G484 The Newtonian World Definitions

(Spelling counts and underlined words are key)

Newton's First Law	A body will remain at rest or continue to move with constant velocity unless acted upon by a force
Newton's Second Law	Force is proportional to the rate of change of **momentum**
Newton's Third Law	When one body exerts a force on another the other body exerts an equal in magnitude and opposite in direction force on the first body
Newton	The force which gives a mass of 1 kg an acceleration of 1 m s^{-2}
linear momentum	the product of mass and velocity ; momentum is a vector
net force on a body	proportional to the rate of change of **momentum**
impulse of a force	Product of force acting on a body and the time its acting; equal to the rate of change of momentum
principle of conservation of momentum	Total momentum is conserved for a closed system/provided no external forces
perfectly elastic collision	A collision with no loss of kinetic energy.
inelastic collision	Some loss of kinetic energy during the collision
Radian	Unit of angle or phase difference; 1 radian is angle subtended by an arc of the circumference equal to the radius; $2\pi=360^{o}$
Circular motion	Occurs when a net force acts on object perpendicular to the velocity
Centripetal force (explain)	When a force is perpendicular to the velocity of an object it will make the object describe a circular path
Centripetal acceleration (explain)	velocity (direction) is always changing, giving acceleration towards the centre of the circle described
gravitational field strength	force per unit mass
Newton's law of gravitation	The gravitation force of attraction between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centre of mass.
Period	Time for one complete oscillation/rotation; Time period = 1/frequency
geostationary orbit	An orbit about the Earth that has the same period of rotation as the Earth (24h) and is in the equatorial plane
displacement	distance from the equilibrium position
amplitude	amplitude is the maximum displacement
frequency	Oscillations/rotations per second; frequency = 1/Time period
Angular frequency	product of 2π x frequency
phase difference	The difference between the pattern of vibration of two points/two waves where one leads or lags behind the other
simple harmonic motion	acceleration is (directly) proportional to displacement and is directed in the opposite direction to the displacement ; (defining a and x and explaining –ve as in opposite direction; $a = -(2\pi f)^2 x$

Brownian motion	smoke particles move in random/haphazard/zig-zag/jiggling/jerky manner
Brownian motion conclusions (explain)	1. air molecules are moving randomly 2. with different speeds 3. mass of air molecules is smaller than smoke particles a. (movement of smoke particles caused by being hit by **randomly moving air molecules** b. smoke particles are continuously moving because the **air molecules** are **continuously moving** c. smoke particles are visible but air molecules are not hence **air molecules must be very small**. d. small movement of smoke particles is due to the large numbers of **air molecules hitting from all sides)**
Pressure (explain)	Pressure = force/area; (molecules make collisions with walls, hence exert a force on the wall (or each collision has a change of momentum)
internal energy	the sum of the random distribution of kinetic and potential energies associated with the molecules of a system
thermal equilibrium	no net heat flow between objects as regions are of equal temperature
absolute zero	the temperature at which a substance has minimum internal energy
specific heat capacity	Energy required to change the temperature of 1kg of a substance by $1^{o}C$/1K
Latent heat of fusion	thermal energy required to change a solid into a liquid at a constant temperature/ to be removed to change a liquid into a solid at a constant temperature
latent heat of vaporisation	thermal energy required to change a liquid into a gas at a constant temperature/ to be removed to change a gas into a liquid at a constant temperature
Boyle's law	pressure is inversely proportional to volume for a fixed mass of gas at constant temperature
Basic assumptions of the kinetic theory of gases	1. molecules move with rapid, random motion 2. perfectly elastic collisions 3. negligible volume of molecules compared with volume of container 4. no intermolecular forces except during collisions/all internal energy is KE 5. collision time negligible compared to time between collisions 6. gravitational force on molecules is negligible
mole	contains 6.02 x 10^{23} particles
Kilowatt-hour	the **energy** used/provided by a 1 kW device in 1 hour
Derive, from first principles, the equation	$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$