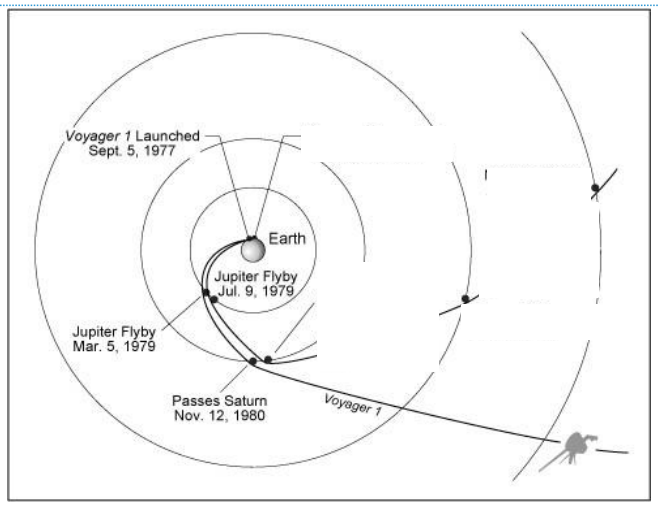
N5 : ELECTRICITY & ENERGY KEY AREAS
1. Conservation of Energy
Principle of 'conservation of energy' applied to examples where energy is transferred between stores. Identify and explain 'loss' of energy where energy is transferred. Calculations of potential and kinetic energy. Calculations involving conservation of energy.

1. Some cars are fitted with a system that stores the energy normally lost as heat in the brakes.

   Using your knowledge of physics, estimate the kinetic energy of a moving car. list any you data you would need and how you would hand this data to determine kinetic energy.

2. The Voyager space probe has been able to travel across the Solar System and visit the outer planets.



   "Gravitational sling-shot" was used to send the probe on its way across the Solar System. The probe was attracted by the gravitational field of each planet it passed but did not hit the planet. Using your knowledge of physics, comment on how this was possible.

3. A new rollercoaster is designed for a theme park. The car is accelerated along a level track and then moves freely around the rest of a circuit. The circuit has an uphill section after the initial level track and then it rolls down the other side before returning to the starting point. Just before it reaches the starting point, the car passes through a "braking zone".

   Using your knowledge of physics, comment on the speed and energy of the car during this ride.

Commented [MC1]: Redraw to leave one flight path

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2. Electrical charge carriers and electric fields
Definition of electric charge. Electrical current as the electrical charge transferred per unit time. Use an appropriate relationship to carry out calculations involving charge, current and time. Difference between alternating and direct current.

4. Using your knowledge of physics discuss and describe the everyday application of electric charge.

5. Using your knowledge of physics discuss why you think mains electricity is AC rather than DC.

6. Which do you think is the most useful AC. or DC? Support your answer (Credit is given for justification rather than choice.)

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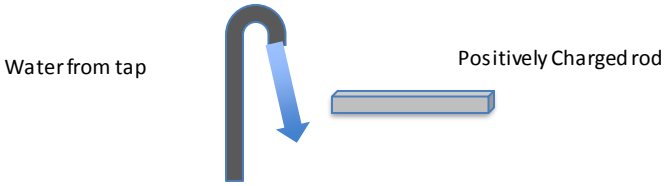
3. Potential difference (voltage)
Effect of electric field on a charged particle. The potential difference (voltage) of the supply is a measure of the energy given to the charge carriers in a circuit.



7. Using your knowledge of physics discuss why you think a positively charged rod bends a flow of water?

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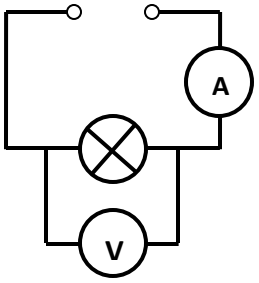
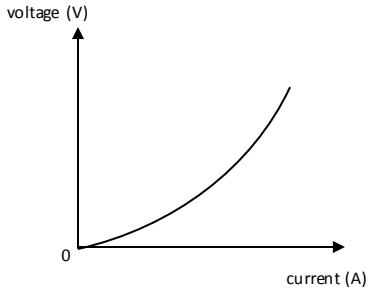
4. Practical electrical and electronic circuits
Measurement of current, voltage and resistance, using appropriate meters in complex circuits.
The function and application of standard electrical and electronic components including cell, battery, lamp, switch, resistor, variable resistor, voltmeter, ammeter, LED, motor, microphone, loudspeaker, photovoltaic cell, fuse, diode, capacitor, thermistor, LDR, relay, transistor.
Current and voltage relationships in a parallel circuit.
Use of appropriate relationships to calculate the total resistance of resistors in series and in parallel circuits, and circuits

8. The following circuit is set up to measure the voltage across and the current through a lamp. The results are recorded on the graph shown.





Using your knowledge of physics, comment on the shape of the graph produced.

9. Draw a circuit diagram using at least three different components from the following list and explain the operation of the circuit.

10. As a classroom activity the teacher instructs you to ask a question of your classmates on the topic of current, voltage and resistance, what question would you ask and what sort of correct responses would you look for?

11. "If 42 Ohms is the answer what is the question?" Draw a circuit diagram with at least 5 resistors to give an overall resistance of 42 **Ω** indicate the value of each resistor in the circuit.

12. A pupil says "***this component is called a resistor because it slows down the flow of charge***" using your knowledge of physics comment on this statement.

13. A pupil discussing a circuit design mentioned using a bigger resistor comment on the word ***bigger*** in this context.

14. A pupil says "***when using ammeters and voltmeters, ammeters are easier to use as they can be placed anywhere in a circuit but care must be taken with the location of voltmeters.***"

    Comment on this observation using your knowledge of physics discuss.

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5. Ohm's law
Use of a V-I graph to determine resistance. Use of an appropriate relationship to calculate potential difference (voltage), current and resistance. The relationship between temperature and resistance of a conductor.

15. Using your knowledge of physics explain Ohm's Law.

16. Using your knowledge of physics explain why a light bulb does not always obey Ohm's Law.

17. Discuss why Ohm's Law is not appropriate for a thermistor.

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6. Electrical power
Use of an appropriate relationship to determine energy, power and time. Use of an appropriate relationship to determine the power, voltage, current and resistance in electrical circuits.

18. Using your knowledge of physics explain the difference between power and energy.

19. Using your knowledge of physics discuss the difference between power and voltage.

20. Using your knowledge of physics explain why a lamp gets hotter as it gets brighter.

(Diag of food label)

Using your knowledge of physics discuss the advantages or disadvantages of the different heating methods.

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7. Specific heat capacity
The same mass of different materials requires different quantities of heat to raise the temperature of unit mass by one degree celsius. The temperature of a substance is a measure of the mean kinetic energy of its particles. Explain the connection between temperature and heat energy. Use an appropriate relationship to carry out calculations involving mass, heat energy, temperature change and specific heat capacity. Conservation of energy to determine heat transfer.

21. Mr McAllister decides to heat up a bowl of soup in a microwave oven.

After two minutes, he finds that the soup and the bowl have not reached the same temperature.

Using your knowledge of physics, explain why this is the case.

22. It is easy to burn your mouth on the contents of a hot apple pie from McDonalds, but still able to hold the pie comfortably in your hands.

Using your knowledge of physics, explain why this is possible.

23. A flooring technician was puzzled that slate tiles always feel colder than wooden floors but they are both at the same temperature when measured by thermometer. Comment on this observation.

Using your knowledge of physics design an experiment to demonstrate the difference between temperature and heat.

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8. Gas laws and the kinetic model
Pressure is the force per unit area exerted on a surface. Describe how the kinetic model accounts for the pressure of a gas. Use an appropriate relationship to calculate pressure, force and area. Explanation of the pressure-volume, pressure-temperature and volume-temperature laws qualitatively in terms of a kinetic model. Use of an appropriate relationship to calculate the volume, pressure and temperature of a fixed mass of gas. The relationship between kelvin, degrees celsius and absolute zero of temperature.

24. Bakers add yeast to bread dough to produce bubbles of carbon dioxide (CO_2).

    Using your knowledge of physics, explain why this causes the dough to rise more in an oven.

25. Using your knowledge of physics explain why it is dangerous to put an aerosol can in a fire.

26. Look at this advert :

> **"GO ANYWHERE" TYRES**
>
> Our new wide tyres will take you across any terrain, any country and in any weather!
>
> BUY NOW!!

    Using your knowledge of physics, comment on the claims made by the "Go Anywhere" tyre company in the above advert.

27. Using your knowledge of physics estimate the pressure exerted on the floor when you stand on two feet, include all assumptions made.

28. Using your knowledge of physics estimate the pressure exerted on the floor by an object of your choice, include all assumptions made.