

Thermal Physics

4.3.1

(c) Describe an experiment that demonstrates Brownian motion and discuss the evidence for the movement of molecules provided by such an experiment;

- Introduce some smoke into a small glass container
- Illuminate glass container using a filament lamp and a glass rod for focusing
- View glass container through a microscope
- Conclusions
 - Smoke particles move in a jerky motion
 - Movement of smoke particles caused by being hit by randomly moving air molecules
 - Smoke particles are continuously moving because the air molecules are continuously moving
 - Smoke particles are visible but air molecules are not hence air molecules must be very small
 - Small movement of smoke particles due to the large numbers of air molecules

(d) Define the term pressure and use the kinetic model to explain the pressure exerted by a gas

- Force per unit area
- Molecules make collisions with walls
- \therefore exerts a force on the wall
- This produces pressure
- Each collision has a change of momentum

4.3.3

(c) Describe an electrical experiment to determine the specific heat capacity of a solid or a liquid

- Liquid:
 - Place liquid in a vessel with an electrical heater and thermometer
 - Connect ammeter in series between supply and heater and voltmeter connected across heater
- Solid
 - Drill two holes into metal block
 - Place electrical heater and temperature sensor into the holes
 - Connect ammeter in series between supply and heater and voltmeter connected across heater
- Measurements
 - Mass of liquid/solid
 - Initial and final temperature
 - Current, voltage and time
 - Use $c = \frac{IVt}{m\Delta\theta}$
- Uncertainties

- Heat losses solved by using insulation
- False temp reading for liquid solved by stirring liquid
- Temperature continues to rise after heater switched off; measure the highest value

4.3.4

(c) State the basic assumptions of the kinetic theory of gases

- A gas consists of a large number of molecules in rapid, random motion
- Collisions between molecules and between the molecules and the walls are elastic
- The gravitational force on the molecules is negligible
- No intermolecular force exists except during collisions
- The total volume of the molecules is negligible compared with the volume of the container

Circular Motion

4.2.2

(n) Define geostationary orbit of a satellite and state the uses of such satellites

- An orbit of the earth made by a satellite that has the same time period as the rotation of the earth and is in the equatorial plane
- Satellites appears to be stationary over a point on the earth's surface and so is always available to receive/transmit radio waves
- A geostationary satellite must:
 - Have its orbit centred on the centre of the earth
 - Be travelling from west to east
 - Be over the equator
 - Have a period of 24 hours
- Used for telecommunications and television broadcasting

4.2.3

(n) Describe examples where resonance is useful and other examples where resonance should be avoided

- Useful:
 - Cooking – Microwaves cause water molecules to resonate
 - MRI – radio waves cause nuclei to resonate
 - Radios – radio waves cause electrons to resonate
- Problem
 - Bridges – wind causes bridge to resonate
 - Vehicles – engine vibrations cause panels to resonate
 - Earthquake – ground vibrating causes buildings to resonate