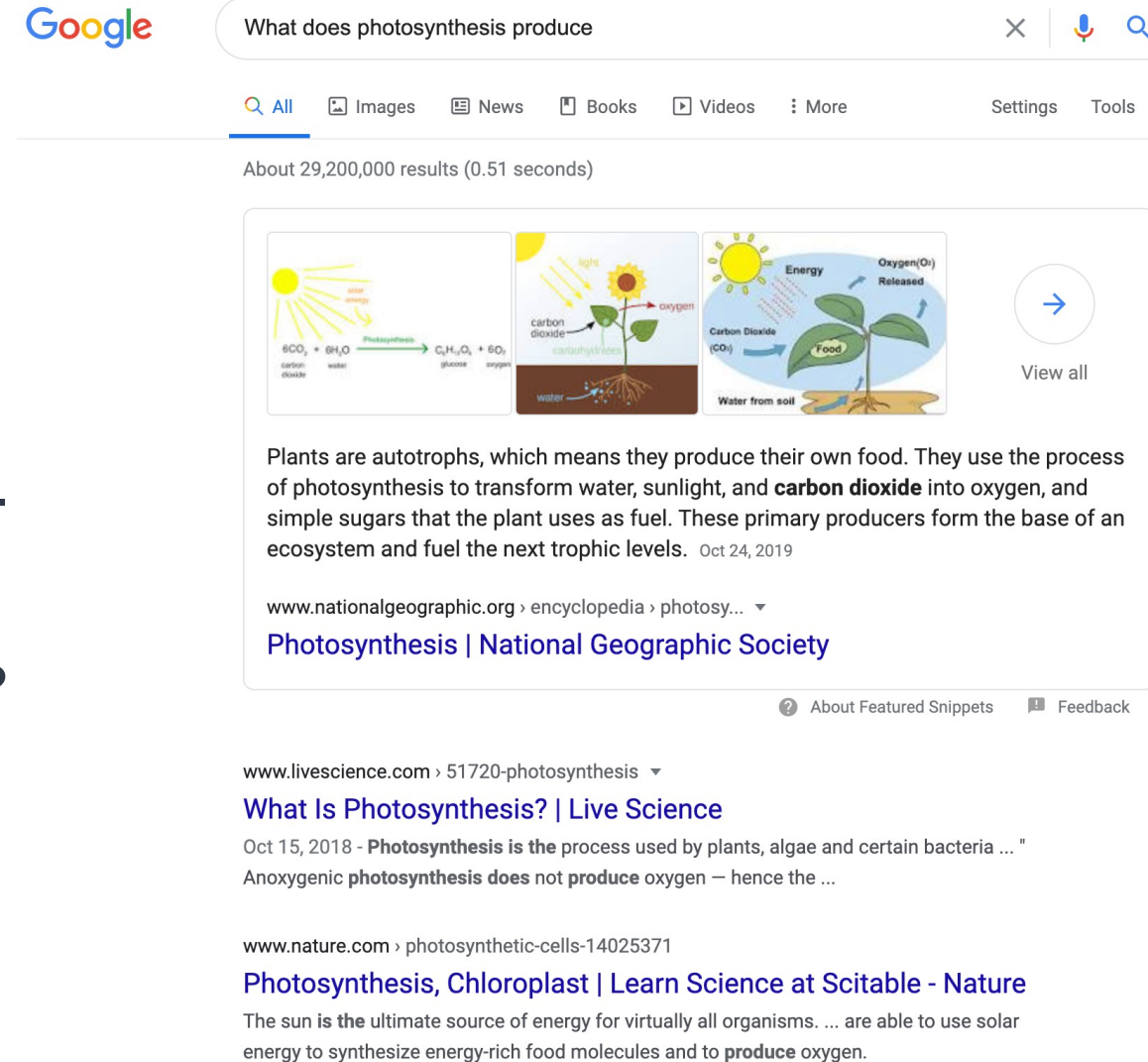


# Summary

- GooAQ: a collection of 3 million question-answer pairs with a diverse set of answers.
- Benchmark state-of-the-art models on different answer types.
- Valuable resource for training models.
- Code & Data: <https://github.com/allenai/gooaq>

# Google answers

- **Idea:** extract answer boxes provided by Google.
- **Challenge:** what to query?
  - Use the queries from the previous section.
- **Challenge:** How to extract the queries?
  - Option 1: use <https://serpapi.com>
  - Option 2: crawl Google!

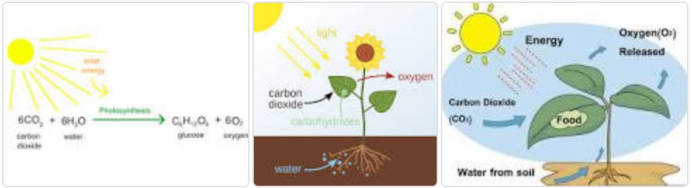


Google

What does photosynthesis produce

All Images News Books Videos More Settings Tools

About 29,200,000 results (0.51 seconds)



View all

Plants are autotrophs, which means they produce their own food. They use the process of photosynthesis to transform water, sunlight, and **carbon dioxide** into oxygen, and simple sugars that the plant uses as fuel. These primary producers form the base of an ecosystem and fuel the next trophic levels. Oct 24, 2019

www.nationalgeographic.org > encyclopedia > photosy...  
[Photosynthesis | National Geographic Society](#)

About Featured Snippets Feedback

www.livescience.com > 51720-photosynthesis  
[What Is Photosynthesis? | Live Science](#)

Oct 15, 2018 - **Photosynthesis is** the process used by plants, algae and certain bacteria ...  
Anoxygenic **photosynthesis does not produce** oxygen — hence the ...

www.nature.com > photosynthetic-cells-14025371  
[Photosynthesis, Chloroplast | Learn Science at Scitable - Nature](#)

The sun is the ultimate source of energy for virtually all organisms. ... are able to use solar energy to synthesize energy-rich food molecules and to **produce** oxygen.

# Mining Google queries

- Mined ~5M queries and saved their HTML pages
- For each HTML page, we check if it contains an answer box.
- If so, we extract them:

Question: ...  
Answer type: ...  
Short answers: ...  
Long answer: ...

# Google questions: examples

who is the president of usa?

All News Images Videos Maps More Settings Tools

About 2,210,000,000 results (1.23 seconds)

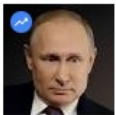
President of the United States / Officeholder

Donald Trump



People also search for

View 15+ more



Vladimir  
Putin  
Trending



Michael  
Flynn  
Trending



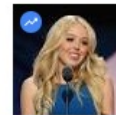
Joe Biden



Melania  
Trump  
Spouse



Barack  
Obama



Tiffany  
Trump  
Trending



John Bolton  
Trending

Feedback

en.wikipedia.org › wiki › List\_of\_presidents\_of\_the\_U...

List of presidents of the United States - Wikipedia

The **president of the United States** is the head of state and head of government of the United States, indirectly elected to a 4-year term by the people through the ...

List of presidents of the United · Acting president of the United · National Union Party

Question: *who is the president of usa?*

Answer type: *short ans*

Short answers: *Donald Trump*

Long answer: -

# Google questions: examples

do canadian citizens need a visa for ecuador?

All News Maps Shopping Videos More Settings Tools

About 820,000 results (0.50 seconds)

**Ecuador** tourist **visa** is not required for **citizens** of **Canada** for a stay up to 90 days. ...

www.visahq.ca > Ecuador Visa

[Ecuador Visa - Application, Requirements - Residents of ...](#)

About Featured Snippets Feedback

travel.gc.ca > destinations > ecuador

## Travel advice and advisories for Ecuador

Dual **citizenship**. Dual **citizens** may enter **Ecuador** on an **Ecuadorian** passport and stay indefinitely. A dual **citizen** entering on a **Canadian** passport will be ...

visaservicescanada.ca > countries > ecuador

## Ecuador | Visa Services Canada

**Canadian citizens** using **Canadian** passports **do not need a visa** for short stays as tourists or on business. This **does not apply** to persons holding **Canadian** ...

### People also ask

Do you need a visa to go to Ecuador?

What countries can a Canadian citizen visit without a visa?

**Question:** *do canadian citizens need a visa for ecuador?*

**Answer type:** *snippet*

**Short answers:** -

**Long answer:** *Ecuador tourist visa is not required for citizens of Canada for a stay up to 90 days. ...*

# Google questions: examples

how many calories burned 30 minutes crossfit



All Images Shopping News Videos More Settings Tools

About 413,000 results (0.63 seconds)

## 260 calories

According to an online calorie estimator from the American Council on Exercise, a 115-pound person running for 30 minutes at a slow-to-moderate pace (a 10-minute mile) would burn about **260 calories**: the same amount people who did CrossFit typically torched in 20 minutes, according to the research. Sep 12, 2018

time.com > Health > Exercise & Fitness

[What Exercise Burns the Most Calories? | Time](#)

About Featured Snippets Feedback

### People also ask

- How many calories do you burn doing a CrossFit workout? ▾
- How many calories do you burn in a 30 minute weight workout? ▾
- How many calories does a 30 minute Zumba workout burn? ▾

Feedback

www.cheatsheet.com > Health & Fitness

[How Many Calories Does CrossFit Really Burn?](#)

Jul 31, 2016 - Curious about **how many calories** you can burn during a **CrossFit** ... is to complete as many rounds as you can before the 20 minutes are up

**Question:** *how many calories burned 30 minutes crossfit?*

**Answer type:** *snippet w/ short answer*

**Short answers:** *260 calories*

**Long answer:** *According to an online calorie estimator from the American Council on Exercise, a 115-pound person running for 30 minutes at a slow-to-moderate pace (a 10-minute mile) would burn about 260 calories: the same amount people who did CrossFit typically torched in 20 minutes, according to the research.*

# Google questions: examples

what are the steps for decision making?

All News Images Videos Shopping More Settings Tools

Systematic Paced Critical



1. Step 1: Identify the decision. You realize that you need to make a decision. ...
2. Step 2: Gather relevant information. ...
3. Step 3: Identify the alternatives. ...
4. Step 4: Weigh the evidence. ...
5. Step 5: Choose among alternatives. ...
6. Step 6: Take **action**. ...
7. Step 7: Review your decision & its consequences.

Sep 23, 2016

www.umassd.edu > fycm > decision-making > process ▾

Decision-making process | First Year Course Modules ...

Question: *what are the steps for decision making?*

Answer type: *list*

Short answers: -

Long answer: [

- Step 1: Identify the decision You realize that you need to make a decision. ...
- Step 2: Gather relevant information. ...
- Step 3: Identify the alternatives. ...
- Step 4: Weigh the evidence. ...
- Step 5: Choose among alternatives. ...
- Step 6: Take **action**. ...
- Step 7: Review your decision & its consequences.

]

# Google questions: examples

what are the ingredients used in making black soap?

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About 87,300,000 results (0.73 seconds)

### How To Make African Black Soap

- 9 oz Coconut Oil.
- 20 oz Palm Oil.
- 3.5 oz **Shea Butter**.
- 0.6 oz Coconut Carbon.
- 0.5 - 1.5 oz Fragrance or Essential Oil.
- 14 oz Water.

www.elementsbathandbody.com › african-black-soap-r...  
[How To Make African Black Soap \(With Recipe\)](#)

About Featured Snippets Feedback

### People also ask

What are the ingredients for making black soap? ▾

How do you make black soap from scratch? ▾

What are the ingredients used for making soap? ▾

**Question:** *what are the ingredients used in making black soap?*

**Answer type:** *set*

**Short answers:** -

**Long answer:** {

9 oz Coconut Oil.,  
20 oz Palm Oil.,  
3.5 oz **Shea Butter**.,  
0.6 oz Coconut Carbon.,  
0.5 - 1.5 oz Fragrance or Essential Oil. ,  
14 oz Water.

}



# Google questions (knowledge)

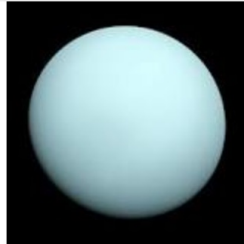
what is the gravitational force of uranus? ✕ 🔊 🔍

[All](#) [News](#) [Images](#) [Videos](#) [Shopping](#) [More](#) [Settings](#) [Tools](#)

About 1,500,000 results (1.04 seconds)

Uranus / Gravity

**8.87 m/s<sup>2</sup>**



People also search for



**Neptune**  
11.15 m/s<sup>2</sup>



**Saturn**  
10.44 m/s<sup>2</sup>



**Jupiter**  
24.79 m/s<sup>2</sup>

[Feedback](#)

People also ask

How does gravity affect Uranus? ▼

Does Uranus have more or less gravity than Earth? ▼

Can u stand on Uranus? ▼




**Question:** *what is the gravitational force of uranus?*









**Answer type:** *knowledge lookup*

**Short answers:** *8.87 m/s<sup>2</sup>*




**Long answer:** --


# Google questions (translation)




how do you say 20 in hebrew?   

 All  Shopping  Images  News  Videos  More  Settings  Tools

About 195,000,000 results (0.61 seconds)





English - detected   Hebrew 

|  |       |
|--|-------|
| 20  | עשרים |
|--|-------|

[Open in Google Translate](#) [Feedback](#)

**People also ask**

|   |   |
|---|---|
| What is the meaning of 20 in Hebrew?      |  |
| How do you say numbers in Hebrew?         |  |
| What does Bevakasha mean in Hebrew?       |  |
| How do you count from 1 to 20 in Italian? |  |

[Feedback](#)

Videos

Question: *how do you say 20 in hebrew?*

Answer type: *translate*

Short answers: *עשרים*

Long answer: -

# Google questions (currency conversion)

1 dollar is equivalent to how many rupees?

All News Images Shopping Videos More Settings Tools

About 772,000 results (0.64 seconds)

1 United States Dollar equals

**73.43 Indian Rupee**

Aug 31, 6:27 PM UTC · Disclaimer



Data provided by Morningstar for Currency and Coinbase for Cryptocurrency

## People also ask

- How many rupees is equal to \$1? ▾
- How much \$1 is equal to? ▾
- What will happen if 1rs is equal to 1 dollar? ▾

**Question:** *1 dollar is equivalent to how many rupees?*

**Answer type:** *currency conversion*

**Short answers:** *75.52 Indian Rupe*

**Long answer:** -

# Google questions (time conversion)

what is the difference between the united states and canada?



All Shopping News Images Videos More Settings Tools

About 3,210,000,000 results (0.84 seconds)

**There is no time difference between Washington, DC and Ottawa, ON, Canada**

**2:27 PM** Monday, in Washington, DC is  
**2:27 PM** Monday, in Ottawa, ON, Canada

Both [United States](#) and [Canada](#) have multiple time zones

[Feedback](#)

People also ask

How are Canada and the United States different?

Is Canada a better place to live than USA?

Why is Canada so similar to the US?

[Feedback](#)

**Question:** *what is the difference between the united states and canada?*

**Answer type:** *time conversion*

**Short answers:** -

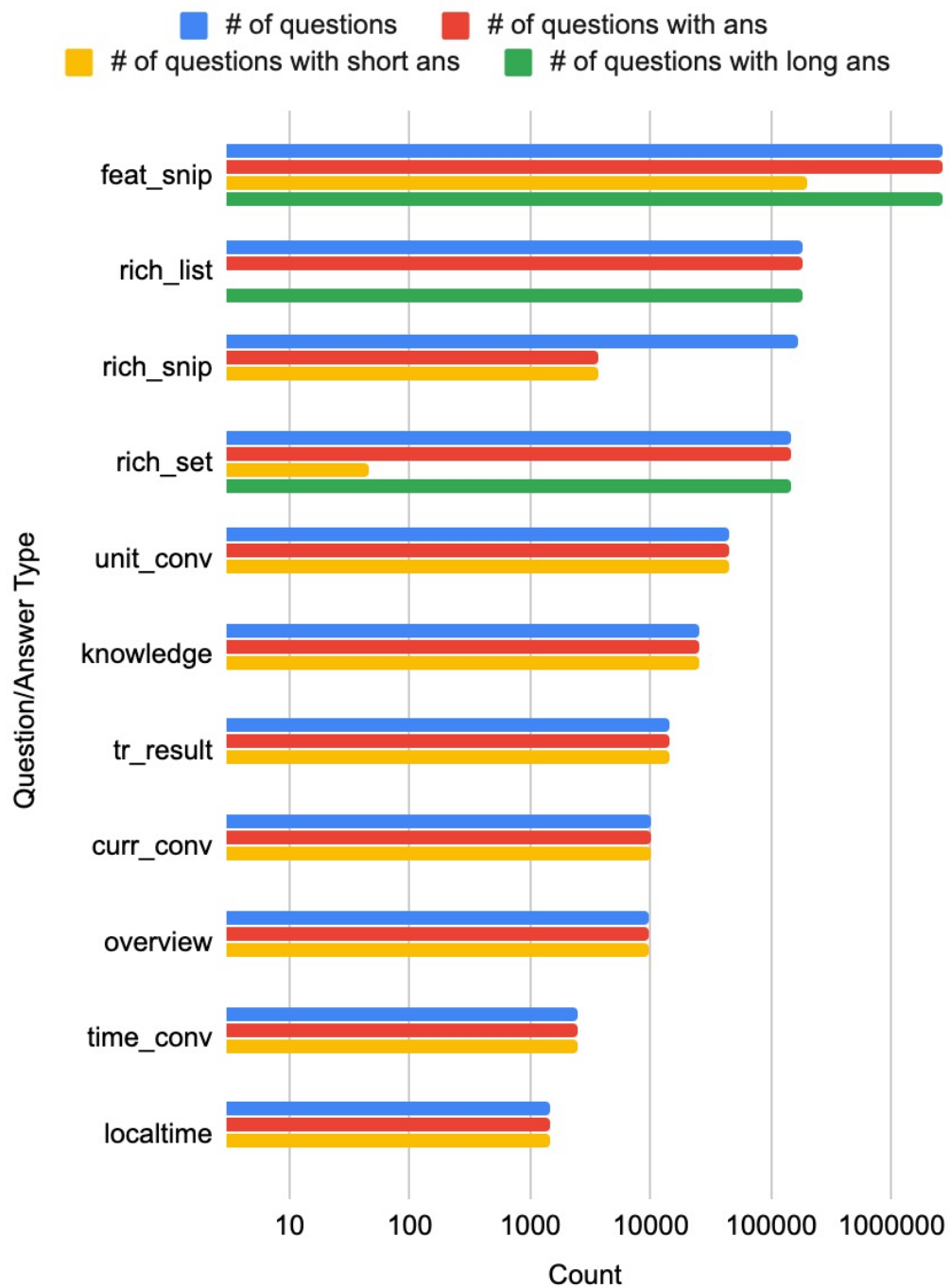
**Long answer:** *There is no time difference between Washington, DC and Ottawa, ON, Canada*

# Google answers: question type statistics

# of questions with any  
answer: 3,146,425

# of questions with short  
answer: 308,697

# of questions with long  
answer: 3,033,898



# Experiment #5

- Take a 200k subset of Google Q/As with short answers (ans length < 5 words)

| ID        | Model              | Trained on  | Dev Score | Test Score |
|-----------|--------------------|---|-----------|------------|
| <b>G</b>  | Giant (T5 – 11B)   | NQ-open   | 34.5      | 35.1       |
| <b>D0</b> | Dwarf (T5 – small) | NQ-open   | 25.3      | 24.5       |
| <b>D1</b> | Dwarf (T5 – small) | Google Queries w/ <b>G</b> 's predictions + NQ-open                 | 26.3      | 26.3       |
| <b>D2</b> | Dwarf (T5 – small) | Google Queries w/ <b>G</b> 's predictions                           | 10.6      |            |
| <b>D3</b> | Dwarf (T5 – small) | Google Queries w/ <b>G</b> 's predictions → NQ-open                 | 26.3      | 26.0       |
| <b>D4</b> | Dwarf (T5 – small) | <b>Filtered</b> Google Queries w/ <b>G</b> 's predictions + NQ-open | 26.4      | 26.4       |

# Questions for you

- What other experiments we could have done here?
- How else would you sell/use this resource?
  - There are a lot of data that can be used for procedural reasoning.
  - Could be used for pre-training a model for QA.