

Nature of Science: 15 questions, 12%

Vector	magnitude NO direction Ex= speed, distance
Scalar	magnitude & Direction. Ex= acceleration, displacement
Significant Figures	all digits after the first <i>non-zero</i> are significant ex: 0.00410 3 sig figs, 23840100 6 sig figs leading zeros don't count adding round to # with the fewest decimals
Accuracy	ex: how close results are to the true value
Precision	how close results are to one another
Systematic Error	consistent error
Acceleration	v/t $1/2gt^2$
Weight	$W=mg$ =mass X gravity
Work	$W=Force \times distance$

Matter and Energy: 19 questions, 15%

Bohr model	electrons move in fixed orbitals (shells) and not anywhere in between and that each orbit (shell) has a fixed energy		
Particles	α = 2p,2n bound	β =high energy, high speed electrons	γ =shortest wavelength electroma- gnetic waves
Fission	breaks	releases energy ex. atom smashing	
Fusion	combines	releases energy ex. sun	
Energy transfer	$radiation$ = emitted	$conduction$ = touch	$convection$ = fluids

Matter and Energy: 19 questions, 15% (cont)

Thermo-dynamics	<i>1st law</i> = conservation of energy	<i>2nd law</i> = entropy increases	<i>3rd law</i> = A perfect crystal at zero Kelvin has zero entropy
Ideal Gas Law	Boyle's law PV=nRT	pressure and volume of a gas have an inverse relationship	
Kinetic energy	energy of motion	$=1/2mv^2$	
Potential energy	stored energy	$=mgh$	
PE=KE	$mgh=1/2mv^2$	$mgh=1/2mv^2 + mg(2R)$	
ME= KE + PE	velocity b4 impact: square root (2gh)		

Waves: 21 questions, 17%

Transverse waves	motion in which all points on a wave oscillate along paths at right angles to the direction of the wave's advance. Ex Water ripples		
Longitudinal waves	vibration of medium is parallel to the direction the wave travels and displacement of the medium is in the same direction of the wave propagation. Ex: sound		
Mechanical waves	an oscillation of matter, and transfers energy through a material medium. ex: sound, water		
Electromagnetic	formed when an electric field couples with a magnetic field. ex. light, gamma		
Compression waves	the particle motion is in the same direction in which the wave is propagating i.e. longitudinal		



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Waves: 21 questions, 17% (cont)

Doppler effect: the change in the frequency of a wave in relation to an observer who is moving relative to the source of the wave

moving away= longer towards=shorter

Sound *Sonic boom*= shock waves created when an object travels through the air faster than the speed of sound

sound barrier sudden increase in aerodynamic drag that happens when an object approaches the speed of sound

Pitch=frequency

Loudness=intensity

Waves pt 2: 21 questions, 17% (copy)

Snell's law: relationship between angles of incidence & refraction

refraction= the bending of light or sound as it passes through something like a wall (sound) or a window (light).

reflection= the throwing back without absorbing it.

$n_1 \sin \theta_1 = n_2 \sin \theta_2$ change in direction

Optics *real image*= occurs where rays converge *virtual image*= rays only appear to diverge

Polarization= division into two sharply distinct opposites

Lenses *converging*= both sides of the lens curve outward it will bend light from distant objects inwards toward a single point, called the focal point

Waves pt 2: 21 questions, 17% (copy) (cont)

convex=refract and converge

further from lens the bigger the object appears

diverging=both sides of the lens curve inward and light from distant objects will bend outwards.

concave=refract and diverge, always smaller

+ behind lens - in front of lens

more lenses, - the focal length

Mechanics: 44 questions, 35%

Newton's 1st *law of inertia*: objects at rest remain at rest

Newton's 2nd $F=ma$: the greater the mass the more force needed to accelerate

Newton's 3rd every action has an equal and opposite reaction

Kepler's 1st all planets move in an elliptical orbit around the sun

Kepler's 2nd planets will move slowly far away from the sun, and faster closer to the sun

Kepler's 3rd the square of the period of any planet is proportional to the cube of the axis of the orbit.

Friction force that resists the sliding/rolling of a solid object over another

Bernoulli's principle an increase in speed of a fluid simultaneously with a decrease in pressure or a decrease in the fluid's PE

Uniform circular motion *centripetal* acceleration, net force is directed to the center



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Mechanics: 44 questions, 35% (cont)

increasing radius decreases force

$$F = m(v^2/r)\cos\theta$$

Rotational motion

motion of an object around an axis. $w = \theta/t$

Harmonic motion $F = -kx$

Hooke's law the force exerted by a spring is proportional to its length

Collisions

elastic- momentum conserved ex. pool balls move apart

inelastic- momentum not conserved ex. 2 cars stuck together, move together

Centripetal force

increase radius, decrease the force.

$$F = m(v^2/r)\cos\theta$$

Bouyant force $F = -\rho gV$

the upward force exerted on an object immersed in a fluid

Displacement

$$D = VT = \text{velocity} \times \text{time}$$

Vectors

add or subtract by placing tip to tail

Pascal's principle

The pressure at any point in the fluid is equal in all directions.

pressure input = pressure output

modulus

bulk= reaction to squeezing

elastic= ratio of stress to strain

young= elasticity and length

shear= elasticity and stress

Pendulums

$$\text{Time} = 2\pi(\sqrt{\text{length/gravity}})$$

$$\text{freq (displacement)} = \text{amplitude} \sin(\text{ang freq} \times t)$$

Electricity & Magnetism: 26 questions, 21% (cont)

Conductors

allows the movement of electrons and ions through.
Ex. copper, gold, silver, steel, aluminium & brass

have moveable charges

Insulators

don't allow electric current to pass through, electrical resistance. Ex. glass, plastic, rubber, air, & wood

Ohm's law

the relationship between voltage, current & resistance
 $V = IR$ in an electrical circuit.

Biot-Savart law

describes the magnetic field generated by a constant electric current

Lorentz force

combination of electric and magnetic force on a point charge due to electromagnetic fields. *to determine the direction of the magnetic force on a positive moving charge, point right thumb in the direction of the velocity (v), index finger in the direction of the magnetic field (B), and middle finger will point in the direction of the the resulting magnetic force*

Electricity & Magnetism: 26 questions, 21%

Coulomb's law $F = k(q_1q_2)/r^2$

the force of attraction/repulsion between 2 charged bodies is proportional to the product of their charges and inversely proportional to the square of the distance between them



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Electricity & Magnetism: 26 questions, 21% (cont)

Ampere's law the sum of the length elements times the magnetic field in the direction of the length element will be equal to the permeability times the electric current.

Lenz's law direction of the electric current induced in a conductor by a changing magnetic field, the magnetic field created by the induced current opposes changes in the initial magnetic field

Kirchoff's laws sum of all currents entering a junction must equal the sum of all currents leaving the junction

Electric field the electric force per unit charge

Electric potential amount of work energy needed per unit of electric charge to move the charge from a reference point to a specific point in an electric field
 $V = k(q/r)$

the stronger the field= more potential

$I = V/R$ $V = IR$ $R = V/I$

Series one path $R_t = R_1 + R_2 + R_3 \dots$

$I_t = I_1 = I_2$ $V_t = V_1 + V_2$

Parallel many paths $1/R_t = 1/R_1 + 1/R_2 \dots$

$I_t = I_1 + I_2$ $V_t = V_1 = V_2$

Electricity & Magnetism: 26 questions, 21% (cont)

decrease resistance= decrease length, increase radius

total resistance is less than individual

Gauss's law how much of something is INSIDE a completely closed surface by measuring how much is flowing out through the sides of that surface.

the electric flux Φ across any closed surface is proportional to the net electric charge q enclosed by the surface

Magnetic field $F = qvB \sin \theta$, where q is the magnitude of the charge, B is the magnitude of the magnetic field, v is the speed, and θ is the angle of the velocity with respect to the field. As θ increases from 0° to 90° , the force increases.



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