SCIENCE ENGLISH

for High School Students

理系高校生のための科学英語授業教材集

立命館高等学校

はじめに

SSH 指定満 15 年を迎えました。第 1 期指定 3 年目の 2005 年に SSH 活動の主対象となる SS コースを立ち上げ、学校設定科目 Science English を設定しました。当時はまだ大変新しい試みで、モデルとすべきものや理系高校生にとって適切な教材が分からず、そして何よりも多くの英語教員にとって無知な分野であるサイエンスと向き合うことが大変苦しく、暗中模索の時代が続きました。

少しずつ生徒が楽しみ、力がつく活動が分かってくるとともに、SSH で可能になってきた国際科学交流を通して、科学分野における国際舞台に必要な英語力を担当英語教員が理解するようになってきました。現在では英語コミュニケーションⅠ、Ⅱで英語プレゼンテーションを中心とした授業を展開し、Science English ではサイエンスのコンテンツを利用してそれをさらに科学的に深化させられるよう工夫しています。

今回の教材集「Science English for High School Students ~理系高校生のための科学英語授業教材集~」は、日本の理系高校生のための授業用教材集のひとつとして提案させていただきました。広く SSH 校でご使用いただき、さらによいものを SSH にかかわる英語科教員・理数科教員のみなさまと作り上げることができればと願っています。

この教材集とあわせまして一昨年度に同じく本校の SSH 英語事業のまとめ集として作成させていただきました実践報告集「SSH 英語科学プレゼンテーション ~通常授業で行う段階的指導の実践、10 年間の軌跡~」もお読みいただけましたら幸いです。

立命館高等学校
SSH 推進機構・英語科
武田菜々子

第一部

この第一部は初めて Science English に触れる高校 1 年生または高校 2 年生を想定したハンドアウト集です。通常のコミュニケーション英語 I やⅡで触れることはない、あるいは少ないと思われる科学の基本的な単語や表現を楽しみながら増やしていくことが目的です。特に No.1~13 までは授業のメインに据えるものではなく、帯活動として使用することを想定しています。毎回の Science English の授業の最初の 20 分間ほどでこのハンドアウトに触れ、残りの 30 分間はその単語を使用した Reading 活動や発表活動に充てるのが理想的です。

立命館高校では Science English 1 のメインテキストとして Houghton Mifflin Harcourt 社の Science Saurus を使用しています。ここに記載させていただいたハンドアウトを使用してペアやグループ活動で楽しく単語等を定着させた後、テキストを使用した読解、サマリー作成、ミニプレゼンの原稿作成、英作文などコンテンツをもとにした個の活動を行うというのが通常の授業の流れです。

Science English で取り扱う内容は日常的に活用できるものが少なく、生徒は特にサイエンスに特化した単語の重要性や有用性を感じにくいという難しさがあります。できれば英語での科学講演や実験講座などの SSH 活動と組み合わせて、「Science English で習った単語のおかげで英語の講義が理解できた」と生徒自身に思わせる仕掛けを打っておくこともその後の学習への動機づけに大変有効です。

Science English No.1 date:

Numbers

1. Practice saying these numbers.

100 ・・・・・
1,000 ・・・・・
10,000 ・・・・・
100,000・・・・・
1,000,000 ・・・・・
1,000,000,000 ・・・・・
1,000,000,000,000 ・・・・・
3,852 ・・・・・
15,989 ・・・・・
725,001 ・・・・・
26,056,309 ・・・・・
17.338 ・・・・・

2. Listen and write down the numbers that you hear.

① _____ ⑤ _____ ⑨ _____
② _____ ⑥ _____ ⑩ _____
③ _____ ⑦ _____ ⑪ _____
④ _____ ⑧ _____ ⑫ _____

Percentages and Fractions

1. Practice saying these percentages and fractions.

25% ・・・・・
74.8% ・・・・
1/2 ・・・・・
1/3 ・・・・・
1/4 ・・・・・
1/7 ・・・・・
4/5 ・・・・・
6/8 ・・・・・

2. Write the percentages or fractions that you hear.

① _____ ⑤ _____ ⑨ _____
② _____ ⑥ _____ ⑩ _____
③ _____ ⑦ _____ ⑪ _____
④ _____ ⑧ _____ ⑫ _____

Science English No.2 date:

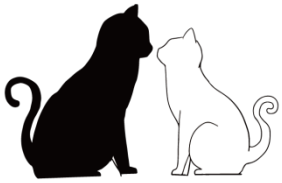
Pair Activity Numbers

A

☆Ask your partner for the missing information. Write it on the chart.

Country	Population	Largest City	Population
Canada	26,100,000	Toronto	
Mexico		Mexico City	21,000,000
Taiwan	21,450,000	Taipei	
Argentina		Buenos Aires	10,500,000
Thailand	55,790,000	Bangkok	

☆Guess the answers. First, write down your own answer, then ask your partner.

1. How many islands are there in Indonesia?  	Your answer
	Your partner's answer
2. How many cats are there in the United States?  	Your answer
	Your partner's answer
3. How many sheep are there in New Zealand?  	Your answer
	Your partner's answer

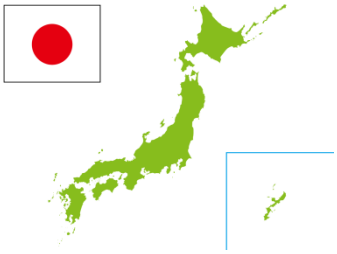
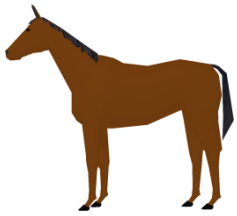
Pair Activity Numbers

B

☆Ask your partner for the missing information. Write it on the chart.

Country	Population	Largest City	Population
Canada		Toronto	3,500,000
Mexico	89,500,000	Mexico City	
Taiwan		Taipei	2,750,000
Argentina	32,600,000	Buenos Aires	
Thailand		Bangkok	5,600,000

☆Guess the answers. First, write down your own answer, then ask your partner.

1. How many islands are there in Japan? 	Your answer
	Your partner's answer
2.How many horses are there in the world?  	Your answer
	Your partner's answer
3. How many people are there in New Zealand?  	Your answer
	Your partner's answer

Science English No.3 date:

Equipment

1. 

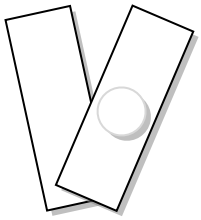
2. 

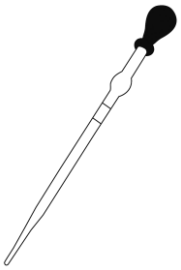
3. 

4. 

5. 

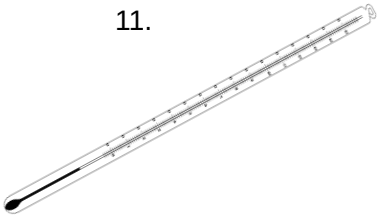
6. 

7. 

8. 

9.

10. 

11. 

12. 

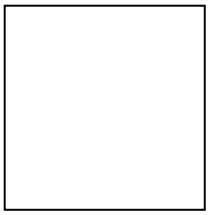
13. 

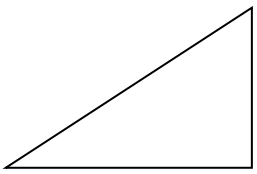
1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	12.
13.		

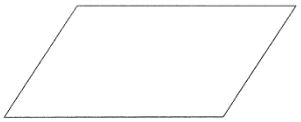
Science English No.4 date:

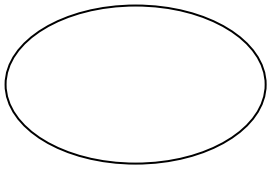
Shapes

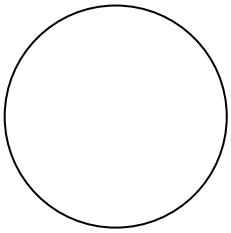
1. 

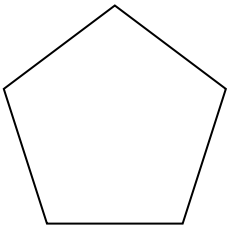
2. 

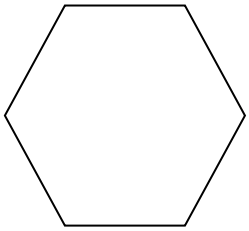
3. 

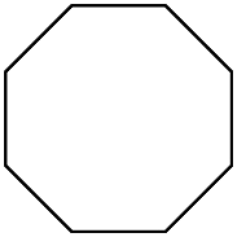
4. 

5. 

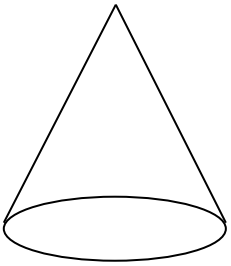
6. 

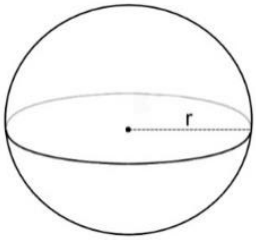
7. 

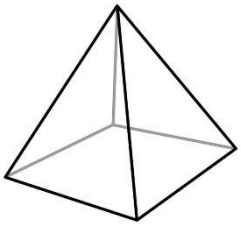
8. 

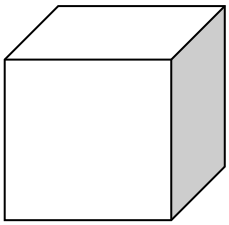
9. 

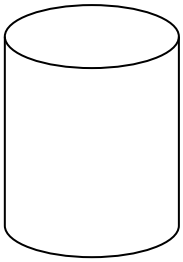
10. 

11. 

12. 

13. 

14. 

15. 

cube, sphere, circle, cylinder, square, pentagon, triangle, cone, rectangle, ellipse, hexagon, trapezoid, parallelogram, pyramid, octagon

1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	12.
13.	14.	15.

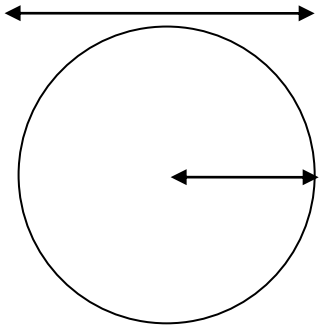
Science English No.5 date:

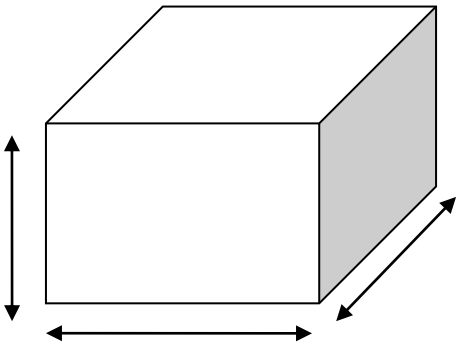
Size

1. Fill in the missing information.

m	meter
μ m	
mm	
cm	
g	
mg	
kg	
t	ton

Noun(名詞)	**Adjective(形容詞)**
length	long
	wide
height	
	deep
	thick





- It is 60 cm long and 30 cm wide.
- It has a length of 60 cm and a width of 30cm.
- It has a radius of 40 cm.
- It weighs two kilograms.

2. Describe something in this classroom and let your partner guess what it is

.....

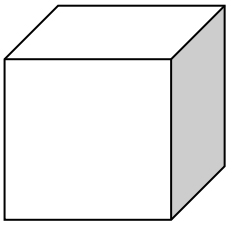
.....

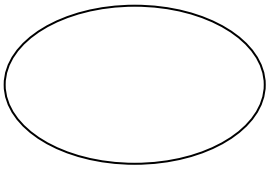
.....

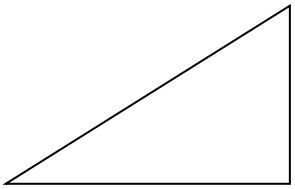
.....

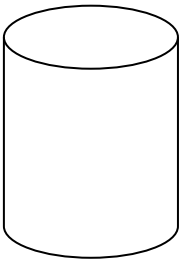
TEST Shapes

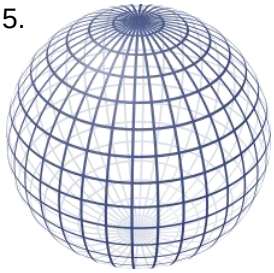
Class No. Name Score /15

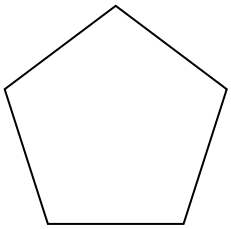
1. 

2. 

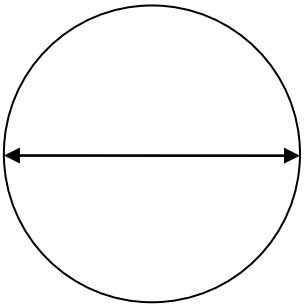
3. 

4. 

5. 

6. 

7. 

8. 

cm	9.
mg	10.
Noun(名詞)	**Adjective(形容詞)**
11.	**long**
12.	**wide**
13.	**high**
14.	**deep**
15	**thick**

1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	12.
13.	14.	15.

Science English No.6 date:

Let's talk

Use numbers when you answer; if you don't know the answer please guess.

- **Numbers**

1. How tall are you?
2. How much does your brain weigh?
3. How many kilos can you lift?
4. How high can you jump?
5. How fast is your heart beating?
6. How long can you stay under water?
7. How far can you throw a sports shoe?
8. How thick is your pencil's lead?
9. How hot do you like your bath to be?
10. What is your favorite daytime temperature?
11 What is your blood temperature?
12 How deep is your love?

- **Shapes**

13. What shapes' names do you know?
14. How do you say them in English?
15. Can you see any in this room?
16. Where can you see them?

- **Your stuff**

17. What is your favorite possession?
18. Where did you get it?
19. How much did it cost?
20. What shape is it?
21. How big is it?
22. How much does it weigh?
23. What do you use it for?

Science English No.7 date:

Pair Activity *Shapes / Describing Game*

Student A: Describe the shapes your teacher shows

Student B: Draw the shapes following the description of your friends without looking at it

1	2
3	4
5	6

Science English No.8 date:

Science Subjects(Fields) and Scientists

Most of the names of science fields come from Greek and Latin. (ex. '- logy' means 'the study of…' in Greek.)

Fields of Science

anthropology	archaeology	astronomy	biochemistry	biology
botany	chemistry	genetics	geography	geology
neuroscience	mathematics	meteorology	oceanography	paleontology
psychology	physics	sociology	volcanology	zoology

Definitions

[ ] ・・・the study of volcanoes
[ ] ・・・the study of the human mind and behavior
[ ] ・・・the study of animals
[ ] ・・・the study of forces of motion, energy, light etc.
[ ] ・・・the study of the sea
[ ] ・・・the study of early humans
[ ] ・・・the study of rocks and minerals
[ ] ・・・the study of weather
[ ] ・・・the study of how humans live in groups
[ ] ・・・the study of living organisms
[ ] ・・・the study of chemical compounds
[ ] ・・・the study of plants
[ ] ・・・the study of the stars and planets
[ ] ・・・the study of chemical compounds and reactions in living organisms
[ ] ・・・the study of ancient (old) history through examining ruins or bones
[ ] ・・・the study of numbers and formulas
[ ] ・・・the study of what makes a society function
[ ] ・・・the study of how humans live on the land (maps, etc.)
[ ] ・・・the study of how life is made and remade through RNA and DNA
[ ] ・・・the study of the brain and nervous system

Root Meanings

☐	*anthro-*	man, mankind	☐	*geo-*	earth	☐	*psych-*	mind
☐	*arche-*	very old	☐	*graphy-*	write, chart	☐	*phys-*	nature
☐	*astro-*	star	☐	*neur-*	nerve	☐	*soci-*	group
☐	*bio-*	life	☐	*met-*	above / beyond	☐	*zoo-*	animal
☐	*botan-*	plant	☐	*oceano-*	sea			
☐	*gen-*	make life	☐	*pale-*	old			

When we talk about a person who studies a subject we usually use the ending:

-ist (after – ology – change the Y to IST) ex. biology ----- biol*ogist*

-ician - mathmetician (like musician)

-er - geographer (like writer)

But be careful! – physician = medical doctor

Check the definition in Japanese (HW)

anthropology		archaeology	
astronomy		biochemistry	
biology		botany	
chemistry		genetics	
geography		geology	
neuroscience		mathematics	
meteorology		oceanography	
paleontology		physics	
psychology		sociology	
volcanology		zoology	

Science English No.9 date:

Math

1. Practice saying the following expressions.

3+7=10・・・ three plus seven equals ten

28-12=16 ・・・twenty-eight minus twelve equals sixteen

4x5=20・・・four by five equals twenty

or ・・・four multiplied by five equals twenty ・・・or ・・・four times five equals twenty

8÷4=2・・・eight divided by four equals two

Instead of “equals,” we can also say “is.”
ex. 3x6=18 three by six is eighteen

2. Write down the expressions you see on the board.

① _____

② _____

③ _____

④ _____

⑤ _____

3. Write down the equations and the answers of the expressions you hear.

① _____

② _____

③ _____

④ _____

⑤ _____

4. Give problems to your partner / answer your partner’s problems.

Yours

① _____

② _____

③ _____

Your partner’s

④ _____

⑤ _____

⑥ _____

Activity *formulas*

Math Bingo!

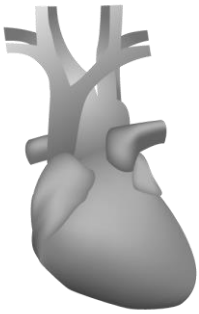
1. Fill in the number 1-20 randomly in the box.
2. Listen to the fractions your teacher will say, calculate and find the number, and cross the number if you have that in the box.

Science English No.10 date:

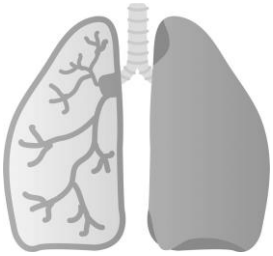
Organs

1.

2.



3.



4.

5.

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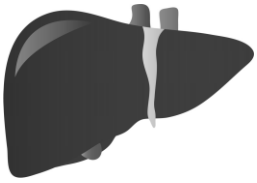
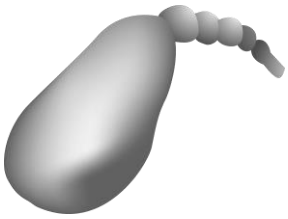


7.



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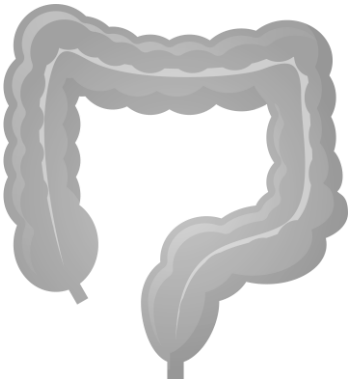
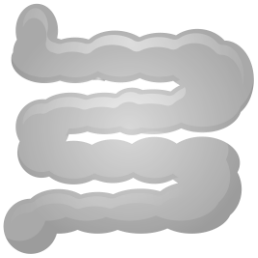
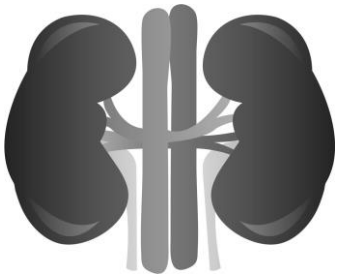


9.



10.

11.

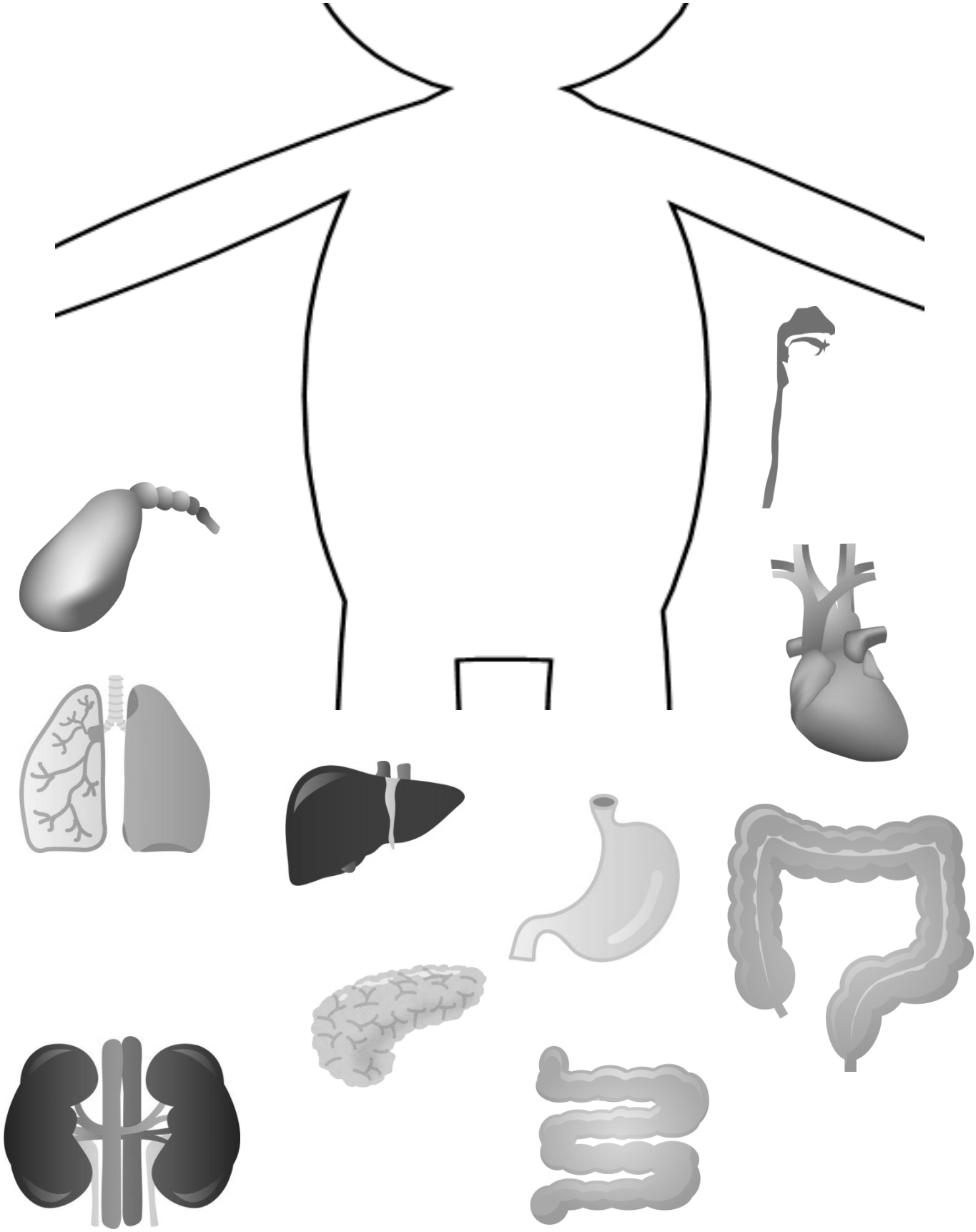


gallbladder / liver / small intestine / pancreas / stomach / brain / large intestine/ heart / kidney /lungs / esophagus /

1.	2.	3.
4.	5.	6.
7.	8.	9.
10.	11.	

Activity *Work in pairs*

Set the organs in the body, indicate their English names.



Science English No.11 date:

Pair Activity your body system

Information Gap A

- The (s) system's main organs are bones. The main functions are to support your (b) and give it shape, to protect your internal (o), to help you (m), to store substances and to make (b) cells.

- The muscular system's main organs are muscles. The main functions are to move your body parts, to move food through your digestive system, to pump blood through your circulatory system and to make you breathe.

- The (d) systems main organs are mouth, (e), stomach, small intestine, large intestine, (l), gall bladder, (p) and so on. The main functions are to break down (f) into simple substances that your cells can use, and to (g) rid of solid wastes from digestion.

- The excretory system's main organs are kidneys, lungs , skin and so on. The main function is to remove liquid wastes and waste gases.

- The respiratory system's main organs are mouth, nose, lungs and so on. The main functions are to take in oxygen from the air you breathe and to get rid of waste gases.

- The (c) system's main organs are (h), veins and so on. The main functions are to move (b) throughout your body, to deliver nutrients and (o) to all cells, to remove (c) (d) and wastes from cells and to help fight (d).

- The nervous system organs are brain, spinal cord, nerves and sense organs. The main functions are to control all other systems in your body, to receive information about your environment, to store memories and to allow you to think.

skeletal system	骨格系	respiratory system	呼吸器系
muscular system	筋肉組織	circulatory system	循環器系
digestive system	消化器系	nervous system	神経系
excretory system	排出系		

Pair Activity *your body system*

Information Gap B

- The skeletal system's main organs are bones. The main functions are to support your body and give it shape, to protect your internal organs, to help you move, to store substances and to make blood cells.

- The muscular system's main organs are (m). The main functions are to move your body (p), to move (f) through your (d) system, to pump (b) through your circulatory system and to make you (b).

- The digestive systems main organs are mouth, esophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas and so on. The main functions are to break down food into simple substances that your cells can use, and to get rid of solid wastes from digestion.

- The (e) system's main organs are (k), (l) , skin and so on. The main function is to (r) liquid wastes and waste (g).

- The (r) system's main organs are (m), nose, lungs and so on. The main functions are to take in (o) from the air you breathe and to (g) rid of waste gases.

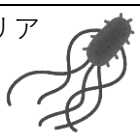
- The circulatory system's main organs are heart, veins and so on. The main functions are to move blood throughout your body, to deliver nutrients and oxygen to all cells, to remove carbon dioxide and wastes from cells and to help fight disease.

- The (n) system organs are (b), spinal cord, nerves and (s) organs. The main functions are to (c) all other systems in your body, to receive (i) about your environment, to store (m) and to allow you to (t).

skeletal system	骨格系	respiratory system	呼吸器系
muscular system	筋肉組織	circulatory system	循環器系
digestive system	消化器系	nervous system	神経系
excretory system	排出系		

Science English No.12 date:

Science Vocabulary –Talking about Nature-

1	生態系	11	無脊椎動物
2	（動物などの）種	12	脊椎動物
3	植物 	13	哺乳類 
4	動物 	14	鳥類 
5	草食動物 	15	爬虫類 
6	肉食動物 	16	両生類 
7	雑食動物 	17	魚類 
8	菌類 		昆虫 
9	原生生物 	19	固有種
10	バクテリア 	20	外来種

Science English No.13 date:

Elements

1	水素	H	hydrogen	
2	炭素	C	carbon	
3	窒素	N	nitrogen	
4	酸素	O	oxygen	
5	フッ素	F	fluorine	
6	ケイ素	Si	silicon	
7	リン	P	phosphorous	
8	硫黄	S	sulfur	
9	塩素	Cl	chlorine	
10	ナトリウム	Na	sodium	
11	鉄	Fe	Iron	
12	銅	Cu	copper	
13	亜鉛	Zn	zinc	
14	ヒ素	As	arsenic	
15	臭素	Br	bromine	
16	銀	Ag	silver	
17	スズ	Sn	tin	
18	ヨウ素	I	iodine	
19	白金	Pt	platinum	
20	金	Au	gold	
21	水銀	Hg	mercury	
22	鉛	Pb	lead	

Science English No.14 date:

Simple Presentation with Gestures

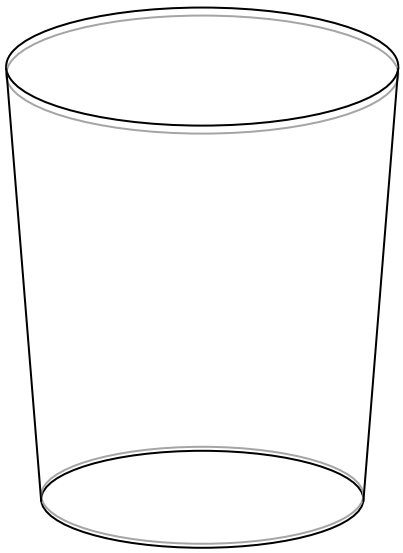
Presentation Script

A very simple experiment can be done / to show / that water gets bigger / when it is frozen. All you need / is an empty plastic cup. / First, / fill half the plastic cup / with water. Then / mark the water level / with a marker / on the outside of the plastic cup. / After that, / put the plastic cup / in a freezer / until the water becomes ice. When the water is frozen, / take the plastic cup / out of the freezer / and observe the new water level. You will see that / the level of the ice / is higher. This proves that / water gets bigger / when it becomes ice.

1. Highlight the part which you think you can use gestures

2. Understand an memorize the script with gestures

3. Cut the plastic cup and make a presentation to your partner using effective gestures



※横方向への膨張を防ぐために、プラスチックカップの横と上を断熱材で覆い、さらに下に熱を伝えやすい金属を敷いて冷凍庫に入れてください。

Science English No.15 date:

Photosynthesis

Photosynthesis Pair Reading A

Like animals, (p) carry out cell respiration to get (e) from food. But unlike animals, plants make their own (f).

There are tiny green structures called (ch) inside each leaf cell. The green color comes from a substance called chlorophyll. Chlorophyll captures the energy in (s).

The plant's roots take in (w) from the soil. Water travels to the plant's (l). The leaves take in (c) (d) from the air. The chloroplasts use the sun's energy captured by (ch) to combine water and carbon dioxide. This produces a kind of (s) called glucose. Glucose is the plant's food.

The process of using the energy in sunlight to produce food for the organism is called (ph).

Photosynthesis Pair Reading B

Like animals, plants carry out cell respiration to get energy from (f). But unlike animals, (p) make their own food.

There are tiny (g) structures called chloroplasts inside each leaf cell. The green color comes from a substance called (ch). Chlorophyll captures the (e) in sunlight.

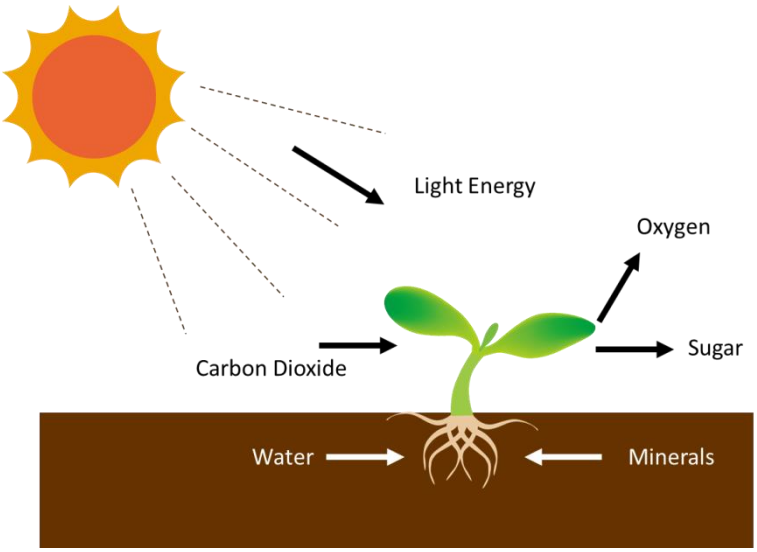
The plant's (r) take in water from the soil. Water (t) to the plant's leaves. The leaves take in carbon dioxide from the (a). The chloroplasts use the sun's energy captured by chlorophyll to combine (w) and (c) (d). This produces a kind of sugar called (g). Glucose is the plant's food.

The process of using the (e) in (s) to produce food for the organism is called photosynthesis.

Science English No.16 date:

Photosynthesis 2

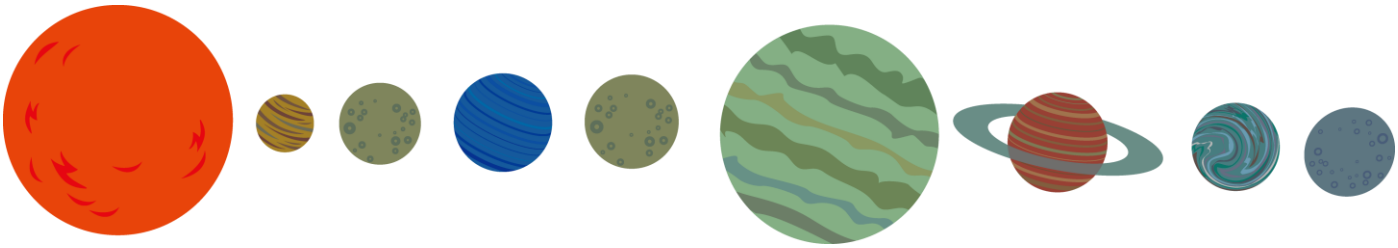
- Key words to explain photosynthesis (choose 10 words)
  -
  -
  -
  -
  -
  -
  -
  -
  -
  -



- Write 100 words presentation script.

Science English No.17 date:

The Solar System



Sun–(　　)–(　　)–The Earth–(　　)–(　　)–(　　)–(　　)–(　　)

Our solar system includes the sun, eight planets and their moons, comets, large space rocks called asteroids, dwarf planets, and small space rocks called meteoroids. Beyond our solar system are stars and groups of stars called galaxies.

The Planets

Eight planets revolve around the sun. Each planet is a different distance from the sun. Earth is the third planet from the sun. The distance between Earth and the sun is almost 150 million kilometers.

Each planet's orbit around the sun is a flattened circle called an ellipse. Each planet takes a different and predictable amount of time to complete one trip around the sun. One trip around the sun is called revolution. The time it takes for a planet to make one revolution around the sun is the planet's year. The closer a planet is to the sun, the shorter the planet's year is.

The planets are much smaller than the sun. The largest planet in the solar system is Jupiter. But Jupitar's diameter is only about one-ninth the diameter of the sun.

New Words

1	comet	（名）彗星	2	asteroid	（名）小惑星
3	dwarf	（名）小人	4	meteoroid	（名）流星体
5	galaxy	（名）銀河系	6	revolve	（動）回転する
7	orbit	（名）軌道	8	flatten	（動）平らにする flattened（過去分詞） 平らな（形容詞として）
9	ellipse	（名）楕円（周）	10	predictable	（形）予言できる
11	revolution	（名）公転	12	diameter	（名）直径

Search on the Internet and answer the following questions

(1) What are “asteroids?”

(2) What are “meteoroids?”

(3) What are “galaxies?”

(4) How many planets revolve around the sun?

(5) How far is the earth from the sun?

(6) What is an “ellipse?”

(7) What is a “revolution?”

(8) How is the planet’s year decided?

(9) What is the size of Jupiter?

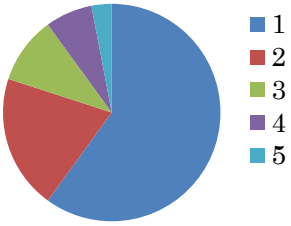
Task

Make a 3-minute presentation about one planet in pairs.

- ☐ Your presentation should consist of three parts(Introduction-Body-Conclusion)
- ☐ Your PPT slides should consists of 6 slides(Title-Intoductin-Body1-Body2-Body3-Conclusion)

Science English No.18 date:

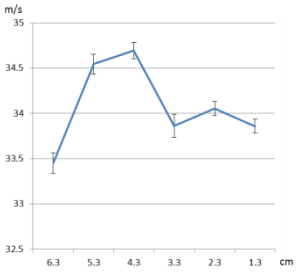
Graph 1



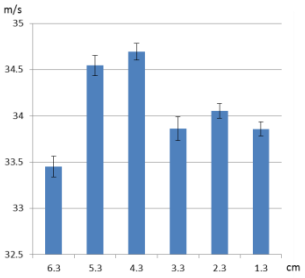
1.

No.	A	B	C	D	E	F
1	0.327	0.349	0.281	0.388	0.306	0.315
2	0.294	0.301	0.304	0.300	0.309	0.257
3	0.339	0.311	0.308	0.276	0.267	0.294
4	0.264	0.303	0.281	0.270	0.295	0.252
5	0.298	0.296	0.273	0.293	0.263	0.273
6	0.244	0.350	0.288	0.245	0.245	0.286
7	0.263	0.241	0.287	0.199	0.262	0.187
8	0.218	0.255	0.268	0.300	0.285	0.316
9	0.261	0.255	0.263	0.309	0.207	0.308
10	0.215	0.297	0.185	0.246	0.259	0.208
11	0.235	0.289	0.239	0.298	0.220	0.246
12	0.220		0.163	0.230	0.318	0.205
13	0.247			0.268	0.324	0.202
14					0.246	0.190
15					0.281	

2.



3.



4.

This graph **shows** ...
This table **lists** ...
This pie chart **represents**

Indicating upward movement: ↗

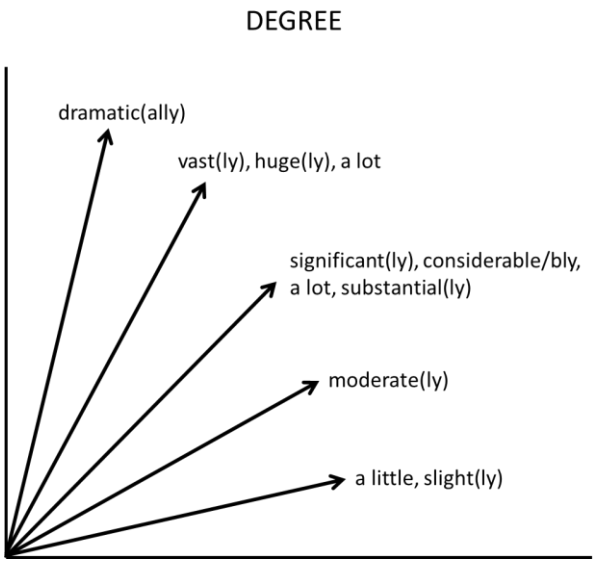
increase	rise	go up

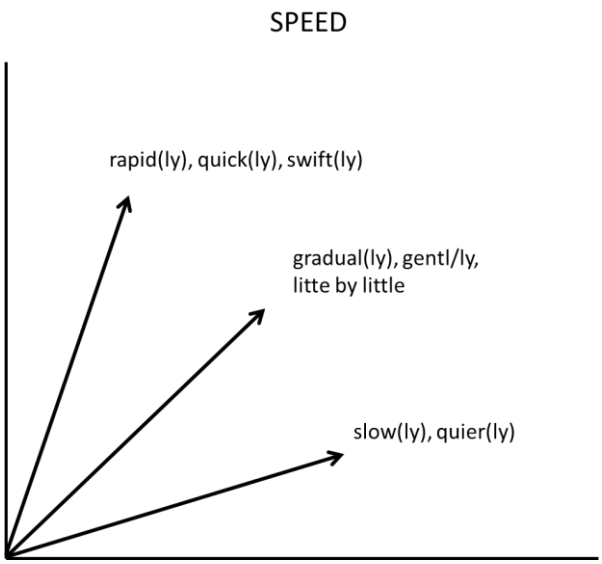
Indicating downward movement: ↘

decrease	fall	drop (off)

Indicating no movement: ➔

keep ... stable	remain stable	hold ... constant

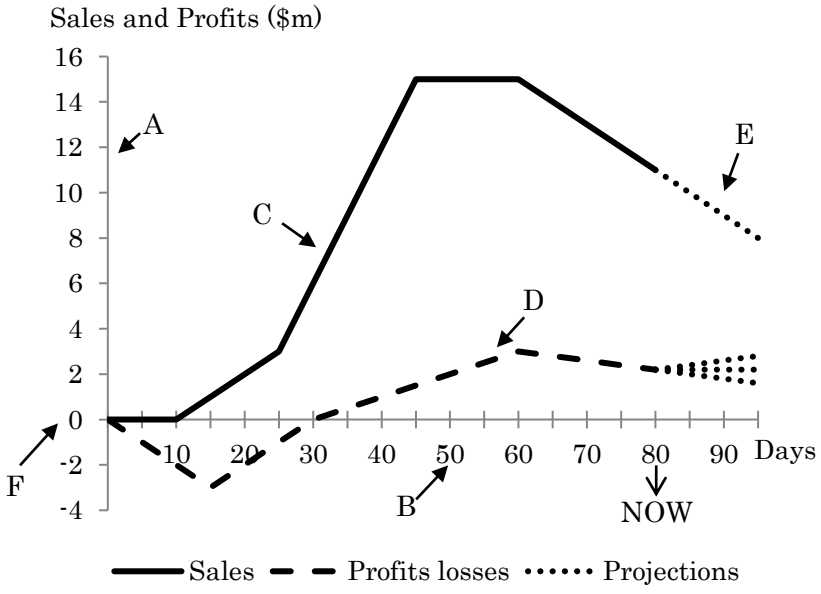




Science English No.19 date:

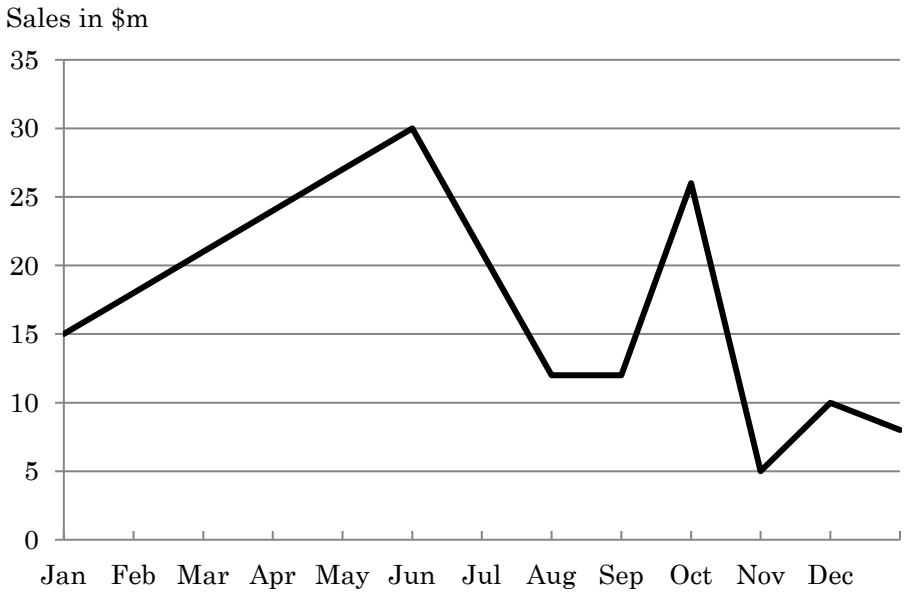
Graph 2

A. Look at the graph and write the appropriate letters after each definition:



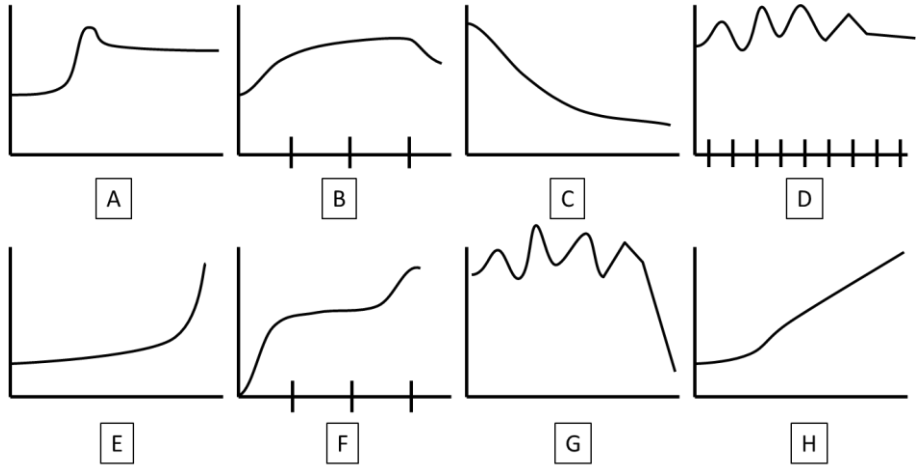
1. the horizontal axis (or the x axis)_____
2. the vertical axis (or the y axis)_____
3. the scale_____
4. a broken line_____
5. a solid line_____
6. a dotted line_____

B. Please fill in the blank.



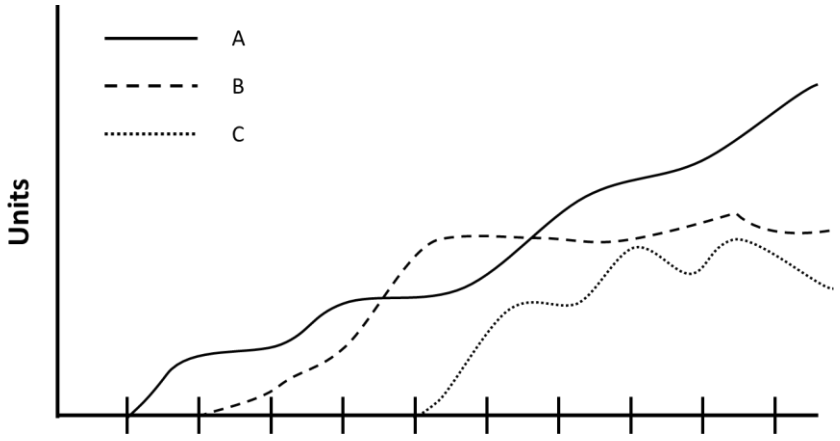
The ..... of this graph shows the twelve months of the past year, while .....shows the sales in millions of dollars. Sales .....steadily from January to May and reached their .....in June. Then they .....in July and .....in August. It .....sharply during September but they .....in October.

C. Match each sentence below with one of the following graphs



1. The acid level rose suddenly. .....
2. The density fell slightly in the final stage. .....
3. The number of animals has remained stable over the past few years. .....
4. At the end of the first hour, it stood at 50 percent of the present level. .....
5. The price reached a peak before falling a little and then keeping the same level. .....
6. The cost has been increasing over several years. .....
7. The share prices fell suddenly and it surprised everyone. .....
8. The value of the shares has been decreasing over a period. .....

D. Look at the graph below, then complete the sentences.



1. The ..... compares A, B and C.
2. The ..... shows time over ten years while the ..... shows number of units.
3. As you can see, A is represented by the .....
4. The performance of B is shown by the .....
5. And a ……. has been used to show the results of C.

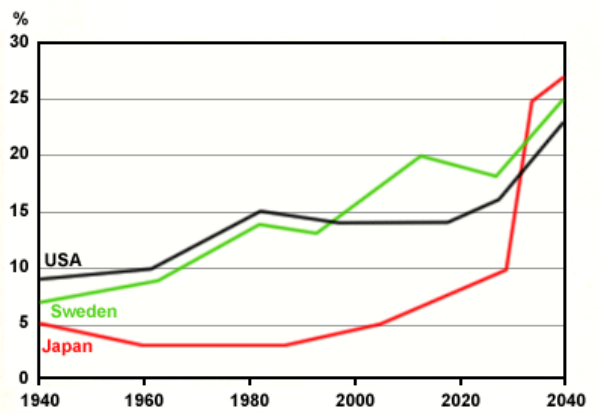
Science English No.20 date:

Graph 3 - Useful Expressions

1	Please take a look at this graph.	このグラフを見てください。
2	According to this graph…	このグラフによると・・・
3	The graph shows the population of…	このグラフは・・・の人口を表しています。
4	As you can see,	見ての通り
5	The number of ~	～の数
6	The amount of ~	～の量
7	The percentage of ~	～のパーセンテージ
8	How ~ changed over time	～が時間とともにどう変化したか
9	The horizontal axis (x axis) shows…	横軸が表しているのは・・・
10	The vertical axis (y axis) shows…	縦軸が表しているのは・・・
11	during the period 2000 – 2015	2000 年から 2015 年の間に
12	in August	8 月には
13	in 2003	2003 年には
14	between 2006-2008	2006 年から 2008 年までに
15	from January to August,	1 月から 8 月で
16	by 2030	2030 年までには
17	increased (decreased) by ~ %	～%まで増加（減少）した
18	stay the same	変わらない
19	remain steady	一定を保っている
20	slightly	わずかに
21	steadily	どんどん
22	gradually	徐々に、段々と
23	significantly	著しく、はっきりと
24	sharply	急激に
25	rapidly	急激に
26	dramatically	劇的に
27	comparing the US with Japan,	日本とアメリカを比べると
28	~% of people answered…	～%の人が・・・と答えた
29	average	平均
30	in total	合計で

Explain the graph

65 歳以上の人口



Online IELTS Preparation

Please ..... this graph.

This graph shows .....

who are over 65 years old in .....

In 1940, the US .....

On the other hand, Japan .....

.....

Around 2000-2020, Sweden .....

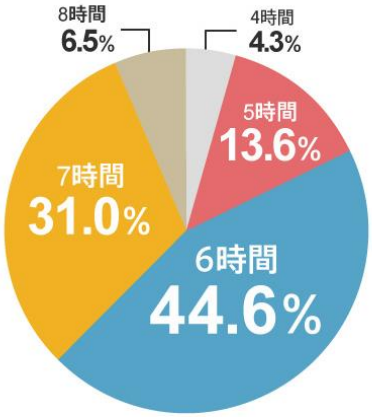
.....

By 2040, Japan .....

.....

I think .....

高 2・9 月の平均睡眠時間



2015 年 8 月実施、現役難関大生 184 人対象 Web アンケート Benesse

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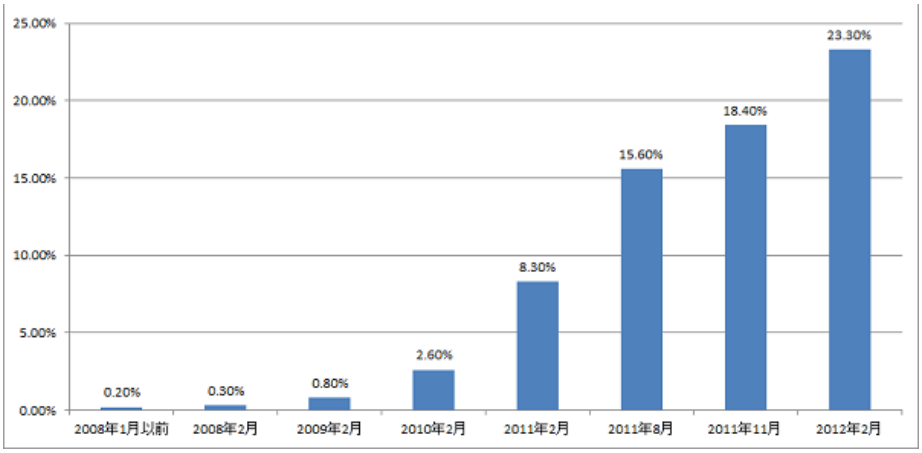
日本のスマートフォン普及率



資料: 株式会社ディーツーコミュニケーションズ スマートフォン普及動向調査

.....

.....

.....

第一部解答　特に必要と思われる解答のみ掲載します

解答

Pair Activity Numbers

A	B
1. 13,000	1. 3,000
2. 49,800,000	2. 75,000,000
3. 60,000,000	3. 3,300,000

No.3

1. Beaker	6. Microscope	11. Thermometer
2. Volumetric Flask	7. Microscope Slides	12. Petri Dish
3. Filter Funnel	8. Pipette	13. Test Tube
4. Erlenmeyer Flask	9. Evaporating Dish	
5. Graduated Cylinder	10. Mortar and Pestle	

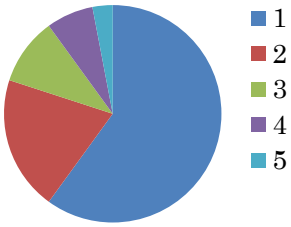
No.9 Math Bingo 読み上げ数式例

2＋4－5＝1	2×2×2＝8	3×4＋3＝15
4×1－2＝2	4＋4－2＋3＝9	5＋5＋6＝16
4×2－5＝3	120÷10－2＝10	2×5＋7＝17
16÷4＝4	2＋6＋4－1＝11	24÷4＋12＝18
8＋3－6＝5	6×2＝12	5＋4＋2＋8＝19
3×3－4＋1＝6	8÷2＋9＝13	5×4＝20
3＋4＝7	7＋9－2＝14	

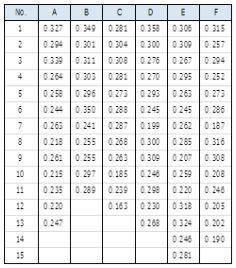
No. 10

1. brain	5. stomach	9. small intestine
2. heart	6. liver	10. pancreas
3. lungs	7. gallbladder	11. kidney
4. esophagus	8. large intestine	

No.18

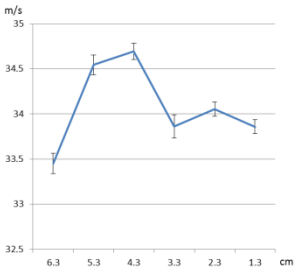


Pie chart

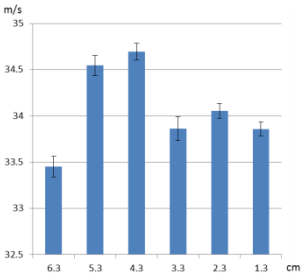


No.	A	B	C	D	E	F
1	0.327	0.349	0.281	0.358	0.106	0.315
2	0.294	0.301	0.304	0.300	0.109	0.257
3	0.339	0.311	0.308	0.276	0.267	0.294
4	0.264	0.303	0.281	0.270	0.295	0.252
5	0.268	0.296	0.273	0.293	0.263	0.273
6	0.244	0.350	0.288	0.245	0.245	0.286
7	0.263	0.241	0.287	0.199	0.262	0.187
8	0.218	0.255	0.268	0.300	0.285	0.316
9	0.261	0.255	0.263	0.309	0.207	0.308
10	0.215	0.297	0.185	0.246	0.259	0.208
11	0.235	0.289	0.239	0.298	0.220	0.246
12	0.220		0.163	0.230	0.318	0.205
13	0.247			0.268	0.224	0.202
14					0.246	0.190
15					0.281	

Table



Line Graph



Bar Chart

No.19

A :　1.B　2. F　3. A　4. D　5. C　6. E

B: The x axis of this graph shows the twelve months of the past year, while y axis shows the sales in millions of dollars. Sales rose steadily from January to May and reached their peak in June. Then they dropped off in July and remained stable in August. It rose sharply during September, they fell in October but then made a significant in November.

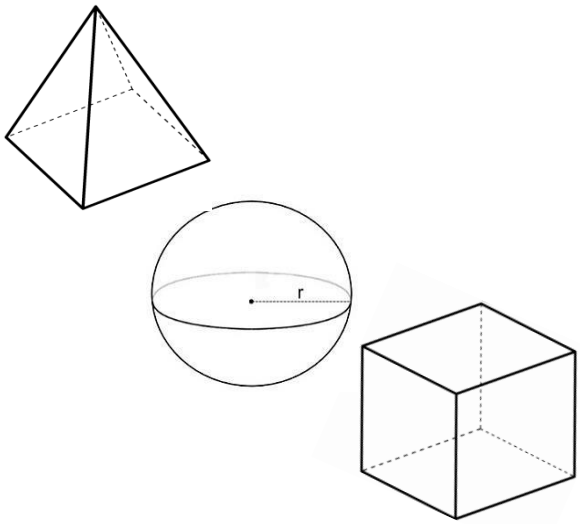
C:　1. E　2. B　3. D　4. F
　　5. A　6. H　7. G　8. C

D:　1. Line graph　2. x axis / y axis　3. solid line　4. broken line　5. dotted line

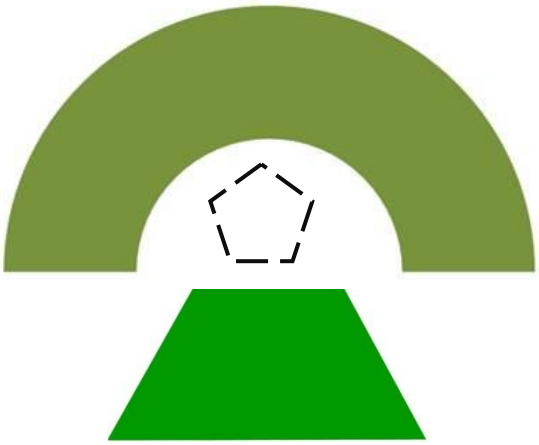
No. 7 Pair Activity Shapes / Describing Game

各図を A4 程度に拡大し、ペアを向かい合わせに座らせ、半分の生徒から見える側に教員が立って図を見せる。生徒 A は口頭のみで生徒 B にどのような図や絵が描かれているのか説明する。生徒 B はその情報を頼りに図をプリントに書き入れる。1 つの図形を説明するのに 4 分ほどかかるのでペアワークで 10 分程度使用します、毎回授業の冒頭に 2 つずつ行うと楽しく始められます。

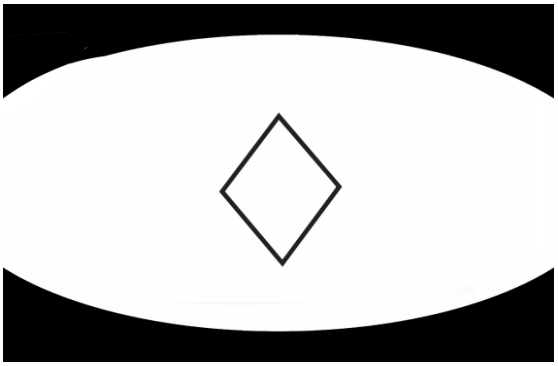
1



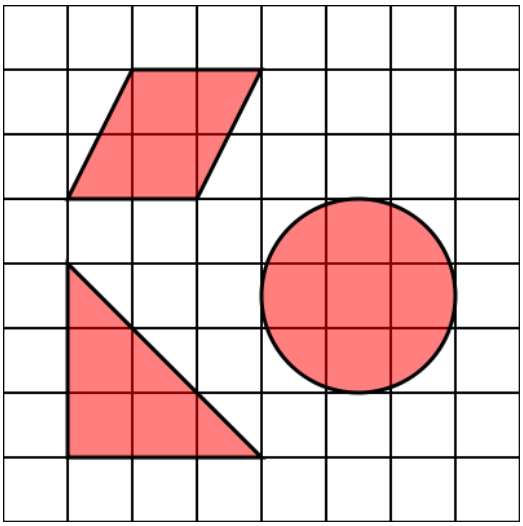
2



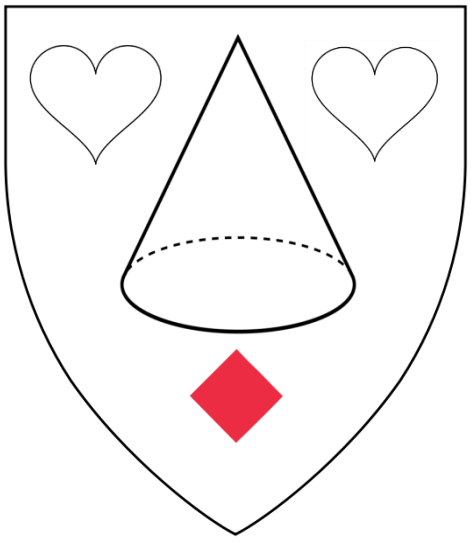
3



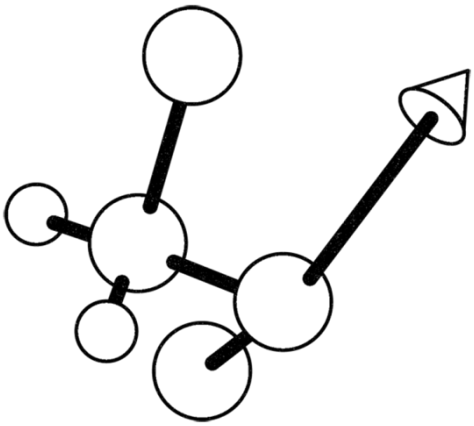
4



5



6



第二部

第二部では、英語プレゼンテーションや即興スピーチの力がある程度養われた、本校では高校 2 年生の 3 学期～3 年生の 1 学期にかけての授業を想定しています。これまでに様々なサイエンストピックをベースとした授業を行ってきましたが、ここに掲載させていただいたのはその中でも生徒に特に人気のあった 7 つのトピックです。

理系高校生の 3 年間の達成目標として「高いレベルで課題研究の成果を英語で発表し、その後の質疑応答に適切に対応できる」ことをおきたいと考えていますが、そのためには 3 年間を通して英語授業内で段階的に指導を行う必要があります。

研究発表と質疑応答を英語で行える生徒集団を育てるために授業内で有効な活動はいくつかありますが、ここで紹介する与えられた英文と PPT スライドを使用しながら行う Ready-Made Presentation は生徒の発表時のデリバリーや発音指導を限られた時間で行うのに大変合理的で有効な指導法ですので、英文を生徒集団の習熟度に合わせながらぜひ段階的に取り入れてみてください。また、授業内で行う「聞いた内容について話す」ことや「読んだ内容について意見を書く」ことは「自分が理解した内容を自分の言葉で表現する」活動でもあり、質疑応答に備えるための生徒の英語運用力を高めるうえでも効果が高いと考えています。

本校ではこれまでこの教材を教員のプレゼンテーションから生徒の即興プレゼンテーションにつなげる 1 時間完結型の授業として使用してきましたが、昨年度から次時のディスカッションと合わせた 2 時間完結型授業として実施しています。対象生徒の英語運用力に合わせて最初の 1 時間分の授業内容を 2 時間に広げ生徒の即興プレゼンテーションの前に音読や準備の時間をしっかり取ってもよいでしょうし、自由な発話や思考力・発想力を鍛えるためにはプレゼンテーション後の議論の時間は大変有効なものだと感じています。

	第二部の教材を使用して実施する授業内の活動
1 時間目	■ トピックの導入（教師のプレゼン） ■ 生徒の即興ペアスピーチ ■ 教員と生徒のインタラクティブ QA ■ 生徒同士のペアリーディング ■ 生徒同士のペアでのリテリングプレゼンテーション ■ 教員からエッセイトピックの提示⇒次時までの課題
2 時間目	■ エッセイトピックに関するグループ議論（3～4 名のグループで） ■ グループ議論からクラス内議論へ ■ You Tube などの関連映像、発展した内容の読み物などを提示

トピック	**発展内容**
ハワイの溶岩	現地に行ったときにどのような調査をしてみたいか？
すばる天文台	ほとんどの天文台はドーム型であるのに、なぜすばる天文台は円筒型なのか？
食虫植物	想像上の食虫植物をデザインしその特徴と食虫方法を説明しよう
植物の屈性	光屈性、重力屈性、水屈性の写真を撮影しよう
生物模倣技術	新しい植物模倣の製品をデザインしよう
エコロケーション	エコロケーションの仕組みを人に応用できるのか
動物の聴覚	なぜコオロギの聴覚は前脚についているのか

このサイエンストピックの授業では生徒の運用力を鍛えるため、「準備した発話」と「即興の発話」、また生徒の Output 活動での「正確さ」と「流暢さ」の両方の側面を考える必要があります。また、前述したように、リスニング、スピーキング、リーディング、ライティングの複数の技能を統合させる活動を意識して取り入れバランスのよい運用力を養います。All in English で四技能統合型授業を行うのに適した授業内容です。

	Prepared/ Impromptu	**Accuracy/ Fluency**	**L**	**S**	**R**	**W**
宿題で書いてきたエッセイの内容をペアでスピーチ	Prepared	Fluency		✓		✓
教師のプレゼンの再生スピーチ	Impromptu	Fluency Accuracy	✓	✓		
PPT スライドを使用してペアでリテリングプレゼン	Prepared	Accuracy		✓	✓	
与えられたトピックをミニ議論	Impromptu	Fluency	✓	✓		
与えられた議題に関するエッセイライティング(宿題)	Prepared	Accuracy			✓	✓

第二部の授業は大変楽しいものになりますが、それを成功させるために必要なことは二つです。一つは、対象生徒にそれまでにある程度の英語運用力や即興プレゼンテーションの力を英語コミュニケーションⅠⅡの授業でつけておくことです。そうでなければ、できないことをやらされるだけの白けた授業になってしまうかもしれません。もう一つはそのコンテンツに授業者が向き合い、よく調べ、楽しいものだと納得し、授業の冒頭に行うトピック導入のプレゼンテーション準備にしっかりと時間をかけることです。授業者がそのトピックを楽しみ、「こんなに面白いから早く生徒に伝えたい！」という思いがあれば、生徒の知的好奇心を刺激する大変楽しい時間となり、クラスが一体となる授業となることは間違いありません。

第二部の授業指導案

この授業では、50 分という短い時間の中で、サイエンスにかかわる興味深いトピックを提示し、理解を促し、生徒に自ら考えさせる時間を与え、英語での発話と発表活動、またエッセイライティングとその後の議論につなげることができます。インタラクティブな授業展開の中で生徒が自ら考え、議論し、またそれぞれの結論にオリジナリティを求めること、また実際に研究発表と質疑応答を行うことを毎回想定させることで、生徒たち一人一人が力をつけていきます。

（１）評価規準

関心・意欲・態度	思考・判断・表現	技能	知識・理解
・講義を主体的に聞くことができる ・授業内で積極的に発話できる ・ペアワークに積極的に取り組める ・議論に積極的に参加できる	・それぞれの科学トピックに関して、自ら疑問を持ち、適切に考えそれを自分の言葉で表現できる ・独自の観点からその内容をまとめることができる	・ペア発表、全体発表において十分なデリバリーと美しい発音で発表できる ・エッセイ課題において正確な英文で内容を表現でき、それをもとに議論ができる	・さまざまな科学トピックについて、その内容を理解できる ・基本用語を理解できる

（２）評価の方法

関心・意欲・態度	思考・判断・表現	技能	知識・理解
授業内での取り組み	エッセイ課題 定期テスト	グループプレゼンテーション大会	エッセイ課題 定期テスト

（３）単元指導計画（全 18 時間）

・Lava in Hawaii①② Subaru Telescope③④ Insectivorous Plants⑤⑥ Tropism⑦⑧
・Biomimicry⑨⑩　Echolocation⑪⑫　Animal Hearing⑬⑭
・プレゼン準備　⑮⑯　・グループプレゼンテーション大会　⑰⑱

（４）授業の目標

① サイエンストピックについて自然な速さでの英語の講義を聞きそれぞれ特徴を理解する
② 英語を使用したインタラクティブな展開において積極的に考え応答する
③ 聞いた内容に関して即座にパートナーに論理的に説明する
④ 準備した内容に関して十分なデリバリーや発音で聴衆に伝える
⑤ アカデミックライティングの手法で与えられた議題に対するエッセイを書く
⑥ 書いてきた英文をもとにグループ議論、クラス議論に活発に参加する

（５）各トピック１時間目の指導過程（50 分）

学　習　活　動	授　業　者　の　働　き　か　け　な　ど
始まりの挨拶　(1 分) ○【生徒⇔生徒】(帯活動) Impromptu Speech (2 分)	○そのとき生徒が話をしやすそうなトピックを選んで即興で 1 分間ずつペアでスピーチをさせる。「文化祭の準備状況」「理科の科目で一番好きなもの」「テスト勉強計画」などなんでもよい。
○【教師⇔生徒】導入プレゼンテーション　(12 分)	○質問を多く投げかけインタラクティブな展開を意識し、新しいトピックに関して生徒自身が興味や疑問を持ち、問題に対して自ら考えられるよう促す。のちに読ませるスクリプトとは異なる表現をあえて使用し多量の Input を与える。
○【生徒⇔生徒】　教員のプレゼンテーションの内容について理解した内容を各生徒１分間ずつパートナーに説明する　(3 分)	○机間巡視をし間違いがあれば正す。2 人目のスピーチでは１人目が話していない新しい情報を含むよう指示する。
○【教師⇔生徒】　インタラクティブ QA　(5 分)	○重要な項目やキーワードなどを再度 PPT (重要箇所に図形をかぶせたもの) を使用し生徒と共に復習し、後に使用する穴埋め音読シートの穴埋め部分のキーワードは特に繰り返し発音などさせながら定着させる。
○【教師⇔生徒】キーとなる用語の確認(英語の定義を使用して)　(4 分)	○PPT スライド 1 枚に重要語句を 10words ほど示し、教師がそのいずれかの英単語の英語での定義を読み上げる。分かった生徒は挙手をして答える。(英語の定義 http://www.ldoceonline.com/)
○【生徒⇔生徒】用語の説明　(4 分) 関連キーワードの Describing Game 3words×2、1words30 秒程度の活動	○PPT スライド１枚につき１つの単語とそれに関連する画像などを貼り付けて示す。生徒 A が前を向いてその単語を確認し英語で生徒 B に伝える。生徒 B は後ろを向いてスライドが見えないようにし、生徒 A の説明する英語でそれが何かあてる。日本語やジェスチャーを介さずその語を説明できるよう促す。
○【生徒⇔生徒】　穴埋めペア Reading　(5 分) Information gap ペアワーク	○穴埋めしながら生徒 A が音読する (書き込まない)。答えを持っている生徒 B は生徒 A が分からないときは答えを与えるのではなく、その単語に関するヒントを出して正解を促すよう指示する
○【生徒】スクリプトを読み、要点をまとめ、トピックによってはオリジナルな Introduction や Conclusion を個人で考える　(5 分)	○スクリプトと全く同じ英文を丸暗記するのではなく、自分の言葉で表現すること、またオリジナルな観点でまとめるよう指示する

○【生徒⇔生徒】 プレゼンの内容について 1 分半でパートナーにペアにプレゼンテーション （5 分)（スライド 3 枚ずつでも構わない）	○デリバリーや発音、英文の内容などを指導しながら机間巡視する。興味深い観点でまとめているペアを探す。
○【生徒⇔生徒】 前でペア一組がプレゼンテーション （4 分) 宿題の提示と終わりの挨拶(1 分)	○代表生徒のデリバリーや発音について全体の前で指導し共有する。オリジナルの結論に対してコメントを行う。

（6）各トピック２時間目の指導過程

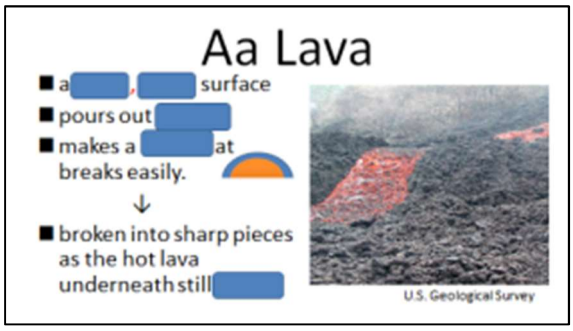
学 習 活 動	授 業 者 の 働 き か け
始まりの挨拶 （1 分) ○【生徒⇔生徒】(帯活動) Impromptu Speech (2 分)	○そのとき生徒が話をしやすそうなトピックを選んで即興で 1 分間ずつペアでスピーチをさせる。「英単語を覚える方法」「中学時代に一番楽しかった行事」「教師になるなら教えたい科目」などなんでもよい。
○【生徒⇔生徒】グループ議論 （12 分)	○クラスを 4 人程度のグループに分ける。司会、書記、発表者を決めさせ、宿題のエッセイをもとにそれぞれ与えられたトピックに関する自分の意見を順に述べるよう指示する。一人ずつのスピーチが終わったら、グループでの意見をまとめる議論をさせる。ひとつの意見に全員が賛同する形でまとめてもよいし複数の意見を統合してグループで一つの意見にまとめてもよい。
○【教師⇔生徒全体】クラス議論（20 分)	○それぞれのグループにおいてまとまった意見をそれぞれ代表生徒に発表してもらう。教員はファシリテーターとして意見をまとめる。
○【教師⇔生徒全体】まとめの議論や提案 （15 分)	○それぞれのトピックに対して事前に調べていたもの、興味深い映像、画像、クイズ、再議論のための議題などを提示する。

（7）全トピック終了後

学 習 活 動	授 業 者 の 働 き か け
グループプレゼンテーション準備（2 時間)	学習した 7 つのトピックから生徒の興味に応じていずれかを選ばせ､5~6 名のグループを編成する。テスト対策として学習内容のまとめを発表するものと内容をさらに発展させた発表を行うものとに分かれる。PPT と発表台本を作成させる。
グループプレゼンテーション（2 時間)	年に 1 度の機会ととらえ、できるだけ本格的な会場や雰囲気を用意する。本番は生徒から募った司会を立てて進行を行う。クラスメイト同士相互評価を行う。

（８）第二部の授業のために授業者が準備するスライド(必須)

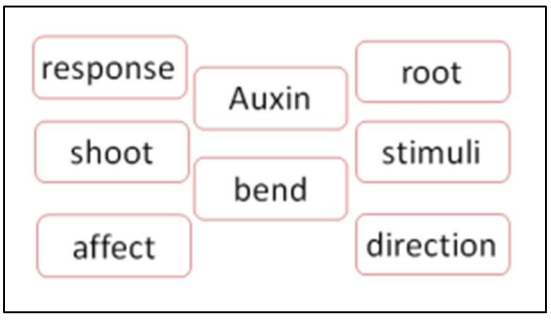
- トピック導入、内容理解のための楽しく知的好奇心をくすぐるような PPT（様々な視覚教材(写真や図表等)やキーワードなど）冊子作成の都合上この PPT は掲載できませんでしたが、ネット上などにコンテンツは豊富にあり各トピック 20~30 枚ほど作成します。
- 教師と生徒のインタラクションを可能にするための PPT スライド（具体的にはトピック導入と同じスライドのキーワードなどに図形をかぶせておき、インタラクションするたびにそれがアニメーション（図形の終了）で開くようになっているもの）



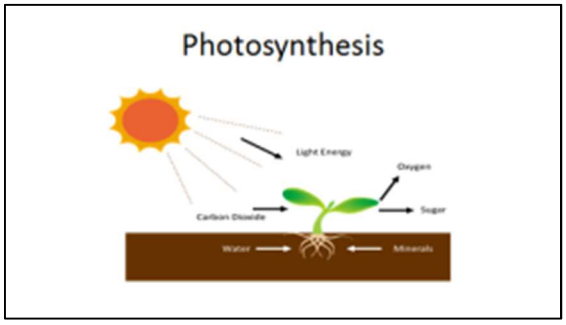
- 生徒が即興リテリングプレゼンテーションで使用する①タイトル②Introduction③④⑤Body⑥Conclusion の 6 枚にまとめたスライド（本冊子に掲載しています）

（９）第二部の授業のために授業者が準備するスライド(必要に応じて)

- トピック導入の後、キーとなる英単語の定義を教員が読み上げ、生徒がそれを当てる活動に使用する語彙スライド



- トピック導入の後、ペアで生徒の一人が示されている単語を英語で説明し(片方がスライドを見て片方が後ろを向く)もう一人がその語を当てるという活動に使用するキーワードスライド



Topic 1: Lava in Hawaii

Today, I would like to tell you about lava in Hawaii. **Lava** is magma that flows onto the Earth's surface. Here, I will explain three types of lava which you can find in Hawaii. They are *Pahoehoe* lava, *Aa* lava and *pillow lava*.

Pahoehoe lava

Pahoehoe derives its name from the Hawaiian word for "ropy" because its surface looks like coils of rope. Pahoehoe lava flows slowly, like wax dripping down from a candle, making a glassy surface.

Aa lava

*A*a is a Hawaiian word that describes a type of lava that has a sharp, rough surface. This stiff lava pours out quickly and makes a crust that breaks easily. The crust is broken into sharp pieces as the hot lava underneath still moves. *Aa* is named after the sound you would make ("Aaah!") if you were to walk across this type of lava in bare feet.

Pillow lava

Pillow lava is made when lava erupts underwater. The size and shape of the lava is like a pillow and this is why it is called *pillow lava*. It has a round shape because the lava cools very quickly when it touches water.

Kilauea is an active volcano in the Hawaiian Islands. The volcano is 1,277 meters high. Its first eruption was in 1823 and it is still active now. The Hawaiian name “Kilauea” means "much spreading". The volcano of Kilauea is said to be the home of Pele, the Hawaiian goddess of fire and volcanoes. Small pieces of lava drops are called Pele’s tears and are often found in strands of volcanic glass known as Pele’s hair. You can find these in Hawaii.

Thank you very much for your attention. I hope you learned something about Hawaii and its volcanoes.

(290 words)

A

<Your Part>

Today, I would like to tell you about (l) in Hawaii. **Lava** is magma that (f) onto the Earth's (s). Here, I will explain three types of lava which you can find in Hawaii. They are *Pahoehoe lava, Aa lava and pillow lava*.

Pahoehoe lava

Pahoehoe drives its name from the Hawaiian word for "(r)" because its surface looks like (c) of rope. Pahoehoe lava flows (**slowly / quickly**), like wax dripping down from a (c), making a (g) surface.

Aa lava

Aa is a Hawaiian word that describes a type of lava that has a (**sharp / round**), rough surface. This stiff lava pours out (**slowly / quickly**) and makes a crust that breaks easily. The crust is broken into sharp pieces as the (**cold / hot**) lava underneath still (m). Aa is named after the (s) you would make ("Aaah!") if you were to walk across this type of lava in (b) feet.

<Your Partner's Part>

Pillow lava

Pillow lava is made when lava erupts underwater. The size and shape of the lava is like a pillow and this is why it is called *pillow* lava. It has a round shape because the lava cools very quickly when it touches water.

Kilauea is an active volcano in the Hawaiian Islands. The volcano is 1,277 meters high. Its first eruption was in 1823 and it is still active now. The Hawaiian name "Kilauea" means "much spreading". The volcano of Kilauea is said to be the home of Pele, the Hawaiian goddess of fire and volcanoes. Small pieces of lava drops are called Pele's tears and are often found in strands of volcanic glass known as Pele's hair. You can find these in Hawaii.

Thank you very much for your attention. I hope you learned something about Hawaii and its volcanoes.

B

<Your Partner's Part>

Today, I would like to tell you about lava in Hawaii. **Lava** is magma that flows onto the Earth's surface. Here, I will explain three types of lava which you can find in Hawaii. They are *Pahoehoe lava, Aa lava and pillow lava.*

Pahoehoe lava

Pahoehoe drives its name from the Hawaiian word for "ropy" because its surface looks like coils of rope. *Pahoehoe* lava flows slowly, like wax dripping down from a candle, making a glassy surface.

Aa lava

*A*a is a Hawaiian word that describes a type of lava that has a sharp, rough surface. This stiff lava pours out quickly and makes a crust that breaks easily. The crust is broken into sharp pieces as the hot lava underneath still moves. Aa is named after the sound you would make ("Aaah!") if you were to walk across this type of lava in bare feet.

<Your Part>

Pillow lava

Pillow lava is made when lava (**e**) underwater. The size and shape is like a (**p**) and this is why it is called *pillow lava*. It has a round shape because the lava cools very **(slowly / quickly)** when it touches (**w**).

Kilauea is an active (**v**) in the Hawaiian Islands. The volcano is 1,277 meters (**h**). Its first eruption was in 1823 and it is still active now. The Hawaiian name "Kilauea" means "much (**s**) ". The volcano of Kilauea is said to be the home of Pele, the Hawaiian (**g**) of fire and volcanoes. Small pieces of lava drops are called Pele's (**t**) and are often found in strands of volcanic glass known as Pele's (**h**). You can find these in Hawaii.

Thank you very much for your attention. I hope you learned something about Hawaii and its volcanoes.

Lava

= magma that flows onto the Earth's surface

- »Pahoehoe lava
- »Aa lava
- »Pillow lava

Pahoehoe Lava

U.S. Geological Survey

- "ropy"

Coils of rope

- flows slowly, making a glassy surface

wax dripping down from a candle

Aa Lava

- a sharp, rough surface
- pours out quickly
- makes a crust that breaks easily.

↓

- broken into sharp pieces as the hot lava underneath still moves.

U.S. Geological Survey

Pillow Lava

- The size and shape is like a pillow.
- Lava that has a round shape because it cools very quickly when it touches water.

Kilauea

- An active volcano
- 1,277 meters high
- The first eruption (1823)
- Still erupting now
- Kilauea="much spreading"

Pele's hair and Pele's tear

- Pele, the goddess of fire and volcanoes
- Small pieces of lava drops

Lava in Hawaii

You are going to participate in the Hawaii Study Program. Think about one mini research topic you would like to investigate there based on different types of lava you learned about in class.

No. Name

Characteristics of lavas in Hawaii (Summary)

Research Topic

Materials and Methods of Research

Possible Results

Topic 2: Subaru Telescope

Good morning everyone. Today, I will be talking about the Subaru Telescope.

Subaru Telescope

Subaru is an 8.2-meter optical-infrared telescope at the summit of Mauna Kea, Hawaii, USA, operated by the National Astronomical Observatory of Japan (NAOJ), National Institutes of Natural Sciences. Astronomical observations started in January 1999, when light from a star reflected off the mirror for the first time. This is called "First Light".

The weight of the telescope is 555 tons and the height is 22.2 meters. The vision of the telescope is about 100 times finer than the human eyes on average. At the most, it is 1000 times finer than the human eye. Therefore, the Subaru telescope can detect the 27th stellar magnitude although the human eye can see about the 6th stellar magnitude. Most importantly, the size of the mirror is 8.2 meters in diameter and it is the largest in the world.

Mauna Kea

"Mauna Kea" means "White Mountain" in Hawaiian. Mauna Kea is a tall mountain with an elevation of 4,200 meters and its summit sometimes becomes white with snow. It is one of the best places in the world for astronomical observations. A clear and dark night sky, stable atmosphere, and low humidity are necessary for good astronomical observing. Mauna Kea satisfies all these conditions.

Why do these conditions lead to good scientific results? Without a clear night sky, it is impossible to observe. A dark night sky allows observing very faint astronomical objects. A stable atmosphere allows taking sharp images, and low humidity allows the infrared light reach the telescope.

Observation with Subaru Telescope

You might know that astronomers no longer observe objects directory through a telescope. Instead, they look at a computer screen when using the newest telescope like the Subaru Telescope! Subaru's 8.2 meter mirror reflects the light of astronomical objects, such as stars and galaxies, and then collects the light with a charge coupled device (CCD) camera. This information about the light is sent to a computer as an image, so that astronomers see the object on the screen.

Thank you very much for your attention. Do you have any questions?

(354 words)

A

<Your Part>

Good morning everyone. Today, I will be talking about Subaru Telescope.

Subaru Telescope

Subaru is an 8.2-meter optical-infrared (t) at the summit of (M)(K), Hawaii, USA, operated by the National Astronomical Observatory of Japan (NAOJ), National Institutes of Natural Sciences. (A) observations started in January 1999, when (l) from a star reflected off the mirror for the first time. This is called "(F)(L)".

The weight of the telescope is (数字) tons the height is (数字) meters. The (v) of the telescope is about (数字) times finer than the human eyes on average. At the most, it is (数字) times finer than the human eye. Therefore, the Subaru telescope can detect the 27th stellar (m) although the human eye can see about the 6th stellar magnitude. Most importantly, the size of the mirror is (数字) meters in (d) and it is the largest in the world.

<Your Partner's Part>

Mauna Kea

"Mauna Kea" means "White Mountain" in Hawaiian. Mauna Kea is a tall mountain with an evaluation of 4,200 meters and its summit sometimes becomes white with snow. It is one of the best places in the world for astronomical observations. A clear and dark night sky, stable atmosphere, and low humidity are necessary for good astronomical observing. Mauna Kea satisfies all these conditions.

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Thank you very much for your attention. Do you have any questions?

B

<Your Partner's Part>

Good morning everyone. Today I will be talking about Subaru Telescope.

Subaru Telescope

Subaru is an 8.2-meter optical-infrared telescope at the summit of Mauna Kea, Hawaii, USA, operated by the National Astronomical Observatory of Japan (NAOJ), National Institutes of Natural Sciences. Astronomical observations started in January 1999, when light from a star reflected off the mirror for the first time. This is called "First Light".

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<Your Part>

Mauna Kea

"Mauna Kea" means "(W) (M)" in Hawaiian. Mauna Kea is a tall mountain with an evaluation of (***number***) meters and its summit sometimes becomes white with (s). It is one of the best places in the world for astronomical (o). A clear and (d) night sky, stable (a), and low (h) are necessary for good astronomical observing. Mauna Kea satisfies all these conditions.

Why do these conditions lead to good scientific results? Without a clear night sky, it is impossible to (o). A dark night sky allows observing very (f) astronomical objects. A stable atmosphere allows taking (s) images, and low humidity allows the (i) light reach the telescope.

Observation with Subaru Telescope

You might know that astronomers no longer observe objects directory through a (t). Instead, they look at a (c) screen when using the newest telescope like the Subaru Telescope! Subaru's 8.2 meter mirror reflects the light of astronomical objects, such as stars and (g), and then collects the light with a charge coupled device (CCD) camera. This information about the light is sent to a computer as an (i), so that (a) see the object on the screen.

Thank you very much for your attention. Do you have any questions?

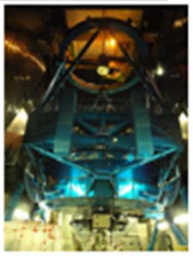
Subaru Telescope

Subaru Telescope

- 8.2-meter optical infrared telescope
- Operated by NAOJ
- At the summit of Mauna Kea
- "First Light" in 1999

Subaru Telescope's Measurements

Weight:
555 tons (about 56 buses heavy)
Height:
22.2 meters
Vision:
about 100 times finer than the human eye.
Magnitude of the stars:
detect the 27th stellar magnitude
Size of the mirror:
8.2 meters in diameter



Subaru Telescope NAOJ

Mauna Kea

Subaru Telescope NAOJ

- White Mountain
- 4,200 meters
- One of the best places for astronomical observations.
  - *A clear and dark night sky*
  - *Stable atmosphere*
  - *Low humidity*

Best Condition for Astronomical Observation

Without a clear night	• it is impossible to observe
A dark night sky	• allows observing very faint astronomical objects
A stable atmosphere	• allows taking sharp images
Low humidity	• allows the infrared light reach the telescope.

Observation with Subaru Telescope

astronomer

Subaru Telescope

Essay Topic: Why does the Subaru Telescope have a unique shape? Summarize the article by using your own creative and original ideas. Include your opinion on the topic supported by reasons and/or examples. (Do not search for information on the Internet.)

No. Name

Topic 3: Botany/Insectivorous Plants

Today, I'm going to talk about insectivorous plants. Do you understand what insectivorous plants are? They are plants that trap and assimilate insects in order to sustain life.

You may understand the meaning of insectivore from related words such as carnivore or herbivore: a carnivore eats meat, and an herbivore eats plants, while an insectivore consumes insects. But unlike carnivores and herbivores, which are animals, the insectivores that we're going to discuss today are plants.

All insectivorous plants contain chlorophyll and have roots, so they do not get all of their nutrients from the insects they take in. Insectivorous plants tend to live in soil that does not have enough nitrogen for them to exist. So in order to get the nitrogen they need, they consume their insect victims.

There are many types of insectivorous plants in the world; there are about 500 known species of insectivorous plants worldwide. In this presentation, we are going to look at one of the better known ones in depth.

The insectivorous plant that we are going to discuss in detail is the Venus flytrap, which is native to North America. Please look at the drawing of a Venus flytrap on the screen. The Venus flytrap catches insects by suddenly snapping the ends of one of its trap leaves around an insect. You can see that a Venus flytrap has a number of trap leaves and that each trap leaf is divided into two parts. Inside the two parts of the trap leaf are three sensory bristles, which resemble tiny hairs.

When an insect touches the sensory bristles inside a trap leaf, the two surfaces of the leaf shut instantaneously, and the insect is trapped inside the parts of the leaf. The Venus flytrap then discharges a digestive liquid into the leaf in order to assimilate the insect and obtain the nitrogen that the plant needs in order to survive.

That's all for today on the Venus flytrap. I hope that you have developed a clear understanding of how the Venus flytrap and other insectivorous plants function.

(343 words)

A

<Your Part>

Today, we're going to talk / about insectivorous plants. Do you understand what insectivorous plants are? They are plants / that (t) and assimilate (i) / in order to sustain life.

You may understand the meaning of insectivore / from related words / such as (c) or herbivore: a carnivore eats meat, / and a herbivore eats (p), / while an insectivore consumes (i). But unlike carnivores and herbivores, which are (a), the insectivores / that we're going to discuss today / are plants.

All insectivorous plants contain (c) and have roots, / so they do not get all of their (n) / from the insects / they take in. Insectivorous plants tend to live in soil / that does not have enough nitrogen / for them to exist. So in order to get the (n) they need, they consume their insect victims.

There are many types of insectivorous plants in the world; / there are perhaps (*number:*) known species of insectivorous plants worldwide. Of these many types of insectivorous plants, / we are going to look at one of the better known ones / in depth.

<Your Partner's Part>

The insectivorous plant / that we are going to discuss in detail / is the Venus flytrap, / which is native to North America.

Look at the drawing of a Venus flytrap / on the screen. The Venus flytrap catches insects / by suddenly snapping the ends of one of its trap leaves / around an insect. You can see / that a Venus flytrap has a number of trap leaves / and that each trap leaf is divided into two parts. Inside the two parts of the trap leaf are three sensory bristles, / which resemble tiny hairs.

When an insect touches the sensory bristles / inside a trap leaf, / the two surfaces of the leaf shut instantaneously, / and the insect is trapped / inside the parts of the leaf. The Venus flytrap then discharges a digestive liquid / into the leaf / in order to assimilate the insect / and obtain the nitrogen / that the plant needs / in order to survive.

That's all for today / on the Venus flytrap. I hope / that you have developed a clear understanding / of how the Venus flytrap and other insectivorous plants function.

B

<Your Partne's Part>

Today, we're going to talk / about insectivorous plants. Do you understand what insectivorous plants are? They are plants / that trap and assimilate insects / in order to sustain life.

You may understand the meaning of insectivore / from related words / such as carnivore or herbivore: a carnivore eats meat, / and a herbivore eats plants, / while an insectivore consumes insects. But unlike carnivores and herbivores, which are animals, the insectivores / that we're going to discuss today / are plants.

All insectivorous plants contain chlorophyll and have roots, / so they do not get all of their nutrients / from the insects / they take in. Insectivorous plants tend to live in soil / that does not have enough nitrogen / for them to exist. So in order to get the nitrogen they need, they consume their insect victims.

There are many types of insectivorous plants in the world; / there are perhaps 500 known species of insectivorous plants worldwide. Of these many types of insectivorous plants, / we are going to look at one of the better known ones / in depth.

<Your Part>

The insectivorous plant / that we are going to discuss in detail / is the Venus flytrap, / which is native to North (A).

Look at the drawing of a Venus flytrap / on the screen. The Venus flytrap catches insects / by suddenly (s) the ends of one of its trap leaves / around an insect. You can see / that a Venus flytrap has a number of trap (l) / and that each trap leaf is divided into two parts. Inside the two parts of the trap leaf are three sensory (b), / which resemble tiny (h).

When an insect touches the sensory bristles / inside a trap leaf, / the two surfaces of the leaf (s) instantaneously, / and the insect is trapped / inside the parts of the leaf. The Venus flytrap then discharges a digestive (l) / into the leaf / in order to assimilate the insect / and obtain the (n) / that the plant needs / in order to survive.

That's all for today / on the Venus flytrap. I hope / that you have developed a clear understanding / of how the Venus flytrap and other insectivorous plants (f).

Insectivorous plants

Insectivores

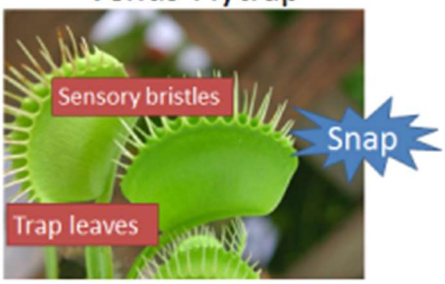
- carnivore
- herbivore

=trap and assimilate insects in order to sustain life

Insectivorous Plants

- Contain chlorophyll and have roots
- Live in soil that does not have enough nitrogen

Venus Flytrap



1. Insect touches the sensory bristles
2. Two surfaces of the leaf shut
3. Insect is trapped
4. The Venus flytrap discharges a digestive liquid
5. The Venus flytrap assimilate the insect and get the nitrogen

Conclusion

Botany/Insectivorous Plants

★Draw an imaginary insectivorous plant. Use more than 5 key words below to describe the plant's key features and the trapping mechanism of how it takes in nutrients from insects.

Key Words ☐trap ☐insect ☐nutrient ☐nitrogen
☐snap ☐trap leaves ☐sensory bristle ☐digestive liquid

No. Name

Topic 4: Tropism

Today, in this presentation, I'll be talking about the concept of tropism as we have just learned about it in our biology class. Have you ever heard the word "tropism"? The word "tropism" refers to "a bending of a plant in response to an outside stimulus." In other words, a "tropism" is a growth in response to a stimulus.

There are three important kinds of tropism. They are phototropism, geotropism or gravitropism, and hydrotropism. In each of these kinds of tropism, a plant, or a part of the plant, bends in response to a different kind of outside stimulus.

First, we'll discuss phototropism. The outside stimulus in phototropism is light. When a plant is affected by phototropism, it grows in the direction of a light source such as the Sun. Plants need light for photosynthesis so they have developed responses to help make sure they grow towards sources of light.

The second kind of tropism is geotropism, or gravitropism. In geotropism, the outside stimulus is gravity. In a plant affected by geotropism, the affected part of the plant grows downward because of the pull of gravity. When a plant is affected by geotropism, it's often the root structure that's affected. When roots grow in the direction of the gravitational pull, it is called positive geotropism. The shoots, on the other hand, grow away from the stimulus. This is called negative geotropism.

The final kind of tropism is hydrotropism. When hydrotropism affects a plant, this means that the plant is drawn to water. A plant under the effect of hydrotropism will grow in the direction of its water source as they obviously need water to survive.

Connected to tropism is a plant hormone called Auxin. It is responsible for controlling the direction of growth of root tips and stem tips in response to different stimuli including light and gravity. I will tell you more about Auxin in the next lesson.

That's all for today. I hope you got more interested in plants. Thank you for your attention.

(336 words)

A

<Your Part>

Today, in this presentation, I'll be talking about the concept of tropism as we have just learned about it in our biology class. Have you ever heard the word "tropism"? The word "tropism" refers to "a (b ing) of a plant in response to an outside (s)". In other words, a "tropism" is (g) in response to a stimulus.

There are three important kinds of tropism. They are (p), (g), or gravitropism, and (h). In each of these kinds of tropism, a plant, or a part of the plant, bends in response to a different kind of (outside / inside) stimulus.

First, we'll discuss phototropism. The outside stimulus in phototropism is ( ). When a plant is affected by phototropism, it grows in the (d) of a light source such as the Sun. Plants need light for photosynthesis so they have developed responses to help make sure they grow (towards / against) sources of light.

<Your Partner's Part>

The second kind of tropism is geotropism, or gravitropism. In geotropism, the outside stimulus is gravity. In a plant affected by geotropism, the affected part of the plant grows downward because of the pull of gravity. When a plant is affected by geotropism, it's often the root structure that's affected. When roots grow in the direction of the gravitational pull, it is called positive geotropism. The shoots, on the other hand, grow away from the stimulus. This is called negative geotropism.

The final kind of tropism is hydrotropism. When hydrotropism affects a plant, this means that the plant is drawn to water. A plant under the effect of hydrotropism will grow in the direction of its water source as they obviously need water to survive.

Connected to tropism is a plant hormone called Auxin. It is responsible for controlling the direction of growth of root tips and stem tips in response to different stimuli including light, gravity, and water. I will tell you more about Auxin in the next lesson.
That's all for today. I hope you got more interested in plants. Thank you for your attention.

B

<Your Partner's Part>

Today, in this presentation, I'll be talking about the concept of tropism as we have just learned about it in our biology class. Have you ever heard the word "tropism"? The word "tropism" refers to "a bending of a plant in response to an outside stimulus." In other words, a "tropism" is a growth in response to a stimulus.

There are three important kinds of tropism. They are phototropism, geotropism or gravitropism, and hydrotropism. In each of these kinds of tropism, a plant, or a part of the plant, bends in response to a different kind of outside stimulus.

First, we'll discuss phototropism. The outside stimulus in phototropism is light. When a plant is affected by phototropism, it grows in the direction of a light source such as the Sun. Plants need light for photosynthesis so they have developed responses to help make sure they grow towards sources of light.

<Your Part>

The second kind of tropism is geotropism, or gravitropism. In geotropism, the outside stimulus is ( ). In a plant affected by geotropism, the affected part of the plant grows (upwards / downwards) because of the pull of gravity. When a plant is affected by geotropism, it's often the (root / shoot) structure that's affected. When roots grow in the direction of the gravitational pull, it is called (positive / negative) geotropism. The shoots, on the other hand, grow (towards / away) from the stimulus. This is called (positive / negative) geotropism.

The final kind of tropism is hydrotropism. When hydrotropism affects a plant, this means that the plant is drawn to ( ). A plant under the effect of hydrotropism will grow in the direction of its water source as they obviously need water to (s).

Connected to tropism is a plant (h) called Auxin. It is responsible for controlling the (d) of growth of root tips and stem tips in response to different stimuli including light, gravity, and water. I will tell you more about Auxin in the next lesson.
That's all for today. I hope you got more interested in plants. Thank you for your attention.

Tropism

Tropism

bending of a plant or a part of a plant in response to an outside stimulus.

*Photo*tropism
*Geo*tropism
*Hydro*tropism

Phototropism

Geotropism

Hydrotropism

Conclusion

Tropism

★Design an experiment to prove the effect of phototropism, geotropism, or hydrotropism using a plant. Observe and describe its growth. You should also take a photo and paste it in the box below.

Key Words: stimulus, respond/response, bend, affect, direction, tropism

No Name

Topic 5: Echolocation

Today, I'll be talking about whales, specifically about how whales use echolocation. Do you know what echolocation is? Well, in broad terms, it's a technique used by whales to determine what's going on in their surroundings. The term, *echolocation* is composed of two ideas, *echo* and *location*. Basically, echolocation refers to the technique of using sound waves and echoes to determine the location of whatever is in the surrounding area.

I have a few points to make about echolocation. The first point is that it seems that only toothed whales can use echolocation. I'm sure you understand that some whales have teeth and others don't. It's only the toothed whales that seem to have this ability.

Next, I'd like to talk about what happens during echolocation. A whale uses echolocation by sending out a series of clicks. The clicks then bounce off objects in the water and are reflected back to the whale. So, echolocation is a series of clicks which are sent out by a whale that bounce off objects, and are then reflected back to the whale.

Now, what is it exactly that a whale can learn from these clicks that bounce off an object? Actually, they can learn quite a bit.　A whale can learn the size and shape of objects that are out there. But that's not all. From the reflected clicks, a whale can learn more than the size and shape of an object. It can also understand how far away the object is and if the object is moving. Additionally, the whale can understand how fast the object is moving and what direction it's moving.

That's all for today. Until the next lesson, I would like to ask you to do more research about echolocation. Please find out some different, but interesting facts about it on the Internet.

(304 words)

出典改訂：Preparation Course for TOEFL iBT, Longman

A

<Your Part>

Today, I'll be talking about whales, specifically about how whales use ( ). Do you know what echolocation is? Well, in broad terms, it's a ( ) used by whale to determine what's going on in their ( ). The term, *echolocation* is composed of two ideas, *echo* and *location*. Basically, echolocation refers to the technique of using sound waves and ( ) to determine the location of whatever is in the surrounding area.

I have a few points to make about echolocation. The first point is that it seems that only ( ) whales can use echolocation. I'm sure you understand that some whales have teeth and ( ) don't. It's only the toothed whales that seem to have this ( ).

<Your Partner's Part>

Next, I'd like to talk about what happens during echolocation. A whale uses echolocation by sending out a series of clicks. The clicks then bounce off objects in the water and are reflected back to the whale. So, echolocation is a series of clicks which are sent out by a whale that bounce off objects and are then reflected back to the whale.

Now, what is it exactly that a whale can learn from these clicks that bounce off an object? Actually, they can learn quite a bit. A whale can learn the size and shape of objects that are out there. But that's not all. From the reflected clicks a whale can learn more than the size and shape of an object. It can also understand how far away the object is and if the object is moving. Additionally, the whale can understand how fast the object is moving and what direction it's moving.

That's all for today. Until the next lesson, I would like to ask you to do more research about echolocation. Please find out some different, but interesting facts about it on the Internet.

B

<Your Partne's Part>

Today, I'll be talking about whales, specifically about how whales use echolocation. Do you know what echolocation is? Well, in broad terms, it's a technique used by whale to determine what's going on in their surroundings. The term, *echolocation* is composed of two ideas, *echo* and *location*. Basically, echolocation refers to the technique of using sound waves and echoes to determine the location of whatever is in the surrounding area.

I have a few points to make about echolocation. The first point is that it seems that only toothed whales can use echolocation. I'm sure you understand that some whales have teeth and others don't. It's only the toothed whales that seem to have this ability.

<Your Part>

Next, I'd like to talk about what happens during echolocation. A whale uses echolocation by sending out a series of clicks. The clicks then ( ) off objects in the water and are reflected back to the whale. So, echolocation is a series of ( ) which are sent out by a whale that bounce off objects and are then reflected back to the whale.

Now, what is it exactly that a whale can learn from these clicks that bounce off an object? Actually, they can learn quite a bit. A whale can learn the ( ) and ( ) of objects that are out there. But that's not all. From the reflected clicks a whale can learn more than the size and shape of an object. It can also understand how ( ) away the object is and if the object is ( ). Additionally, the whale can understand how ( ) the object is moving and what ( ) it's moving.

That's all for today. Until the next lesson, I would like to ask you to do more research about echolocation. Please find out some different, but interesting facts about it on the Internet.

Whales
- Echolocation -

Echolocation

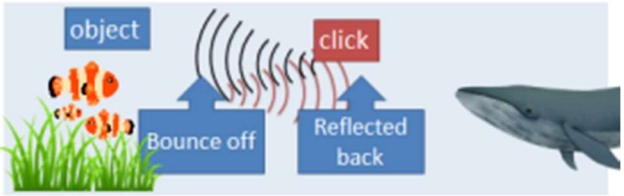
The technique of using echoes to determine the location of whatever is in the surrounding area.

What whales can use this technique?

Toothed whales

Other whales

What happens during echolocation?



What can a whale learn from these clicks?

- The size and shape
- How far
- If it is moving
  - how fast
  - what direction

Conclusion

Echolocation

★Summarize the passage (DO NOT COPY any single sentence). Write your own original question about echolocation and provide an answer for it.

No. Name

<Short essay>

<Question>

<Answer>

Topic 6: Animal Hearing

Today, I would like to talk about how different types of animals hear. Many animals have sense organs that allow them to process sound waves. However, the sense organs are structured in very different ways in different types of animals.

First, let's look at the hearing abilities of some insects. A cricket, for example, has thin membranes that vibrate when sound hits them. The thin "hearing" membranes on a cricket are found on the side of each front leg.

Second, we'll take an example of an amphibian. The frog has large disks that serve as eardrums. These disks are located farther back on the head behind each eye. The disks, or eardrums, behind each eye vibrate when sound hits them.

Third, let's look at the hearing of birds and bats. Birds have external auditory canals. The auditory canal on a bird is just an opening that leads to the middle and inner ear, and this auditory opening on a bird is usually covered with feathers. Birds don't have auricles, which are external parts of the ear that protrude from the body. Bats are not birds; they're mammals. And like most mammals, they have auricles. Bats are dependent on their hearing to navigate in the dark; they have very effective auricles that move to enhance their ability to pick up sound waves as they enter the ear.

Furthermore, let's look at some other types of mammals, the elephant and the rabbit. Mammals are the only animals that have auricles, and elephants and rabbits are mammals, so they have auricles. The auricles of the African elephant are the largest of any animal, and rabbits have auricles that are unusually large in proportion to their bodies. These large auricles allow heat to escape the body.

Finally, let me tell you about echolocation. Some animals are dependent on their hearing to navigate in the dark. Animals that use echolocation produce sounds and listen for echoes as the sound waves are reflected off of objects around them. They use echolocation to determine how far away the objects are and if the object is moving. Bats and whales are two animals that navigate using echolocation, and there are many more.

Today we've discussed the types of hearing organs that various animals have. You should be familiar with animals that have external vibrating membranes, auditory canals, auricles, as well as animals that use echolocation.

Thank you for listening.

(401 words)

出典改訂：Preparation Course for TOEFL iBT, Longman

A

<Your Part>

Today, I would like to talk about how different types of animals hear. Many animals have sense organs that allow them to process sound waves. However, the sense organs are structured in very different ways in different types of animals.

First, let's look at the hearing abilities of some insects. A cricket, for example, has thin (**m**) that vibrate when (**sound / objects**) hits them. The thin "hearing" membranes on a cricket are found on the side of each front (**eye / leg**).

Second, we'll take an example of an amphibian. The frog has large drums that serve as (**e**). These disks are located farther back on the head (**behind / in front of**) each eye. The disks, or eardrums, behind each eye vibrate when sound hits them.

Third, let's look at the hearing of birds and bats. Birds have external (**visual / auditory**) canals. The auditory canal on a bird is just an (**opening / closing**) that leads to the middle and (**inner / outer**) ear, and this auditory opening on a bird is usually covered with (**f**). Birds don't have auricles, which are external parts of the (**ear / eye**) that protrude from the body. Bats are not birds; they're (**reptiles / mammals**). And like most mammals, they have (**a**). Bats are dependent on their (**seeing / hearing**) to navigate in the dark; they have very effective auricles that move to enhance their ability to pick up sound waves as they enter the ear.

<Your Partner's Part>

Furthermore, let's look at some other types of mammals, the elephant and the rabbit. Mammals are the only animals that have auricles, and elephants and rabbits are mammals, so they have auricles. The auricles of the African elephant are the largest of any animal, and rabbits have auricles that are unusually large in proportion to their bodies. These large auricles allow heat to escape the body.

Finally let me tell you about echolocation. Some animals are dependent on their hearing to navigate in the dark. Animals that use echolocation produce sounds and listen for echoes as the sound waves are reflected off of objects around them. They use echolocation to determine how far away the objects are and if the object is moving. Bats and whales are two animals that navigate using echolocation, and there are many more.

Today we've discussed the types of hearing organs that various animals have. You should be familiar with animals that have external vibrating membranes, auditory canals, auricles, as well as animals that use echolocation.

B

<Your Partner's Part>

Today, I would like to talk about how different types of animals hear. Many animals have sense organs that allow them to process sound waves. However, the sense organs are structured in very different ways in different types of animals.

First, let's look at the hearing abilities of some insects. A cricket, for example, has thin membranes that vibrate when sound hits them. The thin "hearing" membranes on a cricket are found on the side of each front leg.

Second, we'll take an example of an amphibian. The frog has large disks that serve as eardrums. These disks are located farther back on the head behind each eye. The disks, or eardrums, behind each eye vibrate when sound hits them.

Third, let's look at the hearing of birds and bats. Birds have external auditory canals. The auditory canal on a bird is just an opening that leads to the middle and inner ear, and this auditory opening on a bird is usually covered with feathers. Birds don't have auricles, which are external parts of the ear that protrude from the body. Bats are not birds; they're mammals. And like most mammals, they have auricles. Bats are dependent on their hearing to navigate in the dark; they have very effective auricles that move to enhance their ability to pick up sound waves as they enter the ear.

<Your Part>

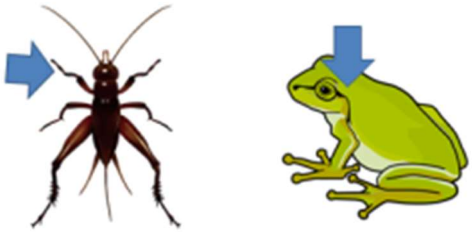
Furthermore, let's look at some other types of mammals, the elephant and the rabbit. Mammals are the only animals that have (**a**), and elephants and rabbits are (**m**), so they have auricles. The auricles of the African elephant are the (**smallest / largest**) of any animal, and rabbits have auricles that are unusually large in (**p**) to their bodies. These large auricles allow (**h**) to escape the b1 qeedy.

Finally let me tell you about (**e**). Some animals are dependent on their hearing to navigate in the (**d**). Animals that use echolocation produce sounds and listen for echoes as the sound waves are reflected off of objects around them. They use echolocation to determine how (**f**) away the objects are and if the object is moving. Bats and ( ) are two animals that navigate using echolocation, and there are many more.

Today we've discussed the types of hearing organs that various animals have. You should be familiar with animals that have external (**v**) membranes, auditory (**c**), auricles, as well as animals that use ( ).

Animal Hearing

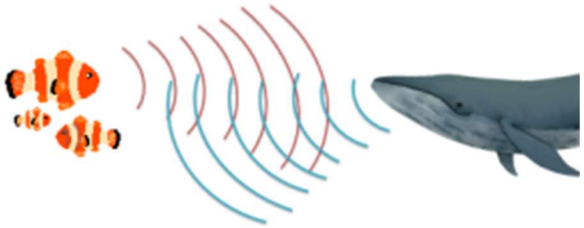
Insects/Cricket
Amphibian/Frogs



Birds/Bats

Mammals/Elephants and Rabbits

Echolocation



Conclusion

Animal Hearing

★Why do crickets have “hearing” membranes on the side of each front leg? Think about the reason why and write an essay about your opinion. Your essay should consist of an introduction, body and conclusion.

No. Name

Key Words Speech（それぞれ名刺サイズに切り取って、再生スピーチを行いましょう）

Lava in Hawaii
- ☐ magma
- ☐ Pahoehoe
- ☐ ropy
- ☐ Aa
- ☐ sharp, rough
- ☐ pillow
- ☐ Kilauea
- ☐ much spreading
- ☐ Pele, goddess
- ☐ tear, hair

Subaru Telescope
- ☐ Mauna Kea
- ☐ weight/height
- ☐ vision/magnitude
- ☐ size of the mirror
- ☐ White Mountain
- ☐ 4,200
- ☐ dark sky
- ☐ stable atmosphere
- ☐ low humidity
- ☐ computer screen

Insectivorous Plants
- ☐ trap
- ☐ carnivore / herbivore
- ☐ insect
- ☐ nutrient
- ☐ nitrogen
- ☐ Venus flytrap
- ☐ snap
- ☐ trap leaves
- ☐ sensory bristle
- ☐ digestive liquid

Tropism
- ☐ tropism
- ☐ bend
- ☐ stimulus
- ☐ photo-
- ☐ sun
- ☐ geo-
- ☐ gravity
- ☐ downward
- ☐ hydro-
- ☐ water

Echolocation
- ☐ whales
- ☐ technique
- ☐ surroundings
- ☐ toothed whales
- ☐ a series of clicks
- ☐ bounce off
- ☐ reflect back
- ☐ the size and shape of objects
- ☐ how far away/how fast
- ☐ what direction

Animal Hearing
- ☐ cricket
- ☐ thin membrane
- ☐ amphibian
- ☐ disks
- ☐ auditory canal
- ☐ bird
- ☐ auricle
- ☐ bat
- ☐ mammal
- ☐ echolocation

Presentation Contest on Science Topics

Date: _____

Place: _____

Topics for Presentation

- Lava in Hawaii
- Subaru Telescope
- Insectivorous Plants
- Tropism
- Echolocation
- Animal Hearing

＜条件＞

- 上記の 7 つの既習トピックより、1 つ、自分が最も興味を持ったものを選ぶ（各トピック 5 名～6 名のグループを編成）
- プレゼンテーションの前半を授業で学んだことのサマリー、後半をそれに関連する新しい情報とし、グループ内で分担する
- 一人 250words 程度の原稿を作成する（2 分間でスラスラ読める長さ）
- 持ち時間は各グループ 10 分間(時間厳守)
- PPT の枚数に制限は設けない(過度なアニメーションを使用しない)
- 発表台本を持つことは禁止

＜評価の高い発表＞

- ☐ 聴衆の知的好奇心を刺激する、興味深い科学内容のプレゼンテーションである
- ☐ 授業で学んだ内容に基づいた疑問に答えた内容である
- ☐ サマリーを担当するもの→オリジナルな構成に基づいた魅力的な展開になっている
- ☐ 「この内容を伝えたい！」というパッションがある
- ☐ これまでに小テストを行ってきた Idiom や単語を上手に発表原稿に取り入れている
- ☐ 聴衆の語彙レベルを把握し難解語句は言い換えるとともに、自分の言葉で豊かに表現できている
- ☐ アイコンタクト、ジェスチャー、声の大きさ、抑揚など、発表態度がよい
- ☐ 発音に注意し、イントネーションや強勢などが正確な英文が話されている

原稿提出 _____→_____に添削後返却

Presentation Script

Title: Class No. Name

Science Topic Presentation Contest / Evaluation Sheet　Name＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

A : Delivery（**発音、声の大きさ、アイコンタクト、ジェスチャー、抑揚、話すスピード**などを総合的に見て）

B : Content（**オリジナル性、豊かな内容、分かりやすさ、メッセージ性、スライド作成**などを総合的に見て）

5 大変素晴らしい　**4** 素晴らしい　　**3** 普通　　**2** もう少し　**1** もっと頑張ろう！

	A	B	合計	タイトル	コメント
1				Lava in Hawaii	
2				Subaru Telescope	
3				Insectivorous Plants	
4				Tropism	
5				Biomimicry	
6				Echolocation	
7				Animal Hearing	

1 位	2 位	3 位

みなさんが記入したコメントは各グループに渡します。上位 3 グループは次回授業で表彰！

裏に続く⇒

＜アンケート＞

1. 今回の発表を終えての感想（自分の発表を終えて、よかったところ、改善すべきところ）

2. 今回の発表を終えての感想（クラスメイトの発表を聞いて、よかった人の名前とその理由）

3. 今回のサイエンストピックの授業を通してあなたの「発表する力」は鍛えられたと感じますか。

（大変そう思う　― そう思う　― そう思わない　― まったくそう思わない）

4. 今回のサイエンストピックの授業を通してあなたの「考える力」は鍛えられたと感じますか。

（大変そう思う　― そう思う　― そう思わない　― まったくそう思わない）

5. 今回のサイエンストピックの授業を通してあなたの「発想力」は鍛えられたと感じますか。

（大変そう思う　― そう思う　― そう思わない　― まったくそう思わない）

6. 今回のサイエンストピックの授業を通してあなたの「疑問を持つ力」は鍛えられたと感じますか。

（大変そう思う　― そう思う　― そう思わない　― まったくそう思わない）

7. 今回のサイエンストピックの授業を通してあなたの「質問する力」は鍛えられたと感じますか。

（大変そう思う　― そう思う　― そう思わない　― まったくそう思わない）

8. その他、力がついたと感じる人はどんな力がついたと感じますか。

9. 大勢の前で英語で発表する、ということに関して今のあなたの一番大きな課題はなんですか。

10. 発表を聞いた後に、発表者に質問をする、ということに関して今のあなたの一番大きな課題はなんですか。

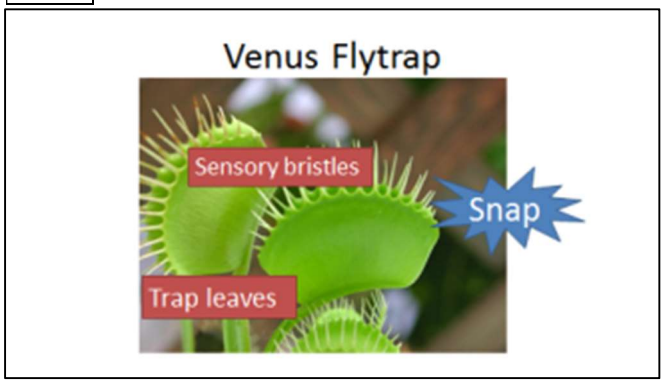
11. ペアやグループで発表活動を行うことのメリット、デメリットは何だと思いますか。

12. 今回のプレゼンテーション大会を踏まえて、今後どのように英語を学習していく必要があると思いますか。

13. 自由記入

＜定期テストへの出題例＞

1 【Insectivorous Plants】Fill in the gaps of the presentation script with the correct word.（8）



All insectivorous plants contain (　1　) and have roots, so they do not get all of their (　2　) from the insects they take in. Insectivorous plants tend to live in soil that does not have enough (　3　) for them to exist, so they consume their insect victims in order to get it.

Look at the drawing of one of the insectivorous plants, a Venus flytrap. The Venus flytrap (　4　) insects by suddenly snapping the ends of one of its trap leaves around an insect. You can see that a Venus flytrap has a number of trap leaves and that each trap leaf is divided into two parts. Inside the two parts of the trap leaf are three sensory bristles, which resemble tiny hairs.

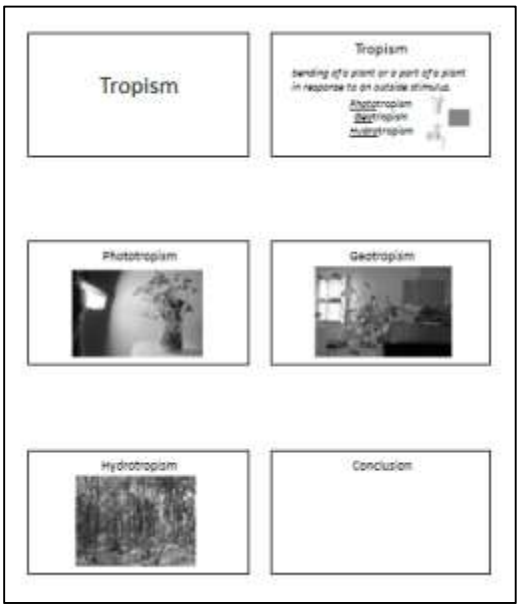
When an insect (　5　) the sensory bristles inside a trap leaf, the two surfaces of the leaf (　6　) instantaneously, and the insect is trapped inside the parts of the leaf. The Venus flytrap then (　7　) a digestive liquid into the leaf in order to (　8　) the insect and obtain the thing that the plant needs in order to survive.

That's all for today on the Venus flytrap. I hope that you have developed a clear understanding of how the Venus flytrap and other insectivorous plants function.

2 【Lava/Subaru】Answer the following questions in English. Your answer should include a subject and a verb. <u>The answer should be more than two sentences (or more than 20 words).</u>（12）

1. What are the features of Aa lava? Mention two.
2. Why does the lava make different shapes? Explain.
3. What is Kilauea and what is the meaning of the word?
4. What are the key numbers of the Subaru telescope? Mention two.
5. Why is the summit of Mauna Kea suitable for astronomical observation?
6. Why is the shape of the Subaru telescope a cylinder?

3 【Tropism】Write a presentation script about tropism based on the six slides below. (8)



解答となる英文の作成条件

●120words 以上のプレゼンテーションの台本とすること

●始めと終わりの言葉、聴衆への質問など、プレゼンテーションを魅力的にするものを含むこと

●3 つの Tropism についてその性質や特徴を述べた理解しやすいものとすること

●2 枚目のスライドは隠れているキーワードを再現して書き起こすこと

文法の正確さ、適切なキーワードを使用した豊かな内容、の 2 つの要素から採点することとする。

＜それぞれのトピックで今までに行って授業が活性した授業内の工夫と二時間目に行う議論の議題＞

Lava in Hawaii

トピック導入時の工夫:簡単な導入の後、Aa lava, Pahoehoe lava, Pillow lava、Pele's tear と Pele's hair などの lava の写真を 20 枚ほど見せ、どの lava か生徒と共に確認する。Aa lava と Pahoehoe lava が重なり合っている画像や、Lava Tree や Lava Tunnel の画像なども見せ説明を加える。加えて海岸に流れ落ちる溶岩や吹き出る溶岩などの迫力ある映像がネット上に豊富にある。特に Aa lava や Pahoehoe lava がドロドロと流れている動画を共に視聴すると生徒の興味をひきやすい。

- U.S. Geological Survey https://hvo.wr.usgs.gov/
- USGS photo glossary of volcanic terms https://volcanoes.usgs.gov/vsc/glossary/

2 時間目の議論の議題:「現地に行ったときにどのようなミニ調査をしてみたいか？」本校では 7 月に希望者対象のハワイ科学研修があるのでこのトピックの設定がしやすい。生徒から出てくるものはそれぞれの溶岩を叩いてみて音の違いを確かめる、ものを溶岩に投げ入れてその破壊力を確かめる、など。

Subaru Telescope

トピック導入時の工夫：最初の導入時にいくつかの数字（重さや大きさなど）に図形をかぶせておき、クイズ形式で紹介すると単純なクイズなので答えやすく盛り上がる。なぜマウナケアが天体観測に適しているのか、これほどの天文台が集まっているのかなど答えを言う前に質問を投げかけペアで 2 分ほど議論させる時間をとることで、生徒は主体的に考え思考力が深まる。マウナケアに建設予定であった Thirty Meter Telescope(TMT)計画が頓挫していること、その次の候補地などについて話題も興味深い。すばる天文台で得られた宇宙の画像は大変美しく、その画像を見せると生徒は歓喜の声を上げる。

- Subaru Telescope NAOC http://www.naoj.org/Introduction/index.html

2 時間目の議論の議題:「ほとんどの天文台はドーム型であるのに、なぜすばる天文台は円筒型なのか？」この議題を提示する前にマウナケア山頂の天文台の写真をいくつか見せ、生徒自身がまずすばるのみ形が異なることに気づくよう促す。生徒が考えてくるものは、コストが低く抑えられる、屋上に太陽光パネルを置き自家発電できる、空間が広くなる、など。実際には斜面に近い場所に立つすばる天文台はドーム型だと中央に空気の揺らぎが起こりやすく、その大気を上に逃がすために円筒型にデザインされた。

Insectivorous Plants

トピック導入時の工夫：食虫植物の写真を見せる前に、想像して描いてみようと促し、上手な生徒に黒板にかかせるとよい導入になる。Venus Flytrap のほかにウツボカズラなどの写真も見せ、中にはネズミまで溶かしてしまう食虫植物がいることを紹介すると生徒は驚きの声を上げる。ネット上に食虫植物の画像や映像は豊富にあり、実際に虫が食虫植物に食べられそうで食べられない、逃げられそうで逃げられない、最終的にはとらえられてしまうような画像をクラスで視聴すると大変盛り上がる。

- Insect Flesh Eater -The Carnivorous Venus Flytrap Versus The Spider https://www.youtube.com/watch?v=Ok0oX0Wxnio

2 時間目の議論の議題：

「想像上の食虫植物をデザインしその特徴と食虫の仕方を説明しよう」高校生の発想力は大変豊かで、こちらの想像を上回る面白い植物がデザインされてくる。科学的要素を含ませるため、どのように虫をおびき寄せるか、どこでそれを感知しどのようにとらえるのか、どのように虫を溶かし吸収するのか、などの説明も加えるよう指示する。書いてきた絵は教材提示装置などで全体で共有できるとよい。

Tropism

トピック導入時の工夫：3 つの Tropism を紹介したのち、さまざまな Tropism の写真を見せ、どの Tropism にあたるかクラス全体で確認する。その後 Thigmotropism, Chemotropism, Thermotropism, Electrotropism なども紹介し、刺激はそれぞれ何であるか考えさせる。食虫植物は Thigmotropism の一種であることを紹介し前時と関連させる。

クイズ 1：光を遮断した箱の片側に色セロファンを貼って光を送った時、何色のセロファンを通した光に植物は最も反応するか(光屈性)⇒青色にもっともよく反応する。クイズ 2：光も水も重力もない場所で植物はどのように伸びていくか⇒くるくると渦巻く。宇宙での実験などで確認。それらを示す画像などがあれば説得力が増す。

2 時間目の議論の議題：「光屈性、重力屈性、水屈性をいずれかを示す実験を行い写真を一枚撮ってくる」スーパーで簡単に手に入る豆苗などで 3 日もあれば自宅で行える実験である。事前に 3 人グループで 3 つの屈性のいずれの実験を行うか決めておく。豆苗を使用するのであれば、横向きに倒し重力で下がっていた芽が次第に上がっていく重力屈性が最も簡単に撮影できると思われる。光屈性や水屈性は意外に難易度が高い。簡単な実験だが、案外条件設定が難しく、思うような結果が得られないことで生徒たちが学びを得ることを期待する。自分たちで実験を行ったことを前提に以下の議論を促す。

議論 1：水屈性と重力屈性ではどちらの力が強いか、またそれを調べるためにどのような実験装置が考えられるか⇒根っこを下向きに置いた植物の葉の上部に水に濡らしたコットンを置く。しばらくは重力屈性に従って根は下向きに伸びていくが、次第に水を求めて上側に伸びようとする。水屈性が優勢。

議論 2：重力屈性と光屈性ではどちらの力が強いか。またどのような実験装置が可能か。⇒光屈性

以下の映像で確認できる。

- Experiment time-lapse: Botany 223 Vancouver Island University/ Phototropism Vs. Gravitropism: Basil Plant https://www.youtube.com/watch?v=RzD4skFeJ7Y

光か重力かなかなか定まらない植物の様子に生徒は好奇心いっぱいで視聴すること間違いない。

また、もう一つの議題として、「屈性を利用して環境にやさしく道路沿いの雑草を除去する方法」を考えさせ議論させるというものも難しいが興味深い。正解に近い答えを考えてくるものが 1 割ほど出る。

- 防草ブロック　https://www.precast-takamisawa.com/products/curb/post.php

Echolocation

トピック導入時の工夫：このトピックは 2 時間目がハイライトであるので 1 時間目はどちらかというと特に面白い情報の提供ができず、プレゼンの指導に時間を割く。

- クジラのクリック音

http://collections.tepapa.govt.nz/exhibitions/whales/segment.aspx?irn=163

- エコロケーションの歌（真面目に導入してから聞かせると盛り上がります）

https://www.youtube.com/watch?v=5mwoOyOleGc

2 時間目の議論の議題：「このトピックで疑問に思ったこと、またそれに対する自分なりの解答」英語での発表会などで会場で質問ができる力を養成する。ここでは Echolocation の授業を受けて、疑問に思ったこと、知りたいと思ったことと自分なりに考えた答えを書いてくるというのが課題である。その中で必ず「エコロケーションは人にも応用できるのか」という疑問とその答えを考えてきている生徒が数名いるはずである。そこを深め、クラス内議論に発展させる。以下の TED TALK 等は聞きやすくまた面

白く、生徒は大変興味を持って視聴する。

■　エコロケーションを使う盲目の Daniel Kish の話

https://www.youtube.com/watch?v=A8lztr1tu4o

■　Daniel Kish の TED TALK

https://www.youtube.com/watch?v=uH0aihGWB8U

■　Extraordinary People - The boy who sees without eyes [2/5]

https://www.youtube.com/watch?v=G1QaCeosUmw

Animal Hearing

トピック導入時の工夫：実際のコオロギの写真から Hearing Membrane を拡大した画像、鳥の耳（穴）、カエルの Disc の画像など、視覚教材をふんだんに取り入れる。なぜ象やウサギは体に対して耳が大きいのか？哺乳類の定義とは何か？随時 1 分程度のペア議論を挟みながら活発に授業を進めていく。

2 時間目の議論の議題：「なぜコオロギの聴覚は前足についているのか」生徒からの回答は「地面に近いと振動がより早く伝わる」「前足は角度を変えやすいので音の方向に向けることができる」など。

＜2015 年度高校 3 年生を対象とした Animal Hearing の 1 時間目にあたる授業を You Tube で公開しています。ご覧ください。＞

2015 年 11 月 20 日

第 21 回全国私立大学附属・併設　中学校・高等学校　教育研究集会

高校 3 年 6 組公開授業　授業者　武田菜々子

■　https://www.youtube.com/watch?v=pr5ilYGGfMA

おわりに

当初、SSH 活動と英語教育は相性が悪いと思いながら悶々と授業をしていました。国際科学教育の効果を確信するに至った今では、SSH 活動はこれからの英語教育を発展させるための最高のコンテンツだと感じています。

今年度本校では、SSH 意識調査の「海外機関との連携による科学英語の力の向上」という項目において高校 2 年生、3 年生の両学年からから 100%の肯定的な回答を得ました。うち、「大変効果あり」と最も強い肯定感を表す回答を、卒業前の 3 年生では 82.8%の生徒が、1 年間の Science English の授業を終えた 2 年生では 60.5%の生徒が選んでいます。Science English の授業などで身に着けた科学英語の力が、実際の国際科学交流場面での有用感につながり、生徒たち自身がその力の向上を実感していることを示すこの結果は大変嬉しいものでした。

本校では、英語授業改革と豊富な国際科学交流場面の提供によって、この 15 年間で生徒の英語運用力、英語プレゼンテーション力、国際場面での生徒の振る舞いが劇的に変化しました。近年は特に国際舞台でリーダーシップをとれる生徒の養成を目標としていますが、国際的なの議論や発表会の際にも積極的に海外生を引っ張っていく力を持つ生徒たちが多く出てきたことを頼もしく思っています。

高校時代にこのような経験を得た生徒たちの大学や社会での活躍は大きく、国際学会での発表、海外の大学への進学、海外でのインターンシップ、グローバル企業への就職など、「高校時代の経験がなければ踏み出せませんでした」との言葉と共に報告を聞くたびに、この SSH での国際科学教育が生徒たちの将来につながったのだと、その姿を何より誇りに思います。これからのグローバル社会で活躍する人材を輩出するためには大学からの英語教育、国際教育では間に合わないでしょう。SSH 校として何を変えていけるのか、どのように貢献していけるのか、これからも考えながら国際科学教育と向き合っていきたいと思っています。

この教材集に関して、ご忌憚のないご意見を賜れればと存じます。

2017 年 3 月

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