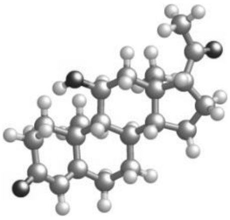


Sc!ence

Name: …………………… (   )

Class: ………………

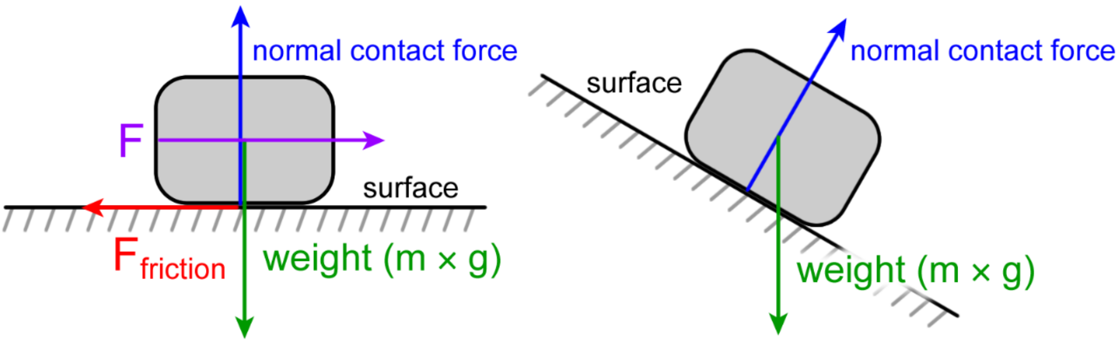
Date: …… / …… / ……

<u>Common Formulae Used in Secondary Two Physics</u>

- *Remember to always check the units given in the question. Can you use the units directly in the calculation, or do they need to be modified, e.g. W → kW or kN/m² → N/m² ?*
- *Write the formula at the start of your calculation, and include units in your calculation to guide you.*
- *Remember to give numerical answers - in decimal - to an appropriate number of significant figures.*
- *Check that you have included appropriate units (where necessary) in your answers.*

1. $w = m \times g$

weight (in N) = mass (in kg) × gravitational field strength (in N/kg = 10 N/kg)



Note: If **F** > $\mathbf{F}_{friction}$ then the object will <u>accelerate</u> towards the right. If **F** = $\mathbf{F}_{friction}$ then the object will either <u>remain stationary</u> or it will move at a <u>constant speed</u> towards the right. If **F** < $\mathbf{F}_{friction}$ then the object will <u>remain stationary</u>.

Note: **F** is not always present in free body diagrams. For example, **F** is *present* when a golf ball is hit by a golf club and the club exerts a force on the ball – but **F** is *absent* the moment the ball is no longer in contact with the club and rolls away from it.

Note: It is assumed that there is <u>no friction</u> on a <u>perfectly smooth surface</u>.

2. Newton's Laws of Motion

First: A body at rest will remain at rest, and a body in motion will remain in motion at constant speed in a straight line, unless a resultant force acts upon it.

Second: The resultant force on a body is equal to the product of its mass and its acceleration. The direction of this force is in the same direction as its acceleration.

$F = m \times a$

force (in N) = mass (in kg) × acceleration (in m/s²)

Third: The force which a body **A** exerts on a body **B** is always equal in magnitude and opposite in direction to the force which body **B** exerts on body **A**.

3. $P = F \div A$

pressure (in N/m^2) = force (in N) ÷ area (in m^2)

Note: Other units of area are the square millimetre, mm^2, and the square centimetre, cm^2.

Note: If the mass of an object is given in kg, then this must be converted into its weight in Newtons ($w = m \times g$) before w can be substituted for F in the equation above.

4. $w.d. = F \times d$

work done (in J) = force (in N) × distance moved in the same direction as the force (in m)

Note: If the mass of an object is given in kg, then this must be converted into its weight in Newtons ($w = m \times g$) before w can be substituted for F in the equation above.

5. The principle of conservation of energy states that *energy cannot be created or destroyed, it can only be converted from one form to another, or transferred from one body to another. The total amount of energy remains constant*.

6. $g.p.e. = m \times g \times h$

gravitational pot. energy (in J) = mass (in kg) × gravitational field strength (N/kg) × height (m)

7. $K.E. = \frac{1}{2} \times m \times v^2$

kinetic energy (in J) = $\frac{1}{2}$ × mass (in kg) × velocity (in m/s) squared

Note: Square the velocity first before multiplying by $\frac{1}{2} \times m$.

8. $P = w.d. \div t$

power (in W) = work done or change in energy (in J) ÷ time (in s)

Note: $w.d. = F \times d$ where F is in N, so a mass in kg must be converted to a force in N before the equation can be used.

9. Ohm's Law: $V = I \times R$

potential difference (in V) = current (in A) × resistance (in Ω)

10. $Q = I \times t$

charge flowing through a circuit (measured in coulombs, C) = current (in A) × time (in s)

11. **Resistors in Series:**

The effective resistance = $R_e = R_1 + R_2 + R_3 \ldots$

The same current flows through all resistors in a series circuit.

The potential difference across resistors in series is different, and must be calculated $V = I \times R$

12. Resistors in Parallel:

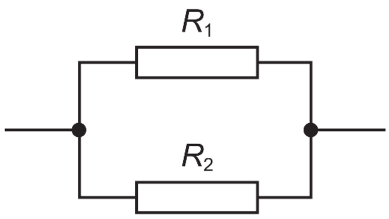
The effective resistance = $^1/_{R_e} = {}^1/_{R_1} + {}^1/_{R_2} + {}^1/_{R_3}\ldots$

The current through resistors in parallel is different, and must be calculated $I = V \div R$.

The potential difference across resistors in a parallel circuit is the same for all resistors.

Note: For resistors in a parallel circuit, if more resistors are added in parallel, then the effective resistance through the circuit decreases, and the current through the main / whole circuit increases – as resistance decreases, so current must increase based upon $I = V \div R$.

Note: For resistors arranged in parallel, the effective resistance through the parallel system is always less than the value of the smallest resistor.



For example, if the value of R_1 Ω is less than the value of R_2 Ω, then the effective resistance through this parallel system will be less than R_1 Ω.

i.e. $R_e\ \Omega < R_1\ \Omega < R_2\ \Omega$

13. $P = E \div t$

electrical power (in W) = energy (in J) ÷ time (in s)

14. The kilowatt-hour (kWh) is a unit of electrical energy equal to 3 600 000 J. The kilowatt-hour is commonly used as the unit for billing consumers for the electricity that their appliances have consumed over the course of one month.

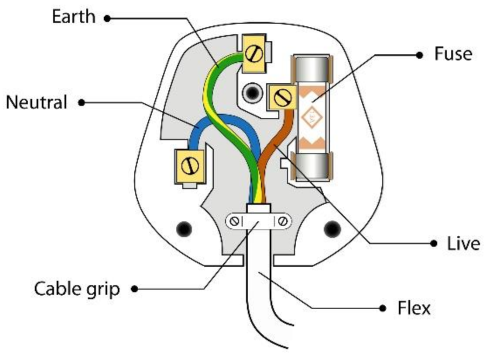
power consumed by appliance (in kWh) = power rating of appliance (in kW) × usage time (in h)

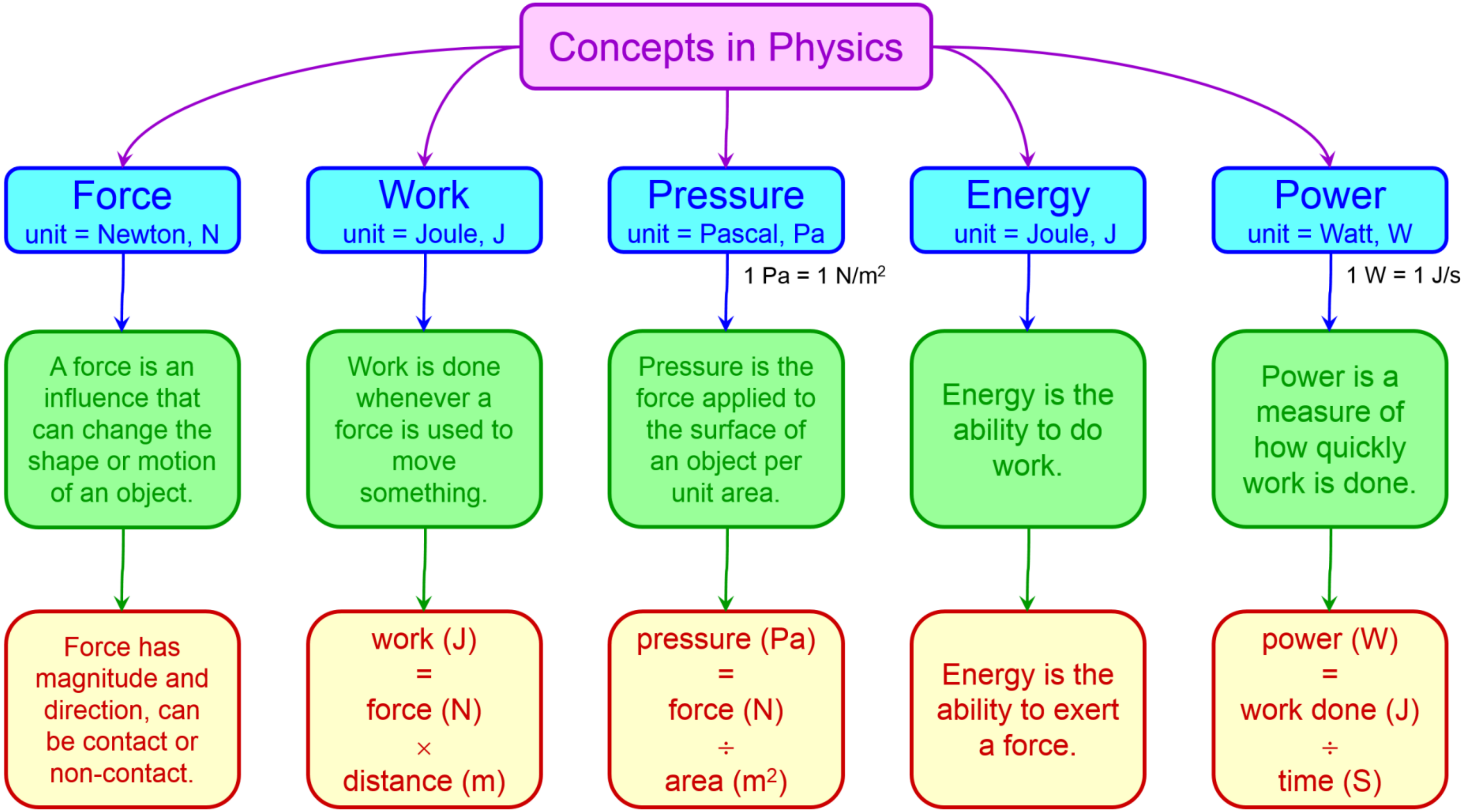
then…

cost (in $) = power consumed by appliance (in kWh) × cost (in $ per kWh)

Note: 1 kW = 1000 W

15. The three pin plug and electrical safety: The switch and the fuse are always connected in the live wire. The current rating of the fuse is rated slightly higher than the current rating of the appliance. The earth wire is connected to the metal casing of the appliance.





Concepts in Physics
Force
unit = Newton, N
Work
unit = Joule, J
Pressure
unit = Pascal, Pa
Energy
unit = Joule, J
Power
unit = Watt, W
1 Pa = 1 N/m²
1 W = 1 J/s
A force is an influence that can change the shape or motion of an object.
Work is done whenever a force is used to move something.
Pressure is the force applied to the surface of an object per unit area.
Energy is the ability to do work.
Power is a measure of how quickly work is done.
Force has magnitude and direction, can be contact or non-contact.
work (J) = force (N) × distance (m)
pressure (Pa) = force (N) ÷ area (m²)
Energy is the ability to exert a force.
power (W) = work done (J) ÷ time (S)