AS Physics (9702)
Topically sorted definitions

Learner Guide
Section 2: Examination advice
Paper 2 and Paper 4 Structured Questions

"Memorise all definitions – you will need to be as precise as possible when quoting them in the examination. Quantities are defined in terms of quantities. Units are defined in terms of units. Remember to use "per" if a ratio is essential to the definition; for example, "pressure" should be defined as "force per unit area" (not "force on unit area").

1. PHYSICAL QUANTITES AND UNITS

- Scalar quantity [1]
  a scalar quantity has magnitude (only)
- Vector quantity [1]
  a vector quantity has magnitude and direction

2. MEASUREMENT TECHNIQUES

- Precision [1]
  precision is determined by the range in the measurements/values/readings/data/results
  or
  the size of the smallest division (on the measuring instrument)
- Accuracy [1]
  how close measured value is to the true quantity value

3. KINEMATICS

- * Distance [1]
  length/measure of space traversed by a body in motion
- Displacement [1]
  distance in a specified direction (from a point)
- Speed [1]
  rate of change of distance **or** change in distance divided by time taken

$$|v| = \frac{\Delta \mathrm{d}}{\Delta t}$$

- Velocity [1]
  rate of change of displacement **or** change in displacement divided by time taken

$$v = \frac{\Delta s}{\Delta t}$$

- Acceleration [1]
  rate of change of velocity **or** change in velocity divided by time (taken)

$$a = \frac{\Delta v}{\Delta t}$$

4. DYNAMICS

- Mass [1]
  mass is the property (of a body/object) resisting changes in motion
  or
  mass is the quantity of matter (in a body)
- Linear momentum [1]
  product of mass and velocity

$$p = mv$$

- Newton's first law of motion [1]
  a body/mass/object continues (at rest or) at constant/uniform velocity unless acted on by a resultant force
- Force / Newton's second law of motion [1]
  (resultant) force is (proportional **OR** equal to) rate of change of momentum

$$F_{net} = \frac{dp}{dt}$$

- Newton's third law of motion [2]
  force on body A (by body B) is equal (in magnitude) to force on body B (by body A)
  force on body A (by body B) is opposite (in direction) to force on body B (by body A)

$$\pm F_A = \mp F_B$$

- * Weight [?]
  the weight of a body is the force acting on the body due to the gravitational field / the force due to gravity **or** gravitational force

$$W = mg$$

- Principle of conservation of momentum [2]
  sum/total momentum (of a system of bodies) is constant
  or
  sum/total momentum before is equal to sum/total momentum after
  for an isolated system **or** no (resultant) external force

$$\Sigma m_n u_n = \Sigma m_n v_n$$

i.e.

$$m_1 u_1 + m_2 u_2 + \cdots = m_1 v_1 + m_2 v_2 + \cdots$$

5. FORCES, DENSITY AND PRESSURE

- Centre of gravity of a body [1]
  the point where (all) the weight (of the body) is taken to act
- Moment of a force [1]
  force multiplied by perpendicular distance (of line of action of force) to/from a point
- Torque of a couple [2]
  torque is the product of one of the forces
  and the perpendicular distance between the forces

$$T = rF \sin\theta$$

- Principle of moments [2]
  for a body in (rotational) equilibrium
  sum/total of clockwise moments about a point is equal to sum/total of anticlockwise moments about the (same) point
- Density [1]
  mass per unit volume **or** mass divided by volume

$$\rho = \frac{m}{V}$$

- Pressure [1]
  force per unit area (normal to the force)

$$P = \frac{F}{A}$$

6. WORK, ENERGY AND POWER

- Work done [1]
  work done is the force multiplied by the distance moved / displacement in the direction of the force
  or
  work done is when a force moves in the direction of the force

$$W = Fd\cos\theta$$

- Efficiency [?]
  ratio of useful energy output from the system to the total energy input

$$\eta = \frac{E_{output}}{E_{input}} \times 100$$

- Kinetic energy [1]
  the energy/ability to do work a object/body/mass has due to its speed/velocity/motion/movement

$$E_k = \frac{1}{2}mv^2$$

- Gravitational potential energy [1]
  the energy/ability to do work of a mass that it has or is stored due to its position/height in a gravitational field

$$E_p = mgh$$

- Elastic potential energy [1]
  elastic PE energy stored (in an object) due to (a force) changing its shape / deformation / being compressed / stretched / strained
- Power [1]
  work done per unit time

$$P = \frac{W}{t}$$

9. DEFORMATION OF SOLIDS

- Hooke's law [1]
  extension is proportional to force (for small extensions)

$$F = kx$$

- Stress [1]
  force per (cross-sectional) area
  $$\sigma = \frac{F}{A}$$

- Strain [1]
  extension divided by original length **or** change in length divided by original length
  $$\epsilon = \frac{\mathrm{e}}{l_0}$$
- Young modulus [1]
  ratio of stress to stress
  $$E = \frac{\sigma}{\epsilon}$$
- Elastic limit [1]
  point beyond which (the spring) does not return to its original length when the load is removed
- * Elastic deformation [1]
  when upon removal of load/deforming force, the material returns back to its original shape
  or
  (temporary) deformation that is reversed/recovered upon removal of external force causing it
- * Plastic deformation [1]
  when upon removal of load/deforming force, the material does not return back to its original shape
  or
  (permanent) deformation that keeps the shape of the material altered despite of removal of external force causing it

14. WAVES

- * Wave motion [?]
  means of moving energy from place to place
- Displacement (*for a progressive water wave*) [1]
  distance (in a specified direction of particle/point on wave) from the equilibrium position
- Amplitude (*for a progressive water wave*) [1]
  the maximum distance (of particle/point on wave) from the equilibrium position
  or
  the maximum displacement (of particle/point on wave)
- * Phase difference [2]
  the amount by which one wave lags or leads another
  expressed using phase angle
  the difference in the phases of two oscillating particles, expressed in degrees or radians
- Period (*for a progressive wave*) [1]
  time for one oscillation/one vibration/one cycle
  or
  time between adjacent wavefronts/points in phase
  or
  shortest time between two wavefronts/points in phase

$$T = \frac{1}{f}$$

- Frequency (*of a sound wave*) [1]
  frequency is the number of vibrations/oscillations per unit time **or** the number of wavefronts passing a point per unit time

$$f = \frac{1}{T}$$

- Wavelength (*of a progressive wave*) [1]
  distance moved by wavefront/energy during one cycle/oscillation/period (of source)
  or
  minimum distance between two wavefronts
  or
  distance between two adjacent wavefronts
  or
  minimum distance between two points having the same displacement and moving in the same direction

$$\lambda = \frac{v}{f}$$

- Speed [1]
  speed at which energy is transferred / speed of wavefront

$$v = \frac{\lambda}{T}$$

- Transverse wave (*by reference to direction of propagation of energy*) [1]
  vibrations (in plane) normal to direction of energy propagation
- Longitudinal wave (*with reference to direction of propagation of energy*) [1]
  vibration(s)/oscillation(s) (of particles) parallel to direction of propagation of energy
- Doppler effect [1]
  change/difference in the observed/apparent frequency when the source is moving (relative to the observer)
  or
  the observed frequency is different to the emitted frequency when there is relative motion between the source and the observer

$$f_o = \frac{f_s v}{v \pm v_s}$$

15. SUPERPOSITION

- Principle of superposition [2]
  waves meet / overlap (at a point)
  (resultant) displacement is sum of the individual displacements
- Node (*of a stationary wave*) [1]
  position (along wave) where amplitude / displacement of vibration is zero
- Antinode (*of a stationary wave*) [1]
  position (along wave) where amplitude of vibration is a maximum
- Diffraction [1]
  diffraction is the spreading of a wave as it passes through a slit or past an edge
- Diffracted waves [1]
  waves spread at (each) slit/gap
- Interference [2]
  when two (or more) waves superpose/meet/overlap
  resultant displacement is the sum of the displacement of each wave
- Coherence [1]
  constant phase difference
- Coherent waves [1]
  constant phase difference (between (each of) the waves)

17. ELECTRIC FIELDS

- Electric field [1]
  a region/space/area where a (stationary) charge experiences an (electric) force
- Electric field strength [1]
  force per unit charge acting on a stationary point charge

$$E = \frac{F}{Q}$$

- Field line (line of force) in an electric field [1]
  path/direction in which a (free) positive charge will move

19. CURRENT OF ELECTRICITY

- Electric current [1]
  flow of charge carriers
$$I = \frac{Q}{t}$$
- Quantised (*charge on carriers*) [1]
  charge exists only in discrete amounts
- Coulomb [1]
  (coulomb is) ampere second
$$C = As$$
- * Potential difference [1]
  work done per unit charge
$$V = \frac{W}{C}$$
- Volt [1]
  joule per coulomb
$$V = \frac{J}{C}$$
- Resistance [1]
  potential difference per current
$$R = \frac{V}{I}$$
- Ohm [1]
  volt per ampere
$$\Omega = \frac{V}{A}$$
- * Ohm's law [?]
  the current in a metallic conductor is directly proportional to the potential difference across its ends, provided its temperature remains constant

20. D.C. CIRCUITS

- Electromotive force (e.m.f.) (*of a cell*) [1]
  energy transformed from chemical to electrical per unit charge (driven around a complete circuit)
- * Potential difference (p.d.) [1]
  energy transformed from electrical to chemical per unit charge (driven between two points on a circuit)
- Kirchhoff's first law [1]
  sum of current(s) into junction is equal to sum of current(s) out of junction
  or
  (algebraic) sum of current(s) at a junction is zero
  $$\Sigma I_{in} = \Sigma I_{out}$$
- Kirchhoff's second law [2]
  sum of electromotive force(s) is equal to sum of potential difference(s)
  around a loop/around a closed circuit
  $$\Sigma E = \Sigma V$$

26. PARTICLE AND NUCLEAR PHYSICS

- * Nucleon number [1]
  the number of neutrons and protons in the nucleus of an atom
- * Proton number [1]
  the number of protons in the nucleus of an atom

Note:

- definitions marked with an asterisk * were extracted from a book or authored by the compiler of this list, i.e. *not* from past paper mark scheme or syllabus
- context for the definition is written in parentheses ( )
- marks for the definition in past paper question/s are indicted in square brackets [ ], ? if unknown