



**Cambridge Assessment  
Admissions Testing**



**NAZARBAYEV  
UNIVERSITY**

**Foundation Year Programme**

**Entrance Tests**

**PHYSICS SPECIFICATION**

**For**

**NUFYP SET 2019**



# Physics

## 1. Electricity

### 1.1 Electrostatics:

- a. charging of insulators by friction
- b. object gaining electrons becomes negatively charged
- c. object losing electrons becomes positively charged
- d. forces between charged objects (attraction, repulsion)

### 1.2 Electric current:

- a. conductors and insulators
- b. current = charge / time
- c. use of voltmeter and ammeter
- d. resistance = voltage / current
- e.  $V-I$  graphs for a fixed resistor and a filament lamp
- f. series and parallel circuits – current and voltage rules
- g. resistor combinations in series (but not parallel)
- h. voltage = energy / charge
- i. knowledge of basic circuit symbols and diagrams

### 1.3 Power and energy:

- a. power = current  $\times$  voltage
- b. energy transfer = power  $\times$  time =  $VIt$

## 2. Motion and Energy

### 2.1 Kinematics:

- a. speed = distance / time
- b. acceleration = change in speed / time
- c. distance-time and speed-time graphs
- d. calculations using gradients and areas under graphs
- e. average speed

### 2.2 Forces and motion:

- a. inertia and Newton's first law
- b. momentum = mass  $\times$  velocity
- c. conservation of momentum
- d. Newton's second law: force = mass  $\times$  acceleration
- e. resultant force
- f. difference between mass and weight, and the relationship between them ( $W = mg$ )
- g. gravitational field strength (approximated as 10 N / kg on Earth)
- h. free-fall acceleration
- i. Newton's third law

### 2.3 Energy:

- a. work = force  $\times$  distance moved in direction of force
- b. appreciation of work done as a transfer of energy
- c. potential energy =  $mgh$
- d. kinetic energy =  $\frac{1}{2}mv^2$
- e. power = energy transfer / time

### 2.4 Energy conversion:

- a. law of conservation of energy
- b. forms of energy
- c. ideas of useful energy and wasted energy
- d. percentage efficiency = (useful output / total input)  $\times$  100

## 3. Thermal Physics

### 3.1 Conduction:

- a. thermal conductors and insulators
- b. factors affecting rate of conduction

### 3.2 Convection:

- a. effect of temperature on density of fluid
- b. fluid flow caused by differences in density
- c. factors affecting rate of convection

### 3.3 Radiation:

- a. infrared radiation (see 4. Waves)

### 3.4 Matter:

- a. particle models of solids, liquids and gases
- b. state changes
- c. evaporation
- d. diffusion
- e. density = mass / volume
- f. experimental determination of densities
- g. comparison of densities of the three states

## 4. Waves

### 4.1 Wave nature:

- a. transfer of energy without net movement of matter
- b. transverse and longitudinal waves
- c. examples (including electromagnetic waves, sound, seismic)
- d. amplitude, wavelength, frequency and period
- e. frequency =  $1/\text{period}$ , and the SI unit of frequency is hertz (Hz); 1 Hz means 1 wave per second
- f. speed = distance/time
- g. wave speed = frequency  $\times$  wavelength
- h. graphical representation of waves (including displacement–time and displacement–distance)

### 4.2 Wave behaviour:

- a. reflection at a surface
- b. refraction at a boundary
- c. effect of reflection and refraction on speed, frequency and wavelength
- d. analogy of reflection and refraction of light with that of water waves

### 4.3 Optics:

- a. ray diagrams for refraction at a planar boundary (qualitative only), and reflection (angle of incidence is equal to angle of reflection)

### 4.4 Sound waves:

- a. longitudinal waves
- b. reflection causes echoes

## 5. Electromagnetic Spectrum

### 5.1 EM waves:

- a. nature and properties of electromagnetic waves (transverse, travel at speed of light in vacuum)

### 5.2 The spectrum:

- a. parts of the spectrum (radio waves, microwaves, IR, visible light, UV, X-rays, gamma)
- b. distinction by different wavelengths, frequencies
- c. order of component parts by wavelength, frequency
- d. applications
- e. dangers

## 6. Radioactivity

### 6.1 Atomic structure:

- a. protons, neutrons and electrons
- b. popular models of atomic structure
- c. relative charges and masses of sub-atomic particles
- d. atomic number, atomic mass
- e. isotopes

### 6.2 Radioactive decay:

- a. emissions from the nucleus
- b. random and spontaneous nature
- c. alpha, beta and gamma emission
- d. nature of alpha and beta particles, gamma radiation
- e. radioactive decay equations
- f. effect of decay on atomic number and mass

### 6.3 Ionising radiation:

- a. penetrating abilities of alpha, beta and gamma
- b. ionising abilities of alpha, beta and gamma
- c. applications, dangers and hazards of ionising radiation

### 6.4 Half-life:

- a. decrease in activity over time
- b. graphical representation of decay (including of decay products)
- c. meaning of half-life



Cambridge Assessment Admissions Testing offers a range of tests to support selection and recruitment for higher education, professional organisations and governments around the world. Underpinned by robust and rigorous research, our assessments include:

- assessments in thinking skills
- admissions tests for medicine and healthcare
- behavioural styles assessment
- subject-specific admissions tests.

We are part of a not-for-profit department of the University of Cambridge.

Cambridge Assessment  
Admissions Testing  
The Triangle Building  
Shaftesbury Road  
Cambridge  
CB2 8EA  
United Kingdom

Admissions tests support:  
**[www.admissionstestingservice.org/help](http://www.admissionstestingservice.org/help)**