if は条件として「不確実な未来の状態や動作」を表す。
when は「確実性の高い未来の出来事」を表す。

例 1

When we talk about static electricity, we are referring to electrons that are transferred from one place to another without flowing in a current.

例 2

However, **if** the wire is looped in a circular manner to form a helix, the magnetic effect of current will increase.

例 3

Do electrical appliances still use electricity **when** they are turned off? Yes, they do! For example, **when** an appliance has a LED or clock display, it will still be using power even **if** the appliance isn't turned on. This might be one watt of power. One watt may not sound like a lot, but **if** you have 20+ electrical appliances in your home using just 1 watt of power, that's 20 watts being used!

Spotting Vampire Electronics
Many devices constantly draw power while plugged in, which can quickly add up on monthly electric bills. Keep an eye out for the following clues as to what should be unplugged when not in use.

External power supplies: *Computers, printers*

Remote controls: *Window AC units, TVs, DVD players*

Digital displays: *washing machines, microwaves, VCRs*

Rechargeable batteries: *Battery charges, cordless telephones, power tools*

Think ▸ **Read Science topics 1 and 2 again. Underline the uses of when and if.**

The language of chemistry 化学の言語の特徴を理解しよう

受動態（**be**＋過去分詞）は、事実や結果に焦点を置き、順序を明確にするのに都合がよい。

例 1

A pure liquid can **be separated** from a mixture of liquids in a solution by fractional distillation.

例 2

The crude oil **is boiled** and **evaporated**, and its vapors can condense at different temperatures in the fractionating column.　　　　　(Science topic 1)
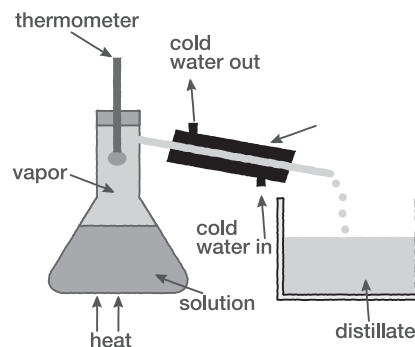
例 3

Because of dead birds and spilled oil, water sports, fishing and other outdoor activities cannot **be enjoyed.**　　　　　　　　　(Science topic 2)

例 4

The success of a distillation can **be evaluated** by collecting temperature and spectroscopic data as the fractions are **being separated**.

例 5

Distillation **is** commonly **used** to separate ethanol – the alcohol in alcoholic drinks – from water.

thermometer
cold water out
vapor
cold water in
solution
distillate
heat

Think ▶ **Read Science topics 1 and 2 and find passive voice expressions. Underline them and think how they are used.**
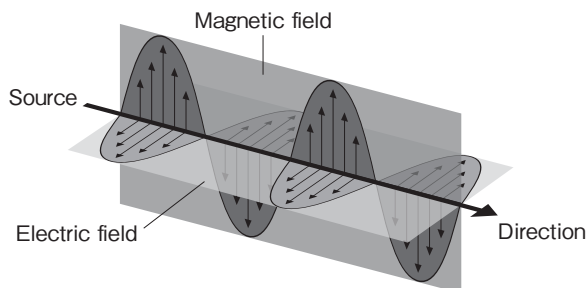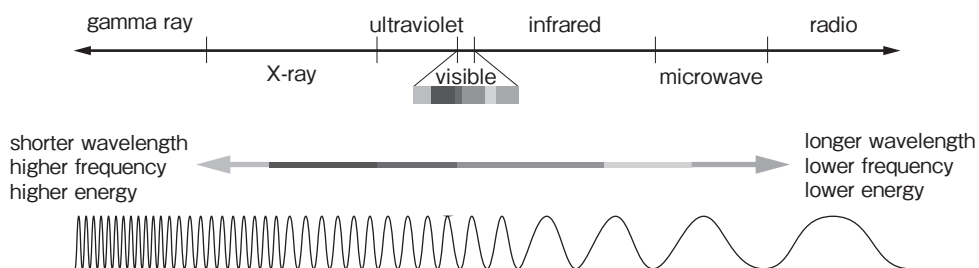
5　Science topic 2　読んで考えよう

051
CD 2-20
Electromagnetic waves and radiation　電磁波と放射線

Think ▶ **What color of light has the most energy?**

Electromagnetic waves are vibrations of electric and magnetic fields. The two fields are oriented perpendicular to each other, and the wave travels in a direction perpendicular to both of the fields. Electromagnetic waves can travel through a vacuum at the speed of light.

The transfer of energy by electromagnetic waves is called 'electromagnetic radiation'. Electromagnetic radiation comes in many forms that our eyes cannot see including X-rays, ultraviolet (UV) and gamma rays, and it can be described by frequency, wavelength or energy. Lower-energy radiation, such as radio waves and microwaves, is usually represented as frequency. Microwaves, infrared (IR) light, visible light and UV light are often expressed as wavelength. And higher-energy radiation, such as gamma rays and X-rays, is also commonly considered as energy. The energy of an electromagnetic wave is directly proportional to its frequency and inversely proportional to its wavelength. The higher energy the wave has, the higher frequency and the shorter wavelength it has. Given this relationship, you can understand what color of visible light has the most energy.

electric field 電場　magnetic field 磁場　perpendicular to 〜に垂直な　vacuum 真空　infrared 赤外線　visible light 可視光線　proportional 比例の

Science quiz できるかな？

1) Integration and differentiation are inverses of each other.

  a) True   **b)** False

2) $\int dx = C$ is a correct formula.

  a) True   **b)** False

3) Although $x = a$ is a critical point for f(x), f(x) does not necessarily have a local minimum or local maximum at $x = a$.

  a) True   **b)** False

4) Which is a maximum value of $y = x^3 - 3x$?

  a) (-2, -2)   **b)** (-1, 2)   **c)** (1, -2)   **d)** (2, 2)

5) The integral of $y = 2x$ is _____.

  a) 2   **b)** 4   **c)** x **d)** x^2

6) The derivative of $2x + 4$ is _____.

  a) 2   **b)** 4   **c)** x **d)** x^2

7) For the function x^2, the slope at $x = 1$ is 2 and the slope at $x = 5$ is ____.

  a) 2   **b)** 4   **c)** 10   **d)** 25

8) The gradient of the curve $y = x^2 - 5x + 6$ is zero at _____.

  a) $x = 2$ **b)** $x = 2.5$ **c)** $x = 3$ **d)** $x = 6$

9) Which of the following is the derivative of $y = x^2 + 4$?

  a) $\frac{d}{dx} = 2x + 4$ **b)** $\frac{d}{dx} = 2x$ **c)** $\frac{d}{dx} = 2x^2$ **d)** 4

10) What is the area under the function $y = 3x$?

  a) $1.5x^2$ **b)** $2x^2$ **c)** $3x^2$ **b)** $6x$
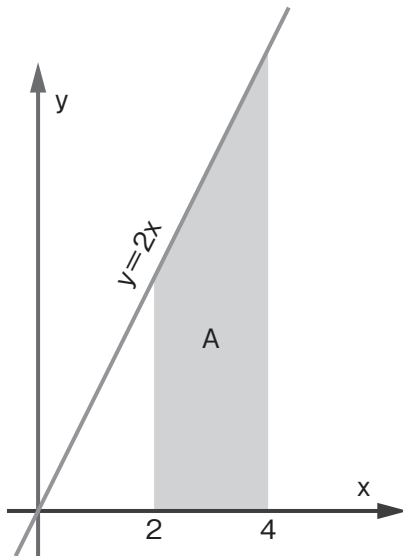
5 The language of math 数学の言語の特徴を理解しよう

グラフ上で積分や面積を表す場合、前置詞がよく使われる。

・区間　　**from** A **to** B, **between** A **and** B
・位置　　area **under** the function $f(x)$, at x = 1

例

Find the area **under** the function y = 2x **between** x = 2 **and** x = 4.

The area A can be found by subtracting the indefinite integral **at** x = 2 **from** that **at** x = 4.

The indefinite integral is: $\int 2x\ dx = x^2 + C$

At x = 2: $\int 2x\ dx = 2^2 + C$
At x = 4: $\int 2x\ dx = 4^2 + C$

Subtract: $(4^2 + C) - (2^2 + C) = 4^2 + C - 2^2 - C$
$= 16 - 4 + C - C$
$= 12$

The definite integral, **from** 2 **to** 4, **of** $2x\ dx$:
$\int_2^4 2x\ dx = [x^2]_2^4 = 4^2 - 2^2 = 12$

Think ▶ Read Math topic again. Underline the prepositions and check how they are used.

6 Self-assessment checklist 学習理解の自己評価

	100%	70%	30%
I understand more about **differentiation and integration**.			
I have learned words and phrases related to **differentiation and integration.**			
I have thought about **differentiation and integration**.			
I have utilized concepts about **differentiation and integration**.			

solar-cell	太陽電池
solid	固体
solution	溶液
split	分裂する
state change	状態変化
steroidogenesis	ステロイド産生
strong acid	強酸
strong base	強塩基
sublimation	昇華（固体→気体）
subshell	副殻
suffix	接尾辞
suffocation	窒息
superheavy	超重元素
synthesize	～を合成する
synthetically	合成的に

T

three states of matter	物質の三態
tin	錫
titrant	滴定剤
trap	閉じ込める
trial and error	試行錯誤

U

undue	過度の
unreasonable	法外な、非現実的な
unstable	不安的な

V

vapor	蒸気
vapor pressure	蒸気圧
vermiculite	バーミキュライト、蛭石
volatile	揮発性の

W

warmer	保湿器
worth	～に値する

Z

zinc	鉛

物理

A

accelerate	加速する

acceleration	加速度
a factor of three	3 倍
ampere	アンペア（電流の単位）
ampere turn	アンペア回数
amplitude	振幅
a police or emergency vehicle	
	警察緊急車両
appliance	電化製品
apply	作用する、加える

B

be proportional to	比例する
by means of	～によって

C

compact fluorescent lamp	
	小さいらせん状蛍光灯 (電球型蛍光灯)
compression	圧縮
conduction	伝導
conductor	伝導体
conventional	従来の
convert	変換する
coulomb	クローン（電荷の単位）
counteract	反対に作用する

D

dashboard	ダッシュボード
discharge	放電する
disturbance	妨害
drawn bow	ピンと張った弓
droplet	水滴

E

elastic potential energy	弾性位置エネルギー
electric(al) circuit	電気回路
electric(al) pressure	電圧 (voltage)
electric charge	電荷
electric field	電場
electricity	電気
electromagnet	電磁石
exert	働かせる

F

filament lamp	白熱電球
flux	流束
force	力

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