



**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

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