

Physics B J645

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

June 2009

J645/MS/R/09

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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Mark Scheme Guidance

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/ = alternative and acceptable answers for the same marking point

(1) = separates marking points

not = answers which are not worthy of credit

reject = answers which are not worthy of credit

ignore = statements which are irrelevant

allow = answers that can be accepted

() = words which are not essential to gain credit

= underlined words must be present in answer to score a mark

ecf = error carried forward

AW = alternative wording

ora = **or reverse argument**

B651/01 Unit 1: Modules P1, P2 and P3 Foundation Tier

Question			Expected Answers	Marks	Additional Guidance
1	a		seismometer (1)	1	more than one answer ringed scores (0) allow correct answer indicated in other ways if no answer ringed. If any answer is ringed ignore all other answers.
	b	i	<u>transverse</u> (1)	1	allow shear (wave)
		ii	<u>solids</u> (1)	1	allow named solids e.g. rock, earth, soil, crust not any answer that contains more than solid
		iii	6000 m/s (1)	1	If more than one answer ringed (0)
			Total	4	

Question		Expected Answers	Marks	Additional Guidance	
2	a	<p>any two from portable / can be carried anywhere / can be used anywhere / can be used on beach or other specified place without electric sockets eg in caravan/car / convenient (1) no wiring needed / does not have to be plugged in / AW (1) available all the time / 24/7 (1)</p>	2	mark first two advantages	
	b	i	1	reflected by walls (1) more than one ticked answer scores (0)	
		ii	1	<p>any one from television (1) video recorder (1) dvd player (1) cd player (1) garage / doors / gates (1) digital cameras / security systems (1) ipod (1) photo frames (1)</p>	<p>allow remote control or any other suitable use ignore data transmission if more than one answer given ALL answers must be correct allow burglar alarms / security alarm. not smoke alarm</p>
		iii	1	C (1) more than one answer scores (0) If no answer on line allow correct answer ticked, circled or underlined on the diagram	
		Total	5		

Question			Expected Answers	Marks	Additional Guidance
3	a	i	M clearly indicating horizontal section of graph (1)	1	not at the very ends of the straight line unless clear that it is the flat part that is indicated (read answer to (ii) before marking)
		ii	temperature is constant / does not change / is steady / AW (1)	1	not ice melts at 0°C not just graph is flat
	b		degree Celsius / °C (1)	1	allow degree Fahrenheit / Kelvin not just degrees or C°
	c		energy (1) temperature (1)	2	answers must be in the correct order ignore °C / °F / K
Total				5	

Question			Expected Answers	Marks	Additional Guidance
4	a		(good) insulator / it insulates / poor conductor (1)	1	allow higher level answers in terms of reduced convection e.g. air is trapped and cannot move not contains the heat / traps the heat
	b		reflects (1)	1	not just bounces off but allow bounces back
	c		radiation (1)	1	more than one answer ringed scores (0)
	d		carpet / underfloor insulation / underlay (1) curtains / double glazing / draught excluders (1) (loft) insulation (1)	3	allow any suitable floor covering (1) but not just floor insulation allow named insulation such as fibreglass / rock wool etc (1)
Total				6	

Question		Expected Answers	Marks	Additional Guidance
5	a	<p>any one from</p> <p>direct solar heating / AW (1)</p> <p>converted to fuel in plants / AW (1)</p> <p>produces convection currents / wind (farms/turbines)/ waves / AW (1)</p> <p>evaporate water to produce rain / HEP / AW (1)</p>	1	<p>allow higher level answers e.g. passive solar heating / light reflected to focus using a curved mirror</p> <p>allow description in terms of large windows facing sun etc/ heating water pipes facing sun</p> <p>allow helping plants grow / making plants grow / photosynthesis</p> <p>allow transfer of KE of air to electricity in turbines</p> <p>not just heating or cooking</p>
	b	renewable (1)	1	not infinite
		Total	2	

Question		Expected Answers	Marks	Additional Guidance
6	a	D A B C	2	D before A (1) all correct (2)
	b	i	1	
		ii	1	
		Total	4	

Question			Expected Answers	Marks	Additional Guidance
7	a	i	coal (1)	1	not oil or gas or named oil such as petrol or diesel
		ii	straw / manure / biomass (1)	1	not wood allow peat / paper allow biofuel
	b		2990 W (2) but if answer is not correct 230 x 13 (1)	2	allow 3000 W / 3 kW for (2)
Total				4	

Question			Expected Answers	Marks	Additional Guidance
8	a			2	all correct = (2) One or two correct = (1) mark incorrect any box that has two or more lines
	b		damages / kills cells / causes cancer (1)	1	allow radiation poisoning allow mutation of cells or named cells but ignore mutation of body or just mutations
Total				3	

Question		Expected Answers	Marks	Additional Guidance
9	a	spying / weather forecasting (1)	1	allow (tele)communications / sat nav / military / tv / taking pictures of the earth/other planets etc
	b	moon (1)	1	
	c	any two from no need for food (1) no need for water (1) no need for oxygen (1) does not need to be air tight (1) less weight carried / smaller (1) no need to get space craft back (1) less fuel needed (1) no need for warmth (1) no need to train astronauts (1)	2	allow no need to protect from harmful rays (1) ignore any mention of cost on its own allow no need for (survival / life support) equipment
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
10	a	rock (1)	1	allow correct answer ticked underlined or ringed if no answer on the answer line
	b	A (1)	1	allow correct answer ticked underlined or ringed if no answer on the answer line
	c	dust (cloud) (1)	1	allow gas / hydrogen
		Total	3	

Question			Expected Answers	Marks	Additional Guidance
11	a	i	tape measure / trundle wheel (1)	1	allow metre wheel / surveyors wheel not metre rule
		ii	stopwatch / stopclock (1)	1	not just clock
	b		16 (3) but if answer is not correct 32 ÷ 2 for (2) but if 3 or 2 marks are not gained recognition that distance = 32 m for (1)	3	18 m/s (2) 36 ÷ 2 (1) if answer is not 16 or 18 m/s
Total				5	

Question			Expected Answers	Marks	Additional Guidance
12	a		A (1)	1	If answer line is blank allow correct answer ticked, circled or underlined. More than one answer = 0
	b		C (1)	1	If answer line is blank allow correct answer ticked, circled or underlined. More than one answer = 0
	c		400 (1)	1	
Total				3	

Question			Expected Answers	Marks	Additional Guidance
13	a	i	distance travelled between time danger seen and brakes start to act / AW (1)	1	must be clear distance not time allow distance travelled whilst reacting allow distance travelled before brakes put on
		ii	distance travelled between time brakes start to act and car stops / AW (1)	1	allow distance travelled after brakes put on
		iii	12 (m) (1)	1	ignore incorrect units
	b	i	acceleration (1)	1	allow deceleration / retardation
		ii	C (1)	1	If answer line is blank allow correct answer ticked, circled or underlined. More than one answer = 0
Total				5	

Question			Expected Answers	Marks	Additional Guidance
14			airbag inflates (1) seat belt stretches (1)	2	allow higher level answers e.g. change shape / absorb energy / increase stopping distance / increase collision time / decrease acceleration e.g. stops head hitting windscreen / dash / steering wheel Prevents you being thrown out of the car Remember only 1 mark for this point
			idea of restraint for either airbag or seatbelt (1)		
Total				2	

Question		Expected Answers	Marks	Additional Guidance
15	a	Increases / AW (1)	1	allow accelerates
	b	weight / gravity (1)	1	not mass
	c	i	1	allow reduces the speed he finally reaches / terminal speed allow takes longer to hit the ground
		ii	1	allow more streamlined or description e.g. stand up position / like a diver/ arms tucked in
	d	opens parachute (1)	1	allow any way of increasing surface area e.g. open arms
		Total	5	
		Paper Total	60	

B651/02 Unit 1: Modules P1, P2 and P3 Higher Tier

Question		Expected Answers	Marks	Additional Guidance
1	a	<u>transverse</u> (1)	1	allow shear (wave)
	b	<u>solids</u> (1)	1	allow named solids e.g. rock / earth / soil / crust not any answer that contains more than solid
	c	6000 m/s (1)	1	if more than one answer is ringed (0)
	d	s-waves do not travel through outer core (1) (proves) outer core liquid (1)	2	allow (s-waves) only go or travel through solids / do not go or travel through liquids (1) ignore refraction or diffraction ignore crust or mantle a diagram on its own does not score but lines on the diagram and correctly labelled can gain marks allow they stop at the liquid (1)
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
2	a	<p>any one from</p> <p>mobile (1)</p> <p>Bluetooth (technology) (1)</p> <p>remote control (1)</p> <p>(wireless) headphones (1)</p>	1	<p>allow phones</p> <p>allow non radio examples of items without wires e.g. wireless connections to pc via router or hub e.g. keyboard or mouse or printer connected to pc e.g. use of internet</p> <p>allow TV signals or broadcasting (from satellites) but not just TV</p> <p>ignore communications</p>
	b	<p>any two from</p> <p>(signal) transmitted to or received by or reaches satellite from A (1)</p> <p>amplifies / processes / boosts (signals) (1)</p> <p>(re-)transmitted (to B or ground / Earth) (1)</p>	2	<p>answers <u>only</u> referring to the ionosphere scores (0)</p> <p>answers in terms of reflection and / or refraction from satellite can only score one mark</p> <p>answer line blank / only 1 mark gained credit marks on the diagram</p> <p>allow sent up to satellite (1)</p> <p>ignore just idea of 'sent up'</p> <p>ignore references to the nature of the signal e.g. reference to any E.M. wave</p> <p>allow sent (down) to B or ground / Earth (1)</p> <p>ignore just idea of 'sent down' or reflected down</p>
		Total	3	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	energy (1) temperature (1)	2	answers must be in the correct order ignore °C / °F / K
		ii	energy used to break inter-molecular bonds (1)	1	allow overcome force of attraction between molecules ignore breaks intermolecular forces or forces of attraction ignore references to flat section of graph or no temperature change ignore endothermic but not exothermic
	b		4200 (2) but if answer is not correct $c = Q \div m\theta$ or $c = 105000 \div 0.5 \times 50$ (1)	2	allow 4.2 J/g°C (2) if unit is changed on answer line but if answer is not correct 4.2 or $105 \div 0.5 \times 50$ or $105 \div 25$ gains the working mark
Total				5	

Question		Expected Answers	Marks	Additional Guidance	
4	a	idea of reduces energy loss by convection or idea of less / no convection (1)	1	allow air movement or correct description of air movement / convection current ignore air or foam is a poor conductor / insulator or other references to conduction not just convection	
	b	radiation (1)	1	more than one answer ringed scores (0)	
	c	temperature – hotness (1) heat – idea of <u>energy</u> (1)	2	allow how hot something is (1) ignore references to cold allow higher level answers e.g. temperature – arbitrary scale (1) heat – absolute scale (1)	
	d	i	0.25 (2) but if answer is not correct 40/160 (x100) (1)	2	allow 25% if % is shown clearly in answer line (2) 25 on its own scores (1) ignore any units other than % on answer line 0.25% scores (1) but the working mark may be gained e.g. 0.25J / 0.25N both score (2)
		ii	any one from energy / heat being radiated in all directions (1) less / no energy or heat loss or less conduction through (outer) wall (1)	1	allow more or better or increased convection around the room ignore supplies heat to the whole room ignore heat given out in all directions ignore released around the room instead of staying in one area
		Total	7		

Question		Expected Answers	Marks	Additional Guidance
5	a	to face the Sun for most of the time / Sun is in the south (1)	1	<p>allow to take in most or more light / energy</p> <p>allow that is where the Sun is</p> <p>allow receives light or Sun all day</p> <p>allow its where the Sun shines most</p> <p>not just facing Sun</p> <p>ignore sunny side of building but allow sunnier side of building</p> <p>ignore heat</p> <p>ignore rises in the east sets in the west</p> <p>ignore light comes from the south</p>
	b	<p>any three from</p> <p>glass lets through or glass is transparent to: energy / light / IR / rays / radiation (1)</p> <p><u>IR</u> from Sun is short(er) wavelength / high(er) frequency (1)</p> <p>(short wavelength) IR or light or radiation or energy absorbed by surfaces or objects in room / the room (1)</p> <p>surfaces (re-)emit <u>IR</u> (1)</p> <p>(this) IR or radiation is long(er) wave(length) / low(er) frequency (1)</p> <p>IR or radiation cannot pass through glass / (so) trapped by glass or inside building / AW (1)</p>	3	<p>note if answered in terms of solar heating panels can only score a maximum of two marks</p> <p>allow energy / light / IR / rays / radiation enters (room) or penetrates glass (1) but ignore heat and waves</p> <p>answers that have the idea of reflection of IR and only light getting through can only score a maximum of two marks</p> <p>ignore heat / rays / waves</p> <p>ignore re-emit heat</p> <p>emit long(er) wave IR scores (2)</p> <p>ignore heat or rays or (sun)light trapped</p> <p>ignore references to convection</p> <p>ignore greenhouse effect</p>
		Total	4	

Question			Expected Answers	Marks	Additional Guidance
6	a	i	(+ / -) 10 (1)	1	
		ii	0.04 (1)	1	
	b	i	step up (transformer) (1)	1	allow description of transformer e.g. more turns on the secondary (coil) / AW
		ii	less energy (or power) lost / AW (1)	1	allow to lower current allow to reduce heating of cables allow idea of more efficient but ignore cost allow thinner / lighter cables ignore no energy lost or energy not wasted
	c		2990 W (2) but if answer is not correct 230 x 13 = (1)	2	allow 3000 W / 3 kW for (2)
	d		advantage: any one from cheaper / AW (1) gives power when less needed by industry (1) disadvantage: any one from only available for limited time (1) cannot be used for TV etc as not available (1) time it is available is usually inconvenient or at night ora (1)	2	ignore references to pollution in either response e.g. at power station or in the home allow using energy from power stations working during the night / when demand is low allow not available when needed or waiting for off peak time allow have to use storage heaters ignore idea of being awake at odd times to use it ignore storage in batteries / storing the electricity ignore references to safety or fire risk
Total				8	

Question		Expected Answers	Marks	Additional Guidance
7	a	<p> α ————— sterilising equipment β ————— thickness gauge γ ————— smoke detectors </p>	2	all correct scores (2) one or two correct scores (1) mark incorrect any box that has two or more lines
	b	fast moving or charged or energetic or ionising particles (1)	1	allow protons / hydrogen (nuclei) / alpha particles / helium (nuclei) / electrons / ions for particles ignore references to from the Sun / space or interfering with satellite signals
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
8	a	<p>any two from expanding Universe (1)</p> <p>red shift (of light from galaxies) (1)</p> <p>residual or background (microwave) radiation or (microwave) radiation from the Big Bang (1)</p>	2	<p>allow Universe spreading out or galaxies moving away from each other (1)</p> <p>allow speed of galaxies (moving apart) increasing (1) but ignore decreasing</p> <p>allow galaxies moving away from a (central) point or from us (1)</p> <p>ignore new galaxies being formed</p> <p>ignore red shift from planets or from planets and galaxies</p> <p>ignore red light alone but red light shift scores the mark</p> <p>allow description of red shift (1)</p> <p>allow Doppler effect (of light) (1)</p> <p>not galaxies red shifted or galaxies moving to red end of spectrum</p> <p>allow idea that (low frequency) radiation that is everywhere in the Universe (1)</p> <p>not idea of cosmic background radiation from microwave uses e.g. communications or microwave cooking</p>
	b	between Mars and Jupiter (1)	1	if answer line is blank allow correct answer ticked, circled or underlined

Question			Expected Answers	Marks	Additional Guidance
	c	i	the distance or how far light travels in a year (1)	1	measure of distance alone scores (0)
		ii	astronomical distances / distances in space are very large (1)	1	not distances between planets (in our Solar System) allow distances too great to be measured in km / miles or km / miles too small (for measuring distances in space) (1) ignore other measurements too small but allow km or miles too small (1) allow idea that in km or miles numbers are too big / difficult to use (1) ignore with light years there are less numbers
Total				5	

Question			Expected Answers	Marks	Additional Guidance
9			16 (3) but if answer is not correct 32 ÷ 2 (2) but if 3 or 2 marks are not gained recognition that distance =32 m (1)	3	18 m/s (2) 36÷ 2 (1) if answer is not 16 or 18 m/s
Total				3	

Question			Expected Answers	Marks	Additional Guidance
10	a		A (1)	1	if answer line is blank allow correct answer ticked, circled or underlined more than one answer (0)
	b		C (1)	1	if answer line is blank allow correct answer ticked, circled or underlined more than one answer (0)
	c		400 (1)	1	
			Total	3	

Question		Expected Answers	Marks	Additional Guidance	
11	a	reduced stopping distance or stopping distance 11m shorter (1)	1	<p>allow reduced thinking or thinking distance 3m less</p> <p>allow braking distance reduced or braking distance 8m less</p> <p>allow reduced braking or stopping time</p> <p>e.g. stopping quicker or faster but ignore braking faster</p> <p>allow idea of reducing accidents / injuries</p> <p>e.g. slower speeds reduce or prevent crashes</p> <p>e.g. if a child runs out will be able to stop quicker compared to when going faster</p> <p>e.g. less impact (on children) at lower speed or in a crash</p>	
	b	i	15(1)	1	
		ii	<p>any two from</p> <p>tiredness / illness (1)</p> <p>drugs (1)</p> <p>alcohol (1)</p> <p>increased speed (1)</p> <p>distraction (1)</p> <p>increasing / old age (1)</p>	2	<p>ignore visibility</p> <p>can gain both marks from either line but a con would reduce the score</p> <p>allow stress as an illness (1)</p> <p>allow any named drug (1)</p> <p>allow lack of concentration (1)</p> <p>allow examples of distraction inside or outside of car</p> <p>e.g. mobile phone / children / radio / looking at people outside the car etc (1)</p> <p>not just 'age'</p>

Question		Expected Answers	Marks	Additional Guidance
	c	<p>any two from</p> <p>SITUATION road conditions – icy / wet / leaves on road</p> <p>EXPLANATION reduced friction or grip (1)</p> <p>-----</p> <p>SITUATION car condition – bad tyres / poor brakes</p> <p>EXPLANATION reduced friction or grip (1)</p> <p>-----</p> <p>SITUATION more passengers / luggage / heavier / increased mass</p> <p>EXPLANATION greater (kinetic) energy or greater momentum (1)</p>	2	<p>must have condition and explanation for each mark</p> <p>not no friction</p> <p>not no friction</p> <p>ignore greater force to stop</p> <p>ignore references to friction and braking distance in the third type of response</p>
		Total	6	

Question		Expected Answers	Marks	Additional Guidance
12	a	<p>any two from increased stopping time (1)</p> <p>increased stopping distance (1)</p> <p>decreased acceleration or force or (rate of) momentum change on driver / passenger (1)</p>	2	<p>allow slows down collision or prolongs collision (between air bag and passenger or driver) (1) allow brings to a stop (more) slowly (1) ignore slows down movement</p> <p>allow slows down the deceleration / decelerates more slowly (1) allow stress for force ignore cushions or absorbs impact / force / collision ignore references to energy</p>
	b	(driver can) keep hands on wheel (1)	1	<p>allow not distracted (by reaching for controls) / AW allow driver can keep eyes or attention or concentrate on the road / driving ignore active or passive safety feature</p>
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
13	a	<p>any two from</p> <p>at first weight is greater than drag or air resistance (1)</p> <p>high(er) speed more drag or air resistance (1)</p> <p>weight = (and opposite to) air resistance (1)</p>	2	<p>ignore references to upthrust or wind resistance throughout answer</p> <p>ignore references to GPE and KE throughout answer</p> <p>allow gravity / gravitational force for weight</p> <p>allow (air) friction for drag</p> <p>ignore just downward force > upward force</p> <p>ignore just weight or gravity pulls him down</p> <p>allow (air) friction for drag</p> <p>allow acceleration reduces as drag increases (1)</p> <p>ignore forces start to balance</p> <p>allow (air) friction for drag</p> <p>allow gravity / gravitational force for weight</p> <p>ignore just forces are balanced</p> <p>but weight and drag or air resistance balance out / are equal (1)</p>
	b	PE does work against friction / AW (1)	1	<p>allow PE transferred to air particles / AW (1)</p> <p>allow converted / transferred into heat (and sound) energy but not sound on its own</p> <p>allow increase internal energy or KE of the air (particles)</p> <p>ignore converted / transferred to other forms of energy</p>
	c	<p>3200 (metres) (2)</p> <p>but if answer is not correct</p> <p>$2720000 \div 85 \times 10$ or (G)PE $\div 85 \times 10$</p> <p>or (G)PE \div mass \times g (1)</p>	2	
		Total	5	
		Paper Total	60	

B652/01 Unit 2: Modules P4, P5 and P6 Foundation Tier

Question		Expected Answers	Marks	Additional Guidance
1	a	positive (1) negative (1)	2	any order allow +ve / + (1) allow -ve / - (1)
	b	attracted / idea of moves towards (comb) (1)	1	allow stick to the comb not repels / moves away from comb not just moves not attracts paper ignore paper becomes charged ignore paper vibrates
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
2	a	<p>any three from</p> <p>grid charged / plates charged (1)</p> <p>dust charged (by grid) / have same charge as grid (1)</p> <p>(high) voltage / pd (between grid and plates or between the plates) (1)</p> <p>dust attracted to plates / grid / metal (1)</p> <p>plates struck / scraped / brushed (1)</p> <p>dust falls / to drop particles into collector (1)</p>	3	<p>eg 'Dust charged by positive / negative grid' scores (2)</p> <p>eg grid and plates charges oppositely (2)</p> <p>allow 'dust sticks to plates / grid / metal (1)</p> <p>not wall / precipitator</p> <p>not merely attracted</p> <p>allow dust (particles) repelled by grid (1)</p> <p>allow higher level ideas that dust particles coalesce / become heavy (er) as additional mark (1)</p> <p>ignore particles collected (given in question)</p>
	b	<p>restarting heart / defibrillators / photocopiers / printers / spray painting (1)</p>	1	<p>allow dusters</p> <p>allow car spraying / painting cars</p> <p>ignore dust extraction</p> <p>ignore sticking balloons to ceiling etc</p>
		Total	4	

Question			Expected Answers	Marks	Additional Guidance
3	a		4 (Ω) (2) but 6/1.5 (1)	2	correct answer alone gains full marks only look to award working mark if answer is incorrect
	b		increases / AW / doubles (1)	1	ignore reasons given not merely changes
Total				3	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	compression (1)	1	allow circled / underlined / ticked answer if answer line blank
		ii	rarefaction (1)	1	allow circled / underlined / ticked answer if answer line blank
	b		scanning / break down kidney stones / measure rate of blood flow / idea of sonar / cleaning teeth / cancer treatment / cleaning instruments / cleaning jewellery / dog training (1)	1	allow looking inside body / body scan / baby scan allow specific examples of scans allow treating kidney stones not looking for babies unless qualified i.e. looking for babies inside (pregnant) mother = (1)
Total				3	

Question			Expected Answers	Marks	Additional Guidance
5			uranium radioactive chain bomb	3	4 correct (3) 3 correct (2) 1/2 correct (1)
Total				3	

Question		Expected Answers	Marks	Additional Guidance
6	a	electromagnetic / e.m. (1) cancer (1)	2	allow transverse (1) allow tumours (1) ignore skin
	b	nuclear second (1)	1	both needed allow alpha / beta / gamma / nuclei / radioactive / atomic not particle / substance allow minute / hour / year / per unit time / AW
	c	smoke detectors (1)	1	allow smoke alarms ignore fire alarms / cancer treatment not (paper) thickness testing
		Total	4	

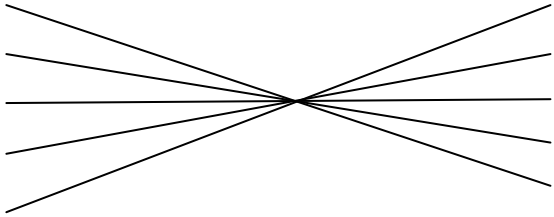
Question		Expected Answers	Marks	Additional Guidance
7	a	D (1) E (1)	2	
	b	light is refracted (1)	1	more than one answer ticked = 0
	c	light is reflected (internally and correct side of the normal) (1) correctly reflected angles equal (by inspection) (2)	2	any refracted light shown on diagram then maximum is 1 mark if candidate has not marked anything on diagram, scroll down
		Total	5	

Question		Expected Answers	Marks	Additional Guidance	
8	a	<p>any two from (tele)communications – TV / mobile (1)</p> <p>idea of weather monitoring (1)</p> <p>spying (1)</p> <p>military (1)</p> <p>SATNAV / GPS / AW (1)</p> <p>space telescope / space observation (1)</p> <p>Earth observation (1)</p>	2	<p>maximum of 1 mark for (tele)communications answers allow sky TV but not just sky allow phones</p> <p>ignore just weather</p> <p>allow tracking / to track things (1)</p> <p>allow to see what is out there / to see objects that might hit the Earth (1) allow described observations e.g. mapping / photography (1) allow Google Earth (1)</p>	
	b	i	24 (1)	1	allow 1 day
		ii	less time / AW (1)	1	allow reference to increased speed as implies the idea of time. e.g. quicker / faster / speeds up / AW
	c		centripetal (1)	1	more than one answer ringed or indicated scores (0)
		Total		5	

Question		Expected Answers	Marks	Additional Guidance
9	a	how fast something is moving / AW (1)	1	allow higher level answers e.g. the number of km per hour / distance travelled in a certain time not just 120 km/h
	b	any one from travelling at different speeds / AW (1) stops at stations / signals (1)	1	idea that train is not moving constantly at maximum speed not just does not travel at maximum speed
	c	140 km/h (1)	1	more than one answer ringed = 0
	d	vector requires direction / scalar does not require direction / AW (1)	1	allow vector has direction and magnitude
		Total	4	

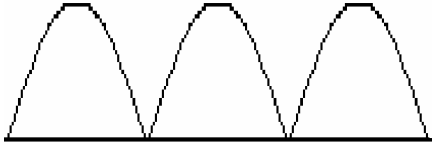
Question		Expected Answers	Marks	Additional Guidance
10	a	The radio waves from the two stations are overlapping (1)	1	more than one answer ticked = 0
	b	loud sound / volume (1) quiet / soft sound / volume (1)	2	allow higher level answers in terms of constructive and destructive interference allow different loudnesses (2) allow sound and no sound (2)
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
11	a	aerial (1)	1	
	b	reflected (1) atmosphere (1)	2	
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
12	a		2	all correct (2) marks, any two correct (1) mark
	b	increases (1)	1	more than one answer ringed scores (0)
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
13	a	(electric) drill (1) (electric) mixer (1)	2	any order allow underlined or ringed answers if answer line blank
	b	A (1)	1	Mark the one answer on the line first. More than one answer is (0) If no answer is on the line mark answers indicated on the list or diagram. If marking on the list or diagram – again more than one answer scores (0)
	c	A = magnet / pole(s) (1) B = coil (of wire) / armature (1)	2	allow North (1) or South (1) not metal ignore magnetic field not just wire
		Total	5	

Question		Expected Answers	Marks	Additional Guidance	
14	a	ac / alternating / alternating current (1)	1	not alternative current / alternate current / indirect current	
	b	i	100 (2) but $240/12 = 2000/N$ (1)	2	correct answer on its own scores full marks only look at working if answer is incorrect
		ii	phone chargers / laptops / radio / national grid / sub stations / doorbell (1)	1	allow any other correct use not operating a low voltage bulb from the mains not TV ignore shaver
		Total	4		

Question		Expected Answers	Marks	Additional Guidance
15	a	A (1)	1	Mark the answer on the line first. More than one answer (0) If no answer is on the line mark answers indicated on the list. If marking on the list – again more than one answer scores (0)
	b	idea of rectification - three (or 2) half cycles above or below the axis (1) full wave rectification (above or below the axis) with all three half cycles correctly lined up (by inspection) with the wave above (2) 	2	
	c	stores charge (1) produces a smoother output (1)	2	ignore energy allow e.g. flatter (output) / AW (1) award correct marking point shown on a diagram
		Total	5	

Question		Expected Answers	Marks	Additional Guidance
16	a	on / high / 1 off / low / 0 (1)	1	both required for the mark, either order
	b	A B 0 1 1 0 (1)	1	allow high / low instead of 1 and 0 allow columns A and B interchanged
	c	LED / relay (1)	1	
		Total	3	
		Paper Total	60	

B652/02 Unit 2: Modules P4, P5 and P6 Higher Tier

Question			Expected Answers	Marks	Additional Guidance
1	a	i	idea of electron transfer (1)	1	<p>allow gain of electrons / negative charges (1) allow 'extra electrons' / negative charges (1) not merely 'electrons' / negative charges (0) not fewer electrons / negative charges (0) not comb lose electrons / electrons to hair (0)</p> <p>ignore friction / rubbing ignore static moves or static electricity moves allow (static) electrons / negative charges move (1) ignore particles</p>
		ii	like charges repel / AW (1)	1	<p>allow 'All hairs repel each other' (1) allow Positives repel (1) but positive electrons repel (0)</p> <p>ignore references to the comb attracting the hair</p>
	b		charges are opposite (1)	1	<p>allow positive attracts negative allow opposites attract (1) allow higher level answers e.g. induction / induced charge not positive electrons eg positive electrons attracted to negative electrons (0)</p>
			Total	3	

Question		Expected Answers	Marks	Additional Guidance
2	a	<p>any three from</p> <p>grid charged / plates charged (1)</p> <p>dust charged (by grid) / have same charge as grid (1)</p> <p>(high) voltage / pd (between grid and plates or between the plates) (1)</p> <p>dust attracted to plates / grid / metal (1)</p> <p>plates struck / scraped / brushed (1)</p> <p>dust falls / to drop particles into collector (1)</p>	3	<p>eg 'Dust charged by positive / negative grid' scores (2)</p> <p>eg grid and plates charges oppositely (2)</p> <p>allow 'dust sticks to plates / grid / metal (1)</p> <p>not wall / precipitator</p> <p>not merely attracted</p> <p>allow dust (particles) repelled by grid (1)</p> <p>allow higher level ideas that dust particles coalesce / become heavy (er) as additional mark (1)</p> <p>ignore particles collected (given in question)</p>
	b	<p>charge / current / electricity passes through worker or to / from earth (1)</p>	1	<p>eg (static) electricity goes to earth' (1)</p> <p>not positive charge or positive electrons move (0)</p> <p>allow idea of 'worker being earthed (1)</p> <p>allow 'worker completes the circuit (to earth) (1)</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
3	a	4 (Ω) (2) but 6/1.5 (1)	2	correct answer alone gains full marks only look to award working mark if answer is incorrect
	b	increases / AW / doubles (1)	1	ignore reasons given not merely changes
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
4	a	particles close(r) together / particle spacing is low(er) / density is high(er) (1)	1	allow higher density (1) allow higher pressure (1) allow idea of particles / waves squashed together (1) ignore wave / air / particles compressed (as the word 'compression' is given in the question) not merely the idea of (a) particle squashed (ie making particle smaller) (0)
	b	transmits reflects travels signals pictures	3	5 correct = (3) 3 / 4 correct = (2) 2 / 1 correct = (1)
		Total	4	

Question			Expected Answers	Marks	Additional Guidance
5			neutron (1) nucleus (1) splits up / halves / divides / AW (1)	3	allow produces new atom(s) / nucleus(ei) / element(s) / isotope(s) / undergoes fission (1) not decays / breaks down (0) ignore unstable
Total				3	

Question			Expected Answers	Marks	Additional Guidance
6	a	i	207 (1)	1	allow stays the same / unchanged (1)
		ii	82 (1)	1	allow increases by one (1)
	b		uranium lead (1)	1	any order
Total				3	

Question		Expected Answers	Marks	Additional Guidance
7	a	increases (1)	1	
	b	light is reflected (internally and correct side of the normal) (1) correctly reflected angles equal (by inspection) (2)	2	any refracted light shown on diagram then maximum is 1 mark
	c	any three from: waves have different wavelengths / frequency (1) but wavelength of red light is longer (than wavelength of blue light) / or a scores (2) or frequency of red light is lower than blue light (2) waves have different speeds (1) but red light travels faster (than blue) scores (2) (red and blue) light slows down (in the prism) (1) but blue light slows down more scores (2) the refractive indices for different coloured light are different (1) but the refractive index for blue light is greater (than for red light) (2)	3	eg blue longer than red light (1) blue has lower frequency (1) eg blue is slower than red (2) eg red slows more than blue (1) eg refractive index for red is greater (1) allow reverse arguments eg red has a lower refractive index (2) eg red slows the most scores (1)
		Total	6	

Question			Expected Answers	Marks	Additional Guidance
8	a	i	24 (1)	1	allow 1 day
		ii	less time / AW (1)	1	allow reference to increased speed as implies the idea of time. eg quicker / faster / speeds up / AW (1)
	b		centripetal (1)	1	more than one answer ringed or indicated scores (0)
	c		stronger gravitational / centripetal force (1)	1	allow closer to Earth / AW (1) allow stronger force / AW (1) but stronger centrifugal force (0) allow polar orbit (1)
			Total	4	

Question			Expected Answers	Marks	Additional Guidance
9	a		vector requires direction / scalar does not require direction / AW (1)	1	allow vector has direction and magnitude
	b	i	30 (2) but 0.5×60 (1)	2	correct answer alone gains full marks only look to award working mark if answer is incorrect
		ii	900 (2) but $1/2 \times 0.5 \times 60^2$ (1)	2	correct answer alone gains full marks only look to award working mark if answer is incorrect
			Total	5	

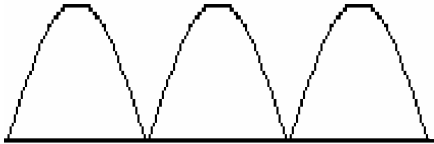
Question		Expected Answers	Marks	Additional Guidance
10		<p>any three from idea that momentum is conserved or zero (1)</p> <p>ball has: small mass (1) and high velocity / speed (1)</p> <p>idea of equal force (1) faster ball / slower cannon (1)</p>	3	<p>allow $mv = mv$ (ie same as momentum is conserved) (1)</p> <p>allow reverse argument for cannon: cannon has large mass (1) and low velocity / speed (1)</p> <p>ignore references to distance on its own eg cannon moves smaller distance scores (0) but ball moves greater distance in the same time scores (1)</p> <p>eg idea of equal force on higher mass produces lower acceleration / velocity / speed (3)</p> <p>eg idea of equal force on smaller mass produces higher acceleration / velocity / speed (3)</p>
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
11	a	transverse / electromagnetic waves (1)	1	<p>not 'light' on its own (as it is in the stem of the question) (0) allow UV / ultraviolet / IR / infrared / visible light (1) eg red light (1)</p>
	b	polarised waves all vibrate in the same plane / AW / ora (1)	1	<p>allow answers from correctly labelled diagrams not just move in same direction but move in the same 'up and down' or 'side to side' direction (1) allow vibrate in same direction (1)</p>
		Total	2	

Question		Expected Answers	Marks	Additional Guidance
12	a	7.5 (2) but 3 x 2.5 (1)	2	mark answer in table first – if missing look on answer line if this is incorrect look for working
	b	i	1	allow 'non-ohmic' (1) allow greater (1) great (0)
		ii	3	explanations should relate to the shape of the graph not stronger resistance
		Total	6	

Question			Expected Answers	Marks	Additional Guidance
13	a	i	A (1)	1	Mark the one answer on the line first. More than one answer is (0) If no answer is on the line mark answers indicated on the list or diagram. If marking on the list or diagram – again more than one answer scores (0)
		ii	downwards (1)	1	more than one answer is (0)
	b		<p>any 2 from stronger magnets / AW (1)</p> <p>more coils / turns / windings / AW (1)</p> <p>reduce magnet – coil distance / AW (1)</p>	2	<p>allow more magnets (1) not bigger magnets (0)</p> <p>allow increased area of coils (1) allow soft-iron core (1)</p> <p>eg move magnets closer (1)</p> <p>ignore increase voltage / power / supply / current allow one reference to lower friction (1) eg using lubrication</p>
			Total	4	

Question			Expected Answers	Marks	Additional Guidance
14			100 (2) but $240/12 = 2000/n$ / ora (1)	2	mark answer first – if incorrect look for working
			Total	2	

Question	Expected Answers	Marks	Additional Guidance
15 a	 <p>idea of rectification - three (or 2) half cycles above or below the axis (1)</p> <p>full wave rectification (above or below the axis) with all three half cycles correctly lined up (by inspection) with the wave above (2)</p>	2	
b	<p>current passes through diode one way (1)</p> <p>idea of the diodes working in correct opposite pairs (1)</p>	2	<p>eg opposite diodes work together (1)</p> <p>eg P-Q and S-R (1)</p> <p>eg S-P and R-Q (1)</p>
c	<p>to give smooth output / AW (1)</p>	1	<p>eg flatter (output) / AW</p> <p>award correct marking points shown on a diagram</p> <p>ignore energy / stores charge</p>
	Total	5	

Question		Expected Answers	Marks	Additional Guidance
16	a	1 0 0 0 (1)	1	allow high for 1 or low for 0
	b	any two from ideas that: correct explanation of how relay works (1) coil / relay uses small current to operate (1) relay switches on larger current (1) bulb connects to output of relay (1) logic gate is isolated / AW (1)	2	eg electromagnet attracts iron lever which completes circuit (1) allow high level answers e.g. logic gate has low power output (1) eg a smaller current / voltage controls a larger current / voltage (2) allow answers in terms of voltage ignore answer in terms of power as this is stated in the question
		Total	3	
		Paper Total	60	

Grade Thresholds

General Certificate of Secondary Education
Physics B (Specification Code J645)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B651/01	Raw	60	-	-	-	37	31	25	20	15	0
	UMS	69	-	-	-	60	50	40	30	20	0
B651/02	Raw	60	43	36	29	22	16	13	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B652/01	Raw	60	-	-	-	31	26	22	18	14	0
	UMS	69	-	-	-	60	50	40	30	20	0
B652/02	Raw	60	45	37	30	23	17	14	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B655/01	Raw	60	55	51	46	42	37	32	27	22	0
	UMS	100	90	80	70	60	50	40	30	20	0
B656/01	Raw	60	54	49	43	38	32	26	20	14	0
	UMS	100	90	80	70	60	50	40	30	20	0

B655 & B656 - The grade thresholds have been decided on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J645	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J645	20.7	50.7	77.1	93.5	98.3	99.4	99.8	99.9	100.0	11054

11262 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

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