OCR : Gateway GCSE : Specification J641

GCSE Additional Science B

First certification Summer 2008

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Name : ____

Page numbers in
New Physics for You
ISBN 07487-8328-8

Module P3 : Forces for Transport	Page numbers in New Physics for You
Item P3a: Speed	
Assessable learning outcomes **Foundation Tier only: low demand**	
Describe faster objects as covering more distance in a given time.	page 122
State that speed is measured in metres per second, m/s.	122
State that the measurements needed to determine speed are: • distance; • time.	122
Describe appropriate means of measuring distance and time in everyday situations using a: • stopwatch/stopclock; • measuring tape or trundle wheel.	8, 122
Describe why speed cameras generally take two photographs: • a certain time apart; • near marked lines on the road.	
Interpret simple graphs of distance against time: • straight line gradient - steady speed; • horizontal line - stationary (zero speed).	126
Assessable learning outcomes **both tiers: standard demand**	
Interpret the relationship between speed, distance and time including: • increasing the speed, which increases the distance travelled in the same time. • increasing the speed reduces the time needed to cover the same distance.	122
State and use the equation: $\text{speed} = \dfrac{\text{distance}}{\text{time}}$	122
Describe, draw and interpret qualitatively simple graphs of distance against time.	126
Describe and interpret the gradient (steepness) of a distance-time graph as speed: • higher speed steeper gradient.	126

Assessable learning outcomes **Higher Tier only: high demand**	
Interpret the relationship between speed, distance and time including the: • effect of changing any one or two of the quantities.	page 122
State and use the equation: speed = $\frac{\text{distance}}{\text{time}}$ (A change of subject may be required).	122
Draw and interpret quantitatively simple graphs of distance against time: • qualitatively for non-uniform speed; • calculate speed from the gradient of a straight line graph.	126
Item P3b: Changing Speed	
Assessable learning outcomes **Foundation Tier only: low demand**	
Describe the trends in speed and time from a simple speed-time graph. • horizontal line - constant speed; • straight line positive gradient - increasing speed; • straight line negative gradient - decreasing speed.	124
Recognise that acceleration involves a change in speed (limited to a straight line): • speeding up; • slowing down.	122
State that acceleration is measured in metres per second squared, m/s^2.	122
Assessable learning outcomes **both tiers: standard demand**	
Describe and interpret the gradient (steepness) of a speed-time graph as a measure of acceleration. • more acceleration, steeper gradient.	124-5
Describe, draw and interpret qualitatively simple graphs of speed against time for uniform accelerations.	124-5
Describe the area under the line of a speed-time graph as distance travelled.	124
Describe acceleration as change in speed per unit time.	122
State and use the equation: acceleration = change in speed/ time taken.	122

Assessable learning outcomes **Higher Tier only: high demand** Describe, draw and interpret simple graphs of speed against time including: • quantitatively for uniform acceleration; • calculations of speed from the gradient of a distance-time graph; • calculations of distance travelled from a speed-time graph for uniform acceleration; • calculations of acceleration from a speed-time graph for uniform acceleration and only qualitatively for non uniform acceleration.	 pages 124-5
State and use the equation: • acceleration = change in speed/ time taken. (A change of subject may be required.)	122
Explain that acceleration could involve either a change: • in speed; • in direction.	122, 70
Interpret the relationship between acceleration, change of speed and time to include: • effect of changing any one or two of the quantities.	122
Item P3c: Forces and Motion	
Assessable learning outcomes **Foundation Tier only: low demand** Describe and recognise simple situations where forces cause things to speed up or slow down.	 87, 89, 128
Describe and recognise that for a given mass: • more force = more acceleration; • less force = less acceleration.	130-1
Describe and recognise that for a given force: • more mass = less acceleration; • less mass = more acceleration.	130-1
Describe and recognise that for a given acceleration: • more mass = more force; • less mass = less force.	130-1
Explain the significance to road safety of: • thinking distance; • braking distance; • stopping distance.	83
Describe thinking distance as: • the distance travelled between the need for braking occurring and the brakes starting to act.	83
Describe braking distance as: • the distance taken to stop once the brakes have been applied.	83
Describe stopping distance as: • thinking distance + stopping distance.	83

Assessable learning outcomes both tiers: standard demand	
Describe and interpret the relationship between force, mass and acceleration in everyday examples.	87, 89, 130-1
State and use the equation: force = mass x acceleration.	130-1
Describe the factors which might increase thinking distance: • driver tiredness; • influence of alcohol or other drugs ; • more speed; • distractions or lack of concentration.	83
Describe the factors which might increase braking distance: • road conditions - slippy, icy, wet; • car conditions - bald tyres, poor brakes; • more speed.	83
Interpret charts of thinking distances and braking distances.	83
Explain the implications of stopping distances in road safety. • driving too close to the car in front; • speed limits; • road conditions.	83
Assessable learning outcomes Higher Tier only: high demand	
State and use the equation: force = mass x acceleration. (A change of subject may be required.)	130-1
Recognise that when body A exerts a force on body B, body B exerts an equal but opposite force on body A: • these constitute two different views of the same interaction and are not balanced forces.	84-5
Explain qualitatively everyday situations where braking distance is changed including: • friction; • mass; • speed; • braking force.	83, 87

Item P3d: Work and Power	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recognise everyday examples in which work is done and power is developed for example: • lifting weights; • climbing stairs; • pulling a sledge; • pushing a shopping trolley.	pages 97, 99, 111
Recognise that work is done when a force moves an object.	97
Recognise that when work is done it depends on: • the size of the force in newtons; • the distance in metres.	97
State that energy is needed to do work.	99
State that the joule is the unit for both work and energy.	35, 97
Describe power as a measurement of how quickly work is being done.	110
State that power is measured in watts (W).	110
Recognise that cars: • have different power ratings; • have different fuel consumptions.	110, 102
Assessable learning outcomes **both tiers: standard demand**	
State and use the equation: work done = force x distance.	97
State and use the equation: $\text{Power} = \frac{\text{work done}}{\text{time}}$	110-1
Interpret fuel consumption figures from data on cars to include; • environmental issues; • costs.	102
Assessable learning outcomes **Higher Tier only: high demand**	
State and use the equation: work done = force x distance. (A change of subject may be required.)	97
State and use the equation: $\text{Power} = \frac{\text{work done}}{\text{time}}$ (A change of subject may be required).	110-1

Item P3e: Energy on the move	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recognise everyday examples in which objects have kinetic energy.	pages 10-11
Recognise and describe fossil fuels as the main fuel in road transport: • petrol; • diesel.	(114)
Recognise and describe how electricity can be used for road transport: • battery driven cars; • solar power.	115
Interpret data about fuel consumption (no recall required.)	102
Assessable learning outcomes **both tiers: standard demand**	
Describe everyday examples in which objects have kinetic energy.	10-11, 98-9, 100-1
State and recognise that kinetic energy is greater for objects with: • higher speed; • greater mass.	109
Interpret data about fuel consumption.	102
Explain that electrically powered cars do not pollute at the point of use whereas fossil fuel cars do.	115
Recognise that battery driven cars need to have the battery recharged: • this uses electricity produced from a power station; • power stations cause pollution.	115
Assessable learning outcomes **Higher Tier only: high demand**	
Use the equation: $KE = \frac{1}{2} \times mv^2$	109
Apply the ideas of kinetic energy: • relationship between braking distances and speed; • everyday situations involving objects moving.	109
Describe and explain that car fuel consumption figures depend on: • energy required to increase KE; • energy required to do work against friction; • different driving styles and speeds; • different road conditions.	102
Interpret data about fuel consumption.	102

Item P3f: Crumple Zones	
Assessable learning outcomes **Foundation Tier only: low demand** Describe the typical safety features of modern cars that require energy to be absorbed when vehicles stop: • heating in brakes; • crumple zones; • seat-belts; • air bags. State some typical active safety features of cars: • ABS brakes; • traction control; • safety cage. State some typical passive safety features of cars: • electric windows; • cruise control; • paddle shift controls - gears, stereo; • adjustable seating. Explain why seatbelts have to be replaced after a crash.	pages 69, 138, worksheet
Assessable learning outcomes **both tiers: standard demand** Describe how seatbelts, crumple zones, air bags are useful in a crash because they: • change shape; • reduce injuries; • absorb energy. Describe how typical active safety features can make driving safer. Describe how typical passive safety features can make driving safer.	69, 138, worksheet
Assessable learning outcomes **Higher Tier only: high demand** Explain that forces can be reduced when stopping (eg. crumple zones, braking distances, escape lanes, crash barriers, seatbelts and air bags) by: • increasing stopping or collision time; • increasing stopping or collision distance; • decreasing acceleration. Describe using the ideas of friction why ABS brakes reduce braking distances. Evaluate the effectiveness of given safety features in terms of saving lives.	69, 136, 138, worksheet

Item P3g: Falling safely	
Assessable learning outcomes **Foundation Tier only: low demand**	
Describe how falling objects: • get faster as they fall; • are pulled by a force called weight (gravity) towards the centre of the earth.	page 89
Recognise that air resistance or drag can slow-down falling objects: • parachutes; • shuttle-cock in badminton.	82, 89
Recognise that frictional forces (drag, friction, air resistance): • act against the movement; • can be reduced (shape, lubricant).	82, 89
Recognise that the shape of moving objects can influence their top speeds: • wedge shape of sports car; • deflectors on lorries and caravans; • roof boxes on cars.	82, 89
Recognise that falling objects do not experience drag when there is no atmosphere: • moon; • outer space.	
Assessable learning outcomes **both tiers: standard demand**	
Describe how objects falling through Earth's atmosphere reach a terminal speed.	89, 128
Explain in terms of the balance of forces why objects: • increase speed; • decrease speed; • maintain steady speed.	87, 89, 128
Recognise that acceleration in free-fall (g) is constant.	128-9
Assessable learning outcomes **Higher Tier only: high demand**	
Explain, in terms of balance of forces, why objects reach a terminal speed: • higher speed = more drag; • larger area = more drag; • weight (driving force) = drag gives terminal speed.	87, 89, 128-9

Item P3h: The energy of games and theme rides	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recognise that objects have gravitational potential energy because of their mass and position in Earth's gravitational field: • more mass = greater PE; • more height = greater PE.	page 10-11, 98-9
Recognise everyday examples in which objects use gravitational potential energy.	10-11, 98-9
Recognise that moving objects have kinetic energy.	10-11, 98-9
Assessable learning outcomes **both tiers: standard demand**	
Describe everyday examples in which objects have gravitational potential energy.	10-11, 98-9
Recognise and interpret examples of energy transfer between gravitational potential energy and kinetic energy.	99
When an object falls it converts PE to KE.	99
PE is also greater when the gravitational field strength (g) is higher.	108
Interpret a gravity ride (roller-coaster) in terms of: • KE; • PE; • energy transfer.	99
Describe the effect of changing mass and speed on KE. e.g. • doubling mass doubles KE • doubling speed quadruples KE	109
Assessable learning outcomes **Higher Tier only: high demand**	
Explain that at terminal speed: • KE does not increase; • PE does work against friction.	89
Use the equation : PE = m g h. (A change of subject is required.)	108
State and use the equation: Weight = mass x gravitational field strength (A change of subject is required.)	131

Module P4 : Radiation for Life	Page numbers in New Physics for You
Item P4a: Sparks	
Assessable learning outcomes Foundation Tier only: low demand	
Describe and recognise that insulating materials can become charged when rubbed with another insulating material.	page 241
State that there are two kinds of charge: • positive; • negative.	241
Describe and recognise that when some materials are rubbed they attract other objects: • small pieces of paper or cork to a rubbed comb or strip of plastic; • certain types of dusting brushes become charged and attract dust as they pass over it.	241
Recognise and describe how you can get an electrostatic shock from charged objects: • synthetic clothing.	246
Recognise and describe how you can get an electrostatic shock if you become charged and then become earthed: • touching water pipes after walking a floor covered with an insulating material e.g. vinyl.	246
Assessable learning outcomes both tiers: standard demand	
State and recognise that like charges repel and unlike charges attract.	241
State and recognise that electrostatic phenomena are caused by the transfer of electrons.	242
Explain how static electricity can be dangerous when: • in atmospheres where explosions could occur e.g. inflammable gases or vapours or with high concentrations of oxygen; • in situations where large quantities of charge could flow through the body to earth.	246
Explain how static electricity can be a nuisance: • dirt and dust attracted to insulators (plastic containers, TV monitors etc); • causing clothing to “cling”.	242, 246-7

Assessable learning outcomes **Higher Tier only: high demand** Describe static electricity in terms of the movement of electrons: • a positive charge due to lack of electrons; • a negative charge due to an excess of electrons. Explain how the chance of receiving an electric shock can be reduced by: • correct earthing; • use of insulating mats; • using shoes with insulating soles. Explain why it is necessary to earth lorries containing inflammable gases and liquids and powders before unloading. Explain how anti-static sprays, liquids and cloths help reduce the problems of static electricity.	page 242 243 246
Item P4b: Uses of Electrostatics	
Assessable learning outcomes **Foundation Tier only: low demand** Recognise and describe how static electricity can be useful: • restarting a heart when it has stopped (defibrillator); • photocopiers/laser printers (detailed structural knowledge not required); • removing dust from smoke in chimneys; • paint spraying.	246, (315)
Assessable learning outcomes **both tiers: standard demand** Describe how static electricity can be useful for restarting the heart when it has stopped (defibrillator): • paddles charged; • good electrical contact with patient's chest; • charge passed through patient to make heart contract; • care taken not to shock operator. Describe how static electricity can be useful for electrostatic dust precipitators to remove smoke particles etc from chimneys: • metal plates/grids put into chimneys; • connected to a high PD; • dust particles attracted to plate/grid; • dust attracts together to form larger particles; • dust falls back down chimney when particles are heavy enough Describe how static electricity can be useful for paint spraying: • spray gun charged; • paint particles charged; • repel giving fine spray; • object charged oppositely to paint; • attracts paint; • even coat, less waste, shadows painted.	 246 246

Assessable learning outcomes **Higher Tier only: high demand** Explain how static electricity can be useful for restarting the heart when it has stopped (defibrillator): • paddles charged; • good electrical contact with patient's chest; • charge passed through patient to make heart contract; • care taken not to shock operator. Explain how static electricity can be useful in electrostatic dust precipitators to remove smoke particles etc from chimneys: • metal plates/grids put into chimneys; • connected to a high PD; • dust particles attracted to plate/grid; • dust particles are attracted together to form larger particles; dust falls back down chimney when particles are heavy enough.	page 246
Explain how static electricity can be useful for paint spraying: • spray gun charged; • paint particles charged; • repel giving fine spray; • object charged oppositely to paint; • attracts paint; • even coat, less waste, shadows painted.	246
Item P4c: Safe Electricals	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recognise that a complete loop is required for a circuit to work.	248
State that an earthed conductor cannot become live.	268
Describe and recognise how resistors can be used to change the current in a circuit.	254-5
State the colour coding for live, neutral and earth wires: • live - brown; • neutral - blue; • earth - green/yellow.	270
Describe that an earthed conductor cannot become live.	268
Describe reasons for the use of fuses / circuit breakers (as re-settable fuses).	269
Describe and recognise that "double insulated" appliances do not need earthing.	269

Assessable learning outcomes **both tiers: standard demand**	
Explain the behaviour of simple circuits in terms of the flow of electric charge.	pages 249, 252
Describe how variable resistors can be used to change the current in a circuit: • variable resistor configured as rheostat only.	255
Describe the relationships between current, potential difference (pd) and resistance: • for a given resistor, current increases as pd increases and vice versa; • for a fixed pd, current decreases as resistance increases and vice versa.	253
State and use the equation: $\text{resistance} = \frac{\text{voltage}}{\text{current}}$	253
Describe and explain the functions of the live, neutral and earth wires: • live - carries the high voltage; • neutral - the second wire wire to complete the circuit; • earth - a safety wire to stop the appliance becoming live.	268-9
Describe how a wire fuse works: • if the current becomes too large; • wire fuse melts, breaking the circuit	269
Explain why "double insulated" appliances do not need earthing: • case of appliance is a non conductor and cannot become live.	269
Assessable learning outcomes **Higher Tier only: high demand**	
State and use the equation: $\text{resistance} = \frac{\text{voltage}}{\text{current}}$ (A change of subject may be required.)	253
Explain how a wire fuse protects an appliance.	269
If the appliance develops a fault: • too large a current causes the fuse melt; • preventing flow of current; • prevents flex overheating and causing fire; • prevents further damage to appliance.	269
Explain the reasons for the use of fuses/circuit breakers as re-settable fuses (structure and mode of operation not required).	260
Explain how a wire fuse and earthing protects people.	269

Item P4d: Ultrasound	
Assessable learning outcomes **Foundation Tier only: low demand**	
State and recognise that ultrasound is a longitudinal wave.	pages 166, 226
Recognise features of a longitudinal wave: • amplitude; • wavelength; • frequency; • compression; • rarefaction.	166-7, 225
Describe and recognise that ultrasound can be used in medicine: • to look inside people by scanning the body; • to break down kidney and other stones; • to measure the speed of blood flow in the body.	228-9
Assessable learning outcomes **both tiers: standard demand**	
Describe features of longitudinal waves: • amplitude; • wavelength; • frequency; • compression; • rarefaction.	166-7, 225
State and recognise that the frequency of ultrasound is higher than the upper threshold of human hearing.	226
Describe applications of ultrasound: • body scans; • breaking down kidney and other stones.	228-9
Assessable learning outcomes **Higher Tier only: high demand**	
Describe the motion of particles in longitudinal and transverse waves.	116, 225
Explain how ultrasound is used in: • body scans (reflections from different layers; • breaking down accumulations in the body such as kidney stones.	228-9
Explain the reasons for using ultrasound rather than X-rays: • able to produce images of soft tissue; • does not damage living cells.	229

Item P4e: Treatment	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recall that nuclear radiation is used in medicine.	210, 214, 346
Recall that x-rays and gamma rays are electromagnetic waves.	346-7
Recall that nuclear radiation can damage cells.	346, 350
Recognise that gamma rays are used to treat cancer.	210, 214
Recall that nuclear radiation is used to sterilize hospital equipment.	347
Recall that the person in hospitals who takes x-rays and uses radiation is a radiographer.	
Assessable learning outcomes **both tiers: standard demand**	
Recall that only beta and gamma radiation can pass through skin.	341
Describe that beta or gamma emitters are used as tracers in the body.	346-7
Describe that X-rays and gamma rays: • have similar wavelengths; • are produced in different ways.	208
Assessable learning outcomes **Higher Tier only: high demand**	
Explain that: • gamma rays are given out from the nucleus of certain radioactive materials; • X-rays are made by firing high speed electrons at metal targets; • X-rays are easier to control than gamma rays.	208, 341, 312
Explain how radioactive sources are used in medicine: 1. to treat cancer: • gamma rays focused on tumour; • wide beam used; • rotated round the patient with tumour at centre; • limiting damage to non-cancerous tissue.	210, 214
2. as a tracer: • beta or gamma emitter; • drunk/eaten/ingested/injected into the body; • allowed to spread through the body; • followed on the outside by a radiation detector.	346

Item P4f: What is radioactivity?	
Assessable learning outcomes **Foundation Tier only: low demand**	
Describe and recognise that the radioactivity of an object is measured by the number of nuclear decays emitted per second.	page 350
Describe and recognise that radioactivity decreases with time.	344
Describe that radiation comes from the nucleus.	343
Assessable learning outcomes **both tiers: standard demand**	
Describe radioactive substances as decaying naturally and giving out nuclear radiation in the form of alpha, beta and gamma.	340-1
Describe radioactivity as coming from the nucleus of an atom that is unstable.	343
State that an alpha particle is a helium nucleus.	340
State that a beta particle is a fast moving electron.	340
Assessable learning outcomes **Higher Tier only: high demand**	
Explain and use the concept of half-life.	344
Interpret graphical or numerical data of radioactive decay.	344
Describe what happens to a nucleus when an alpha particle is emitted: • mass number decreases by 4; • nucleus has two less neutrons; • nucleus has two less protons; • atomic number decreases by 2; • new element formed.	345
Describe what happens to a nucleus when a beta particle is emitted: • mass number is unchanged; • nucleus has one less neutron; • nucleus has one more proton; • atomic number increases by one.	345
Construct and balance simple equations in terms of mass numbers and atomic numbers to represent alpha and beta decay.	345

Item P4g: Uses of radioisotopes	
Assessable learning outcomes **Foundation Tier only: low demand**	
Describe and recognise that there is background radiation in the environment which is always present.	pages 340, 350
State that radioisotopes are used as tracers in industry and hospitals.	346
Describe that alpha sources are used in some smoke detectors.	347
Assessable learning outcomes **both tiers: standard demand**	
Describe background radiation and state that it is caused by radioactive substances in rocks and soil and by cosmic rays.	340, 350
Recall examples of the use of tracers: • to track dispersal of waste; • to find leaks/blockages in underground pipes; • to find the route of underground pipes.	346
Describe how a smoke detector with an alpha source works.	347
Recall that radioactivity can be used to date rocks.	347, (352)
Recall that measurements from radioactive carbon can be used to find the date of old materials.	347, (352)
Assessable learning outcomes **Higher Tier only: high demand**	
Explain that some background radiation comes from waste products and man made sources e.g. waste from: • industry; • hospitals.	350
Describe how tracers are used in industry: • radioactive material put into pipe; • gamma source used so that it can penetrate to the surface; • progress tracked with detector above ground; • leak/blockage shown by reduction/no radioactivity after this point.	346
Explain how the radioactive dating of rocks depends on the calculation of the uranium/lead ratio.	352
Explain how measurements of the activity of radioactive carbon can lead to an approximate age for different materials: • the amount of Carbon 14 in the air has not changed for thousands of years; • when an object dies (e.g. wood) gaseous exchange with the air stops; • as the Carbon 14 in the wood decays the activity of the sample decreases; • the ratio of current activity from living matter to the activity of the sample leads to a reasonably accurate date.	352

Item P4h: Fission	
Assessable learning outcomes **Foundation Tier only: low demand**	
Recognise that nuclear power stations use uranium as a fuel.	pages 348-9
Describe the main stages in the production of electricity: • source of energy; • used to produce steam; • used to produce electricity.	104, 349
Describe that the decay of uranium can be a chain reaction.	348
Describe that a nuclear bomb is a chain reaction that has gone out of control.	348
Recall that materials can be made radioactive by putting them into a nuclear reactor.	346
Assessable learning outcomes **both tiers: standard demand**	
Describe how domestic electricity is generated at a nuclear power station: • nuclear reaction; • producing heat; • producing steam; • turning a turbine; • turning a generator.	349
Describe the process that gives out energy in a nuclear reactor as nuclear fission.	348
State that nuclear fission produces radioactive waste.	350
Describe how materials become radioactive when they absorb extra neutrons.	348
Assessable learning outcomes **Higher Tier only: high demand**	
Describe what happens to allow Uranium to release energy: • uranium nucleus hit by neutron; • causes nucleus to split; • energy released.	348
Explain what is meant by a chain reaction: • when each uranium nucleus splits more than one neutron is given out; • these neutrons can cause further uranium nuclei to split.	348
Explain how scientists stop nuclear reactions going out of control: • rods placed in the reactor; • to absorb some of the neutrons; • allowing enough neutrons to remain to keep the process operating.	348-9