Physics Revision Notes – Forces And Motion

1. **Speed** is a scalar quantity describing how fast an object is moving (in m/s).
2. **Velocity** is a vector quantity describing how fast an object is moving in a given direction (in m/s).
3. **Acceleration** describes how fast an object is speeding up (in m/s^2).
4. The formula for **speed** (or the magnitude of a velocity):

$$\text{Speed (m/s)} = \frac{\text{Distance (m)}}{\text{Time (s)}} \quad - \quad s = \frac{d}{t}$$

5. The formula for **acceleration**:

$$\text{Acceleration (m/s}^2\text{)} = \frac{\text{Change in velocity (m/s)}}{\text{Time (s)}} \quad - \quad a = \frac{\Delta v}{t}$$

6. On a **distance-time graph**, the gradient represents the speed.
7. On a **velocity-time graph**, the gradient represents the acceleration, and the area under the graph represents the distance travelled.
8. **Newton's laws of motion**:
   - If the forces acting on an object are **balanced** (i.e. it the forces are in equilibrium), then it will continue to move at a **constant velocity** (no motion results in a constant velocity of 0m/s).
   - If the forces on acting on an object are **unbalanced**, then it will **accelerate** in the direction of the unbalanced force (i.e. the **resultant force**).
   - For every **action**, there is an **equal and opposite reaction**.
9. The formula for **force**:

$$\text{Force (N)} = \text{Mass(kg)} \times \text{Acceleration (m/s}^2\text{)} \quad - \quad F = ma$$

10. The **stopping distance** for a car is the thinking distance plus the braking distance.
11. The **thinking distance** is the time taken to react to an external stimulus, and time taken to react to this is 0.6s (the distance depends on the car's speed). It can be longer when the driver is drunk, under the effect of drugs, old, distracted, or tired.
12. The **braking distance** is the time taken for a car to stop after the brakes have been applied:

$$\text{Braking distance (m)} = \frac{\text{Velocity before braking (m/s)}}{2} \times \text{Time taken (s)} \quad - \quad d = \frac{v}{2} \times t$$

    This can be longer when the road is icy or wet, or if the tyres are slippery or worn.
13. **Boyle's law**:

$$P_1 V_1 = P_2 V_2$$

14. **Hydraulics** can be used to amplify forces, e.g. in a car braking system.
15. The formula for **pressure**:

$$\text{Pressure (Pa } or \text{ N/m}^2\text{)} = \frac{\text{Force (N)}}{\text{Area (m)}} \quad - \quad P = \frac{F}{A}$$