



Foundation Year Programme

Entrance Tests

PHYSICS SPECIFICATION

NUFYP SET 2017

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 × 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/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.

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:

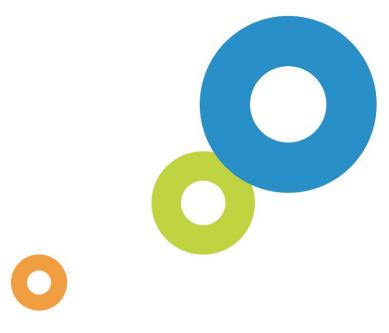
- a. emissions from the nucleus
- b. random and spontaneous nature
- c. alpha, beta and gamma emission
- d. nature of alpha and beta particles, gamma radiation
- e. radioactive decay equations
- f. effect of decay on atomic number and mass.

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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