CP7-8 Revision Mat (pg 179 - 182 revision guide)

Work and Power

State the equation that links force, distance and work done

E = f x d

work done = force x distance

Calculate the work done when Jim pushes a box 10m with 200N of force

work done = 200N x 10m

= 2000J

Calculate the force when a crane uses 500kJ to lift steel bars 30m high.

F = E/d = 500 000 / 30

= 16,666.7 N

State the equation that links time, power and work done

Power = work done / time P = E / t

The rate at which energy is transferred

State the unit of power Watts (W)

(1 watt = 1 joule per second, J/s)

Calculate the power if 1000J of energy is needed to run up the stairs in 10 seconds

P = E / t = 1000 / 10 = 100W

Work done = f x d = 1000 x 10 = 10000

A man takes 10 seconds to push a car with a force of 1kN a distance of 10m. Calculate the power of the man.

P = E/t = 1000 / 10 = 100W

Objects affecting each other

Identify an example of a contact force

Normal contact force, friction, air resistance / tension

Identify an example of a non-contact force

gravitational force, electrostatic force, magnetic force

Explain why the gravitational forces between the Earth and the moon are an example of an action-reaction pair.

Pairs of forces acting on different objects in opposite directions

State three examples of force fields

1. magnetic
2. electromagnetic / electrical field
3. gravitational

Explain what will happen if two identically charged plastic rods are suspended next to each other

They will repel

Draw a diagram to show two objects attracting each other

Draw a diagram to show two objects repelling each other

Vect

Draw
weig
500N

Calcu
direc

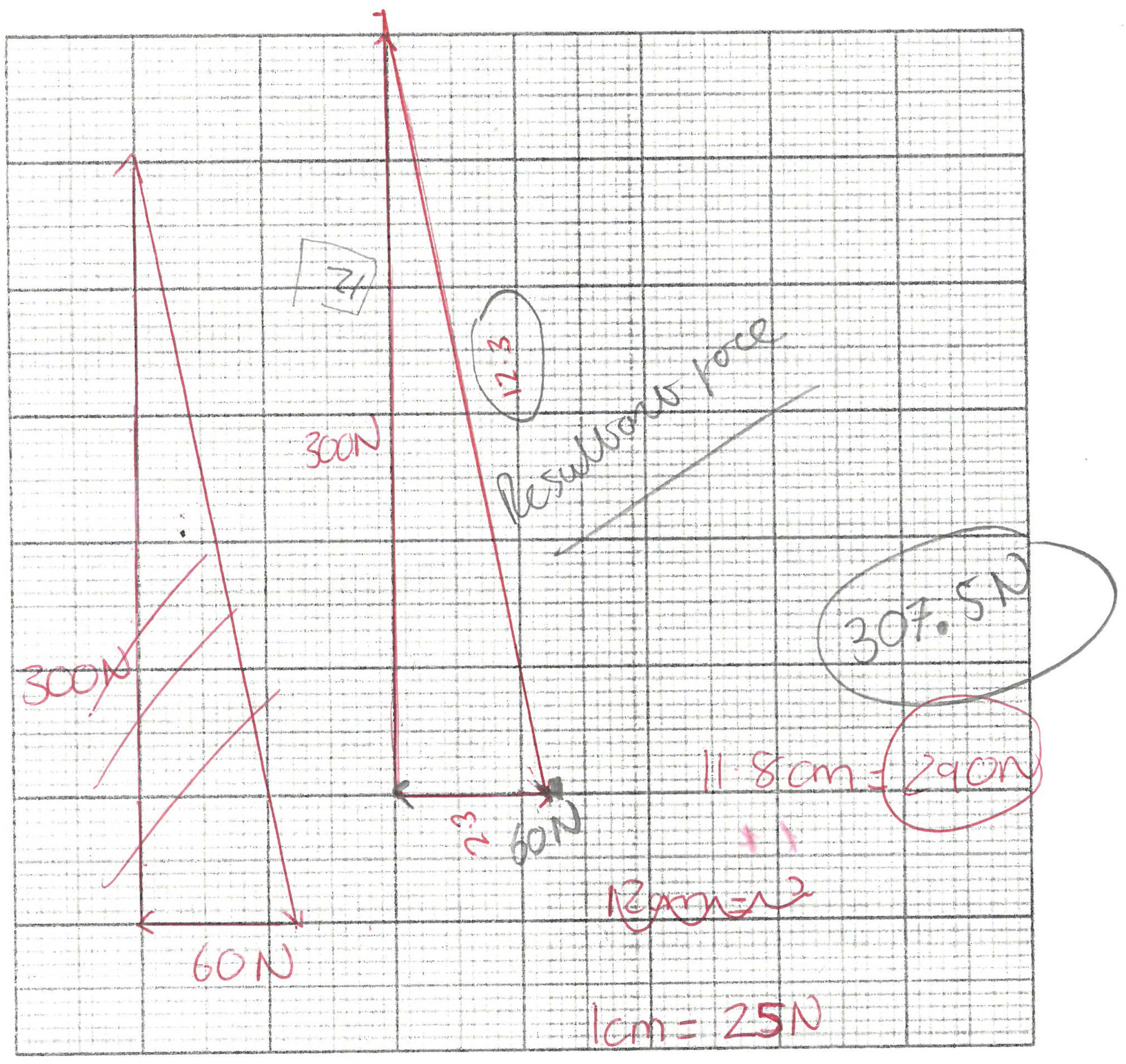
Use t
resul

1 cm
= 12

Resul

A sky
result
There

Use g
deter
result



300N
60N
300N
12.3
2.3
60N
12
Resultant force
307.5N
11.8cm = 290N
1cm = 25N

Transferring Energy

Explain why a resistor gets hot when current flows through it

electrons collide with the ions in the resistor - this gives ions energy + they vibrate more - harder for electrons to go through, the current decreases, heats up

Explain how resistance can be reduced in wires

- Thicker wire
- Shorter wire

Equation given in exam:

$E = I \times V \times t$

Energy transferred = Current x Potential difference x time

Calculate the energy transferred when a 9V battery supplies 0.2A of current to an appliance for 5 minutes.

$E = 0.2 \times 9 \times (5 \times 60)$

$= 540J$

Calculate the time taken to transfer 3000J to a lamp with a current of 0.8A when it is connected to a 230V supply

$t = \frac{E}{I \times V} = \frac{3000}{0.8 \times 230}$ (1sf)

$= 163$ seconds

Power

State the three equations to calculate power

1) Power = $\frac{\text{work done}}{\text{time taken}}$ $P = \frac{E}{t}$
2) Power = current x P.d $P = I \times V$ ($V = IR$)
3) Power = $I^2 \times R$
   Power = current^2 x resistance

Calculate the power of a kettle connected to a 230V supply and 13A of current is required.

$P = I \times V = 13 \times 230 =$ 2990W

Calculate the resistance when 3A flows through and 8kW of power is transferred

$R = \frac{\text{Power}}{\text{current}^2} = \frac{8000}{3^2} = 888.9\Omega$

Transferring energy by electricity

Describe the energy transfers in a mains operated hairdryer

Electrical → heat
Electrical → sound
Electrical → kinetic

Describe the energy transfer of a battery operated heated gloves

Chemical → heat

Electrical Safety

Describe why earth wires are needed in plugs

Safety - carries the current away if something goes wrong and stops the appliance casing becoming live

Explain how fuses make circuits safe

Surge in current melts the fuse breaking the circuit + cuts off live supply

Explain the advantage of circuit breakers over fuses

- Turn off quicker (than melting a fuse)
- Reset (have to replace a fuse)

(more expensive than fuses)

CP10- 11 Revision Mat (pg 195 - 199)

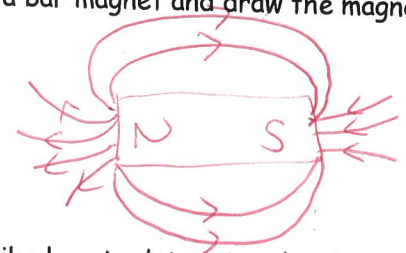
When will magnets attract and repel?

unlike poles attract
like poles repel

Describe what a magnetic field is

Causes forces between magnets
a region where the magnetic
or magnetic materials (iron,
nickel or cobalt) experience a force

Draw a bar magnet and draw the magnetic field



Describe how to determine the shape of a magnetic field

Plotting compasses show the
shape + direction of the field
around a magnet

Describe the difference between a permanent magnet and an induced magnet

permanent - produce own
magnetic field all the time
induced (temporary) - only produce
a magnetic field while they're in a
magnetic field

Describe the evidence that suggests the Earth has a magnetic field

Compasses always point towards
the Earth's north pole. Earth creates
own magnetic field (North pole is
actually Earth's magnetic south pole
shows inside (core) of Earth must
be magnetic

Electromagnetism

Describe what an electromagnet is

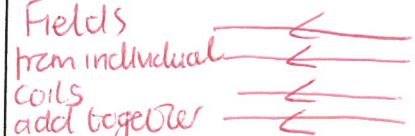
a magnet with a magnetic
field that can be turned on and
off using an electric current

Define a solenoid

A long coil with lots of
loops

Draw a diagram to show the magnetic field inside a solenoid

Fields from individual coils add together



inside (uniform)

weak on outside of solenoid (fields cancel one another)

Describe how to increase the strength of an electromagnet

Insert an iron core, increase
No of coils, increase current

Magnetic Forces (*Higher*)

State three factors that affect the force experienced by a current carrying conductor in a magnetic field

1) Increase strength of magnetic field (1) Strength of magnetic field
2) Increase speed of movement/change (2) Current flowing through wire
3) More turns per unit length of coil (3) Length of wire in field
on the coil of wire

Equation given in exam: F = B x I x L

State the units of each symbol in the equation

F = Newtons (N)
B = Magnetic Flux Density (T / Tesla or N/Am)
I = current (Amps)
L = length (m)

Transformers and energy

Describe what the national grid is
a network of wires + transformers that connect UK powerstations to consumers

Explain why step up transformers are used
Boosts p.d really high current, more efficient, less energy lost

Explain why electricity is transferred across the national grid at high voltages
to reduce losses + make national grid more efficient (high current makes wire heat up so loss of energy is wasted as thermal

Explain why step down transformers are used
Back to a safe, usable level for consumer.

Electromagnetic induction (Higher)

Describe what a transformer is
Transformers change the p.d but only for an alternating current (ac)

Describe how a transformer works
use induction to change the size of the p.d of an alternating current
2 coils of wire - primary + secondary joined with an iron core (Step up - more on second
Step down - more on primary

alternating p.d → alternating magnetic field → induced alternating p.d in secondary coil

Describe two ways to increase the potential difference in electromagnetic induction:

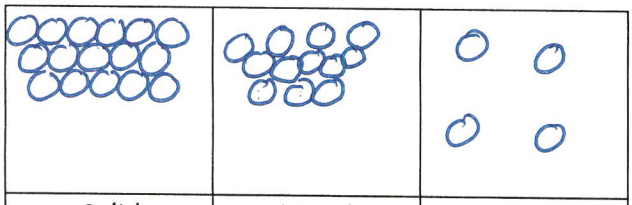
1) increase strength of magnet
2) more turns per unit length of
3) speed of movement/change of

CP12-13 Revision Mat (pg 200 - 206)

Particles and density

What does the kinetic theory state?
A way of explaining matter - how matter behaves in terms of how they move + forces between them

Draw particle diagrams for solid, liquid and gases



Solid	Liquid	Gas

Describe how particles are arranged in solids
Strong forces of attraction, close together, fixed, regular arrangement, only vibrate around fixed position (don't have much energy)

Describe how particles are arranged in liquids
- Forces of attraction are weaker
- close together but can move past one another, irregular, move in random directions but low speed

Describe how particles are arranged in gases
almost no forces of attraction
More energy than liquid + free to move, random directions, high speed

Explain why gases are compressible
lots of space between the particles

(5) Read volume of water collected
This is the volume

Describe the difference between chemical and physical changes
Physical - only the form of a substance changes (state)
Chemical - new substances are created by the reaction

State the equation that links mass, density and volume

$\text{Density} = \frac{\text{mass}}{\text{volume}}$ $\left(\rho = \frac{m}{V}\right)$

(g/cm³ or kg/m³)

A 400kg block of steel has a volume of 10m³.
Calculate the density

$= \frac{400kg}{10m^3} = 40kg/m^3$

$\rho \times V$

If the density of an object is 3500kg/m³
Calculate the volume if the object has a mass of 400kg.

$V = \frac{m}{\rho} = \frac{400}{3500} = 0.11m^3$

Practical Skills:

List the equipment needed to investigate densities of objects
Density of liquid - measuring cylinder
Balance to measure mass of empty measuring cylinder (zero it) - pour in set volume of liquid + record mass. work out density

Describe one way of increasing the accuracy of measuring the density
- use a measuring cylinder with more accurate markings
- zero the measuring cylinder + pour liquid in

(3) Hold measuring cylinder under spout (4) Place object in (1) Heat push (2) fill

Energy Calculations

Equation given in exam:

$$\Delta Q = mc\Delta\theta$$

m = mass	(kg)
c = specific heat capacity	(J kg^{-1} °C^{-1})
θ = temperature change	(°C)

The specific heat capacity of water is 4182 J/kg°C. Calculate the energy needed to heat 4kg of water from 20 to 80°C

$\Delta Q = 4 \times 4182 \times 60$

$= 1003680\text{J}$

Calculate the temperature change when 30000J of energy is transferred to a 3kg brick if the specific heat capacity is 840 J/kg°C.

$\Delta\theta = \frac{\Delta Q}{m \times c} = \frac{30000}{3 \times 840}$

$= 11.9\,(12°C)$ (25 20)

Calculate the mass of bricks if 50000J of energy is transferred raising the temperature from 20 to 40°C.

Specific heat capacity is 840 J/kg°C.

$m = \frac{\Delta Q}{c \times \Delta\theta} = \frac{50000}{840 \times 20}$ (16800)

$= 2.98\text{kg}$

Energy Calculations

Equation given in exam:

$$Q = m \times L$$

Q = Thermal energy (J)
m= mass (kg)
L = specific latent heat J/kg)

$\div 1000 = 0.18\text{kg}$

When a kettle boils, 180g of water changes to steam. Calculate the amount of energy required for this change.

Specific latent heat of vapourisation = 2.3 x 10^6 J/kg

$Q = 0.18\text{kg} \times 2.3 \times 10^6$

2300000

$= 414000\text{J}$

Calculate the energy released when 0.025kg of condensation form.

The specific latent heat of vapourisation of water = 2.3 x 10^6 J/kg

$Q = 0.025 \times 2.3 \times 10^6$

23 00000

$= 57500\text{J}$

Bending and Stretching

Describe the difference between elastic and inelastic objects

Elastic - return to original shape when forces removed

Inelastic - will keep new shape after forces are removed

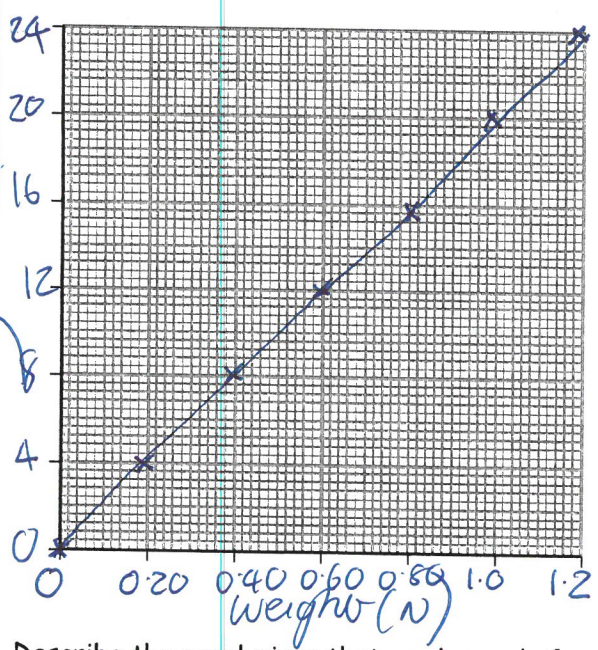
Identify force A which is acting on the bungee jumper ..... weight due to gravity

Plot the following data on the graph paper provided

weight (N)	extension (mm)
0.20	4.0
0.40	8.0
0.60	12.0
0.80	16.0
1.00	20.0
1.20	24.0

÷100 cm → m

Bending and Stretching



Describe the conclusions that can be made from the graph

weight + extension are directly proportional - straight line passing through origin.

State the equation that links spring constant, extension and force

$F = k \times x$ (N/m)

(N) Force = spring constant × extension (m)

Calculate the force needed to make a spring extend by 10cm if the spring constant is 200N/m

$F = 200 \times 0.1 = 20N$

Current, Charge and Energy

$Q = I \times t$

Calculate the time taken for 33C of charge and a current of 6A.

$t = \frac{Q}{I}$ $t = \frac{33}{6} =$ 5.5secs

State the equation that links potential difference, charge and energy transferred.

energy transferred = charge × p.d

$E = Q \times V$

Calculate how much energy is transferred when 10C of charge flows through a potential difference of 5V

$E = 10 \times 5 =$ 50J

Calculate the energy transferred when an appliance is used for 5 minutes from the mains (230V) with a current of 5A.

$Q = I \times t$ $Q = 5A \times (5 \times 60)$ $= 1500C$

$E = Q \times V = 1500 \times 230$

$=$ 345,000J

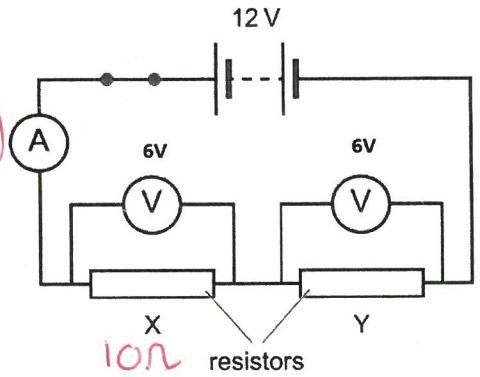
Resistance

State the equation that links resistance, current and potential difference

$V = I \times R$

State the unit of resistance (Ω) ohm

Resistance



a) Calculate the current flowing through resistor X which has a resistance of 10Ω.

$V = I \times R$ $I = \frac{V}{R}$ $= \frac{6V}{10}$ $=$ 0.6A

b) Calculate the resistance of resistor Y

$R = \frac{V}{I} = \frac{6V}{0.6A} =$ 10Ω

Describe what happens to the total resistance when the resistors in the diagram above are placed in parallel

Series → add together 10 + 10

In parallel → will go down = 20Ω

two paths so twice as much current flows (V = IR)

More about resistance

Draw circuit symbols for the following components:

Diode

Variable resistor

Filament lamp

Thermistor

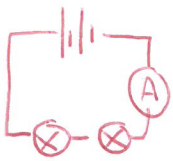
LDR

CP9 Electricity and Energy (pg 184 - 193 in revision guide)

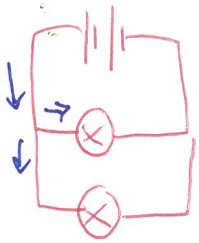
Electric Circuits

Draw a labelled diagram of an atom to identify the protons, electrons and neutrons.

Draw a series circuit containing a battery, 2 bulbs and an ammeter



Draw a parallel circuit containing a battery and 2 bulbs.



Describe how current flows in a series circuit (always use the same)

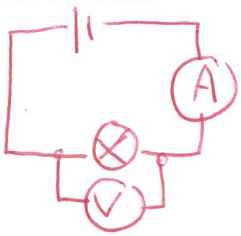
The rate of flow of charge (in metals - flow of electrons)

Describe how current flows in a parallel circuit

Splits between the different branches

Current and Potential Difference

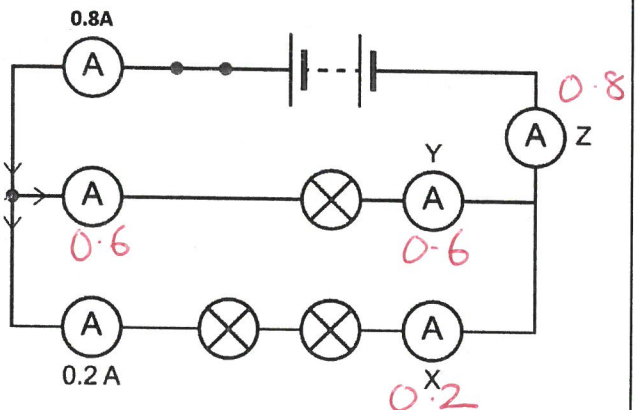
Draw a series circuit with a cell, bulb, ammeter and a voltmeter to measure the potential difference across the bulb.



Describe how to measure current and potential difference in a circuit

Ameter in series -> amps

Voltmeter placed parallel -> volts



Identify the ammeter reading on

X 0·2 (A)

Y 0·6 (A)

Z 0·8 (A)