Buttershaw Business and Enterprise College

AMBITION RESILIENCE COURTESY KINDNESS

AQA Combined Science Trilogy Physics Paper 2 Higher Key Recall Facts

Forces, Waves and Magnetism/Electromagnetism

Exam Date – Friday 16th June

Name……………………………………………………

Group……………………………………………………

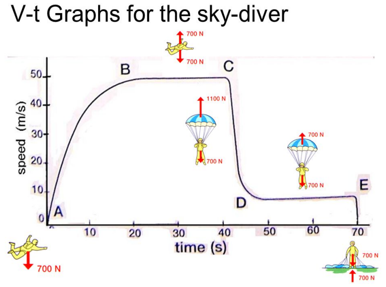
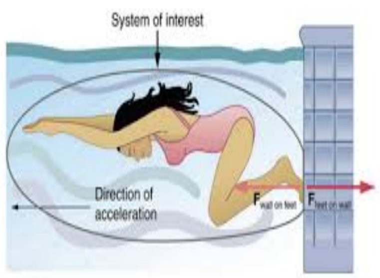
Teacher…………………………………………………

Forces Recall Facts

1. What is a scalar quantity?	Quantity that only has size/magnitude
2. Give examples of scalar quantities	Distance, time, speed, temperature, power
3. What is a vector quantity?	Quantity that has magnitude and direction
4. Give examples of vector quantities	Displacement, velocity, force, weight
5. How do you draw a vector?	Using an arrow in the right direction. The length of the arrow represents the size of the vector quantity.
6. Name some forces	Weight – force of an object caused by the pull of gravity. Air Resistance – force opposing an object moving through air. Water Resistance – force opposing an object moving through water. Drag – Air Resistance and/or water resistance. Reaction Force – Force upwards from a surface, such as a ground or table. Upthrust – Force causing an object to float in water or air. Magnetic – attractive or repulsive force between 2 magnets. Electrostatic – attractive or repulsive force between 2 charged objects.
7. Describe the difference between a contact and non-contact force	A contact force is one where the objects must be touching in order to experience a force e.g. friction, air resistance, reaction force A non-contact force is one where the objects do not have to be touching in order to experience a force e.g. gravity, magnetic, electrostatic
8. What is the gravitational field strength on Earth?	9.8N/Kg (one kg of mass on Earth will have a weight of 9.8N)
9. How does the gravitational field strength of a planet affect an object's weight?	The greater the gravitational field strength, the greater the weight.
10. How does the gravitational field strength of a planet affect an object's mass?	Mass is not affected by gravitational field strength. Mass, in kg, is the 'amount of matter' something is made up of. This does not change with gravity.
11. What is the centre of mass of an object?	A single point that the weight of an object can be considered to act through.

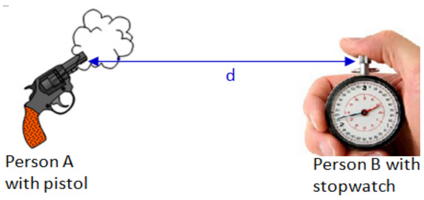
12. What is the resultant force?	The sum of all the forces acting on an object.
13. What happens when the resultant force on an object is zero?	If there is no resultant force, a stationary object will…. • Remain stationary. A moving object will….. • Keep moving at constant speed in the same direction
14. What happens when there is a resultant force on an object?	If there is a resultant force, the object will….. • Accelerate • Decelerate • Change direction
15. Describe what happens to an object working against resistive forces	The temperature of the object increases if it must work against friction and/or drag
16. What is the spring constant?	A measure of how stiff the spring is. If k has a higher value, the spring is more difficult to stretch.
17. What is meant by extension?	The difference (in m) between the stretched and unstretched lengths of a spring.
18. What is elastic deformation?	When an object is bent, stretched, compressed, or twisted, but returns to its normal shape when the forces are removed.
19. What is inelastic deformation?	When an object is bent, stretched, compressed, or twisted and does not return to its normal shape when the forces are removed.
20. What is Hooke's Law?	The extension of a spring is directly proportional to the force applied if the elastic limit is not reached.
21. What is the limit of proportionality (elastic limit)?	The point at which too much force has been applied and the spring undergoes inelastic deformation and does not return to its original length.
22. What is the difference between distance and displacement?	Displacement is a distance in a given direction, for example 300m East.
23. What is the difference between speed and velocity?	Velocity is speed in a given direction, for example 30m/s West.
24. What is the difference between average speed and instantaneous speed?	Average speed is the speed over a whole journey Instantaneous speed is the speed at one particular moment in time
25. Typical values of speed that you need to know	Human Walking 1.5m/s Human Running 3.0m/s Human Cycling 6.0m/s Car on the Motorway 30m/s Express Train 60m/s Jet Plane 200m/s Speed of Sound in Air 330m/s Speed of any EM Wave 300,000,000m/s

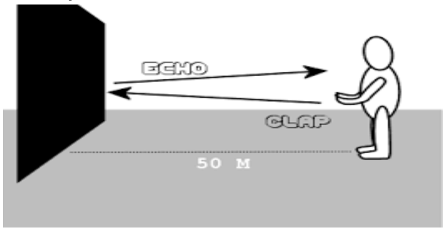
26. What is represented by the gradient of a distance-time graph?	Speed. Steeper the gradient, the faster the speed
27. What is represented by the following on a distance-time graph? a) (-) flat line b) (/) straight diagonal line up c) (\) straight diagonal line down)	a) Stationary b) Constant speed moving away. c) Constant speed moving back.
28. (HT only) How is acceleration/deceleration represented by a distance-time graph?	Changing gradient Acceleration – gradient gets steeper. Deceleration – gradient gets shallower.
29. How is average speed obtained from a distance-time graph?	Average speed = total distance / total time
30. (HT only) How is instantaneous speed obtained from a distance-time graph?	Draw a tangent to the line at that point (time) Calculate the gradient of the tangent (y / x)
31. What is acceleration?	A change in velocity. Because velocity is a vector quantity, then acceleration can be a change in speed or a change in direction or a change in both.
32. (HT only) How can an object travelling at constant speed be accelerating?	Changes direction
33. What is represented by the following on a velocity-time graph? a) (-) flat line above x-axis b) (-) flat line on the x-axis c) (/) straight diagonal line up d) (\) straight diagonal line down)	a) Constant velocity b) Stationary c) Constant acceleration d) Constant deceleration
34. What is represented by the gradient of a velocity-time graph?	Acceleration
35. (HT only) How can you calculate the distance travelled from a velocity-time graph?	Area under the graph

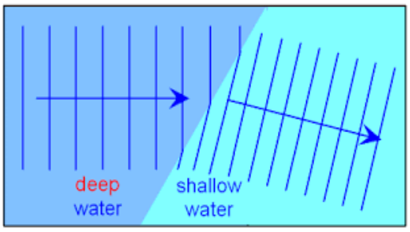
36. What two factors affect air resistance?	Surface area and speed: The greater the surface area, the greater the air resistance. The greater the speed, the greater the air resistance
37. Describe and explain the changes in velocity of a skydiver falling V-t Graphs for the sky-diver 	1) Initially, weight >> air resistance, large resultant force downwards, so skydiver accelerates. 2) As skydiver accelerates, air resistance increases. Weight is still greater than air resistance, but resultant force is less, so reduced acceleration. 3) Weight = air resistance, so no resultant force and skydiver falls at high constant velocity called terminal velocity. 4) Opens parachute, so weight < air resistance, so resultant force upwards, so skydiver decelerates. 5) As skydiver decelerates, air resistance decreases, so weight = air resistance again, so slower constant velocity
38. What is Newton's First Law (concerning situations where there is no resultant force)?	If the resultant force on an object is zero, the forces are balanced, so the object will remain stationary or keep moving at constant speed (there will be no acceleration).
39. What is Newton's Second Law (concerning situations where there is a resultant force)?	If there is a resultant force on an object, the forces are unbalanced, so the object will speed up, slow down or change direction (it will accelerate).
40. (HT only) What is inertia?	Inertia is the tendency of objects to continue in their state of uniform motion (stationary or constant speed
41. What is Newton's Third Law (concerning paired forces)?	For paired forces, every force has an equal and opposite force. Paired forces act upon two different objects and must be the same type of force.  Here, the swimmer pushes the wall to the right, so the wall pushes the swimmer to the left. The forces are equal in size and opposite in direction.
42. (HT only) What is momentum?	The product of mass and velocity.
43. (HT only) What is meant by conservation of momentum?	When objects collide in a closed system, the total momentum (mass x velocity) of all the objects after the collision is the same as the momentum before the collision. Total momentum before = total momentum after

44. (HT only) Example of conservation of momentum If a swimmer jumps off the boat, the boat moves backwards. Explain why in terms of conservation of momentum	Momentum before = momentum after Before diving in the momentum of the diver and (small) boat is zero After diving the diver has forwards momentum/ momentum to the right Therefore the (small) boat has equal backwards momentum/ equal momentum to the left.
45. What force causes a car to slow down when the brakes are applied?	Friction (between the brake pads and the wheel).
46. What is meant by 'thinking distance'?	The distance traveled by a car during the time it takes for the driver to react. Depends on reaction time.
47. What is the typical range of human reaction time?	0.2-0.9s
48. What is meant by 'braking distance'?	The distance travelled by a car once the brakes have been applied.
49. What is meant by the 'stopping distance'?	The sum of the thinking distance and braking distance.
50. What factors increase thinking distance (reaction time)?	Alcohol and certain drugs; distraction (including mobile phone use); tiredness, speed of car.
51. What factors increase braking distance?	The size of the braking force (how hard the driver brakes; poor friction from the road surface; wet or icy conditions; poor maintenance of brakes or tyres, mass of car, speed of car.
52. Describe the energy changes during braking	The kinetic energy store of the car decreases The thermal energy store of the car tyres/road/surroundings increases
53. Why is a large deceleration dangerous?	Large decelerations need large braking forces causing overheating of the brake pads making them less effective. Large braking forces may also cause the car to skid
54. Why does work need to be done when braking?	A force is required to decrease the kinetic energy (and momentum) of a vehicle. The size of the work done depends on the size of the original kinetic energy. The faster and/or bigger the vehicle, the more kinetic energy at the start, and so more work needs to be done by the brakes to stop/slow down the vehicle.

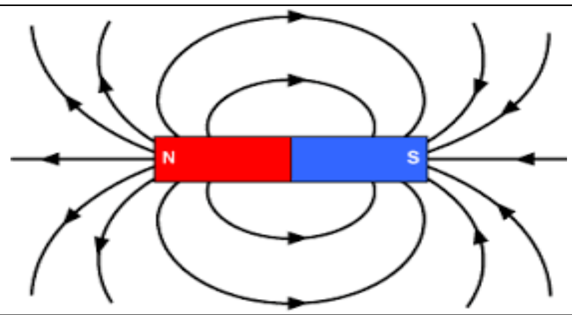
Waves

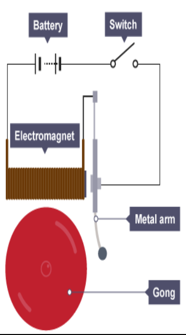
1. What is a wave?	Vibrations that transfer energy from place to place without matter/particles (solid, liquid or gas) being transferred.
2. Name the two types of waves	Transverse and Longitudinal
3. Define a transverse wave	Particles vibrate perpendicular to the direction of the energy transfer.
4. Examples of transverse waves	Any EM wave, water waves, S-waves
5. Definition of a longitudinal wave	Particles vibrate parallel to the direction of the energy transfer. Have compressions (high pressure or particles close together) and rarefactions (low pressure or particles further apart)
6. Examples of longitudinal waves	Sound waves, P-waves
7. Give an example that shows waves transfer energy, and not particles	**Example 1** Place an object that floats into water tank. Create ripples/water waves. The object will bob up and down but stay in the same place. **Example 2** When sound is created (banging on a drum), the sound waves reach a person's ear, but the sound does not create a vacuum near the drum (particles have not moved.
8. (HT only) What is the relationship between frequency and wavelength if the wave speed is constant?	Frequency of a wave is inversely proportional to the wavelength. This means that if the frequency of a wave is doubled, the wavelength will halve if the wave speed is the same
9. Define the following words. a) Wavelength b) Frequency c) Amplitude d) Time period	a) The length of one complete wave (from a point on one wave, to the same exact point on the next wave) b) Number of waves passing a point in a second c) Height of a wave from the middle d) How long a wave is in seconds.
10. Describe the pistol method for measuring the speed of sound waves.  	1) Measure a large distance (above 300m) between person with pistol, and person with stopwatch. 2) Measure distance with trundle wheel/GPS 3) Person fires pistol 4) Other person starts stopwatch when they see light, and stops the stopwatch when they hear the sound (light travels faster than sound) 5) Speed = distance / time

11. Describe the clap echo method for measuring the speed of sound in air 	1) Stand around 50m from a wall – measure distance with a trundle wheel 2) Clap and listen for the echo 3) Times the distance by two, as sound travels to the wall and back 4) Speed = distance ÷ time 5) Could time 11 claps and weight for 10 echoes to come back
12. Define the terms emitted, absorbed, transmitted, reflected and refracted	***Emitted –*** given out from a source ***Transmitted –*** goes through a medium ***Absorbed –*** taken in by the medium ***Reflected –*** bounces off the surface of a medium ***Refracted –*** changes direction due to a change in speed when travelling into a different medium
13. Recall the EM spectrum in order, with uses for each one	***Radiowaves*** – Television and Radio Signals ***Microwaves*** – Mobile Phones and Cooking Food ***Infrared*** – Electrical Heaters, Cooking Food and Infrared Cameras ***Visible Light*** – Fibre Optics, Vision ***Ultraviolet*** – Tanning, Security, Energy Efficient Lamps, Fluroscent Marking ***X-Rays*** – Medical Imaging (broken bones), Security ***Gamma Rays*** – Medical Imaging, Radiotherapy, Tracers, Sterilising Equipment
14. State hazards for the different EM Waves	***Radiowaves*** – None ***Microwaves*** – (skin) burns ***Infrared*** – (skin) burns ***Visible Light*** – None, but damage to retina if very bright ***Ultraviolet*** – Skin cancer, damage skin, wrinkles, ageing ***X-Rays*** – Cancer, damage cells ***Gamma Rays*** – Cancer, damage cells
15. Split the parts of the EM spectrum into ionising and non-ionising radiation	**Non-ionising** - Radiowaves, microwaves, infrared and visible light **Ionising** – Ultraviolet, x-rays and gamma rays
16. (HT only) Why are radiowaves used to send TV and Radio signals?	They are able to diffract (bend) around the curved surface of the Earth. Also, the signal can be bounced off the ionosphere (layer around the Earth) without the information being lost.
17. (HT only) Explain what happens when radio waves are absorbed by an aerial?	When radio waves are absorbed, they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.

18.(HT only) Why are microwaves used to send mobile phone signals?	Microwaves can penetrate through the atmosphere to a satellite in orbit around Earth. Other EM waves will generally struggle to penetrate the atmosphere.
19.Why does UV only cause skin cancer?	UV cannot penetrate through the skin to cause cancer of internal organs
20.(HT only) Why are x-rays used to show broken bones?	X-rays penetrate through soft tissue (muscle/organs), but are absorbed by denser material, such as bone. So, these areas show up as white.
21.How are gamma rays formed?	Gamma rays are given off due to changes in the nuclei of atoms.
22.(HT only) Why are gamma rays used as tracers and radiotherapy?	Most penetrating type of radiation, so can go through body
23.Explain the term ionisation	Ionising radiation has enough energy to knock electrons off of atoms. This leads to change in molecules, such as DNA, as well as changing cells. This can lead to mutations in DNA, cancer and damage to living tissue.
24.Why does refraction occur?	When waves change medium, they change speed. This leads to a change in direction.
25.(HT only) Why does refraction lead to a change in wavelength?	When waves change speed, the frequency must remain the same. As wave speed = frequency x wavelength, if frequency is the same, the wavelength must also change. A decrease in wave speed leads to a decrease in wavelength.
26.(HT only) Why does light change direction towards the normal when it goes from air to glass?	Light slows down when it enters glass, as glass is denser. This makes it change direction towards the normal
27.(HT only) What happens to a wave front when it enters a different material along the normal?	As the whole wave front enters the medium at the same time, the whole wave changes speed at the same time, causing a change in wavelength but not direction.
28.(HT only) Explain the diagram below. 	Here, the bottom part of the wave front hits the shallow water first and starts to slow down. The top part of the wave is still in deep water, so carries on moving at the same speed. Eventually, the whole wave front is in shallow water and travels at the same speed. The wavelengths are shorter in shallow water. Smaller velocity means shorter wavelength.

Magnetism and Electromagnetism

1. What is the direction of the magnetic field line?	From the north pole of a magnet to the south pole.
2. What is the Magnetic Field?	It is the region around a magnet where a force acts on another magnet.
3. How is a magnetic field detected?	Scatter iron filings around the field Move a compass around the magnet
4. Describe how a magnetic field can be plotted	Move a compass around the magnet. Draw an arrow to show the direction in which the compass points. Join the arrows up to draw the magnetic field.
5. Draw the magnetic field around a simple bar magnet	
6. Where is the magnetic field strongest?	At the poles
7. Describe the relationship between the distance from the magnet and the strength of the magnetic field	The further away from the magnet, the weaker the magnetic field.
8. What happens when two same poles of a bar magnet are brought near each other?	Repel
9. What happens when two same poles of a bar magnet are brought near each other?	Attract
10. What is an induced magnet?	Something that only becomes magnetic when placed inside a magnetic field e.g. a paper clip.
11. What is a permanent magnet?	Something that is always magnetic.
12. Describe 3 differences between an induced magnet and a permanent magnet	1) An induced magnet is only magnetic when inside another magnetic field. 2) An induced magnet always attracts as the ends can switch poles, whilst a permanent magnet shows attraction and repulsion. 3) An induced magnet loses its magnetism as soon as it is moved away from another magnetic field

13. Describe how you would find out whether a material is a permanent magnet, induce magnet or not magnetic	• Non-magnetic material – will not attract or repel with a permanent bar magnet. • Induced magnet – this will attract to both poles of a permanent bar magnet. • Permanent magnet – this will attract to one side of the permanent bar magnet, and repel to the other pole.
14. Name some magnetic materials?	Iron, Steel, Cobalt and Nickel.
15. What is the proof that the Earth has a magnetic field?	The needle always settles in a **north-south** direction. Earth's core is made of moving iron and nickel causing a magnetic field
16. How do we create a magnetic field around a wire?	When a current moves through a wire.
17. How can we strengthen the magnetic field?	By shaping a wire into solenoid (coil of wire).
18. What can be used to strengthen the magnetic field of a solenoid?	Place an iron core through the middle of the solenoid.
19. Describe the difference between a solenoid and an electromagnet	• Solenoid – coil of wire • Electromagnet – coil of wire with an iron core in the middle
20. Advantages of electromagnet compared to permanent?	Can be switched off. The strength of an electromagnet can be varied.
21. 3 ways to make electromagnet stronger	• Wrap the coil of wire around an **iron core**; • Increase the **number of turns on the coil of wire**; • Increase the **size of the current**.
22. Examples of electromagnets	Scrapyards and switches in electrical devices.
23. How does an electric bell work? 	When the switch is pressed to close it, it allows a current to flow through the coil of wire. This creates a magnetic field around the electromagnet. This attracts the metal arm, moving it towards and hitting the gong. This breaks the circuit so the metal arm moves back as the electromagnet does not have a magnetic field around it anymore
24. (HT only) Why does a current carrying wire inside a magnetic field move?	The coil of wire carrying a current has a magnetic field around it. This magnetic field interacts with the magnetic field of the magnets, and experiences a force. This is known as the motor effect.

25.(HT only) What is the size of the force when the current and magnetic field are parallel to each other?	It is zero. The wire will not experience a force if the current and magnetic field are parallel to each other
26.(HT only) Why does an electric motor continuously rotate?	If the wire is as a coil of wire between 2 magnets, there is a magnetic field due to the permanent magnets and there is a magnetic field around the coil of wire. The current on each side is in a different direction, so the force on each side is in a different direction. The split-ring commutator reverses the direction of current every half turn to make sure that the direction of current on each side stays the same and therefore the direction of the force stays the same to allow the coil to continuously rotate.
27.(HT only) How can the motor be made to rotate faster?	• Increase the current • Increase the number of turns on the wire • Stronger magnetic field • Increase length of wire in magnetic field
28.(HT only) How can the motor be made to rotate in the other direction?	• Reverse direction of current • Reverse direction of magnetic field
29.(HT only) What is Fleming's Left-Hand Rule?	Used to find out the direction of the force Place the first finger in the direction of the magnetic field (N → S) Place second (middle finger) in the direction of the current (+ve to –ve) The thumb will then show the direction of the force