

**Physics B J645**

**Gateway Science Suite**

General Certificate of Secondary Education

**Mark Schemes for the Units**

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**June 2008**

**J645/MS/R/08**

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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	i	chips <b>and</b> coffee (1)	1	<b>both correct</b> answers needed for the mark either order acceptable more than 2 answers scores (0) <b>allow</b> temperatures ie 120 <b>and</b> 90
		ii	ice cream <b>and</b> milk (1)	1	<b>both correct</b> answers needed for the mark either order acceptable more than 2 answers scores (0) <b>allow</b> temperatures -5 <b>and</b> 3
		iii	orange juice (1)	1	more than 1 answer scores (0) <b>allow</b> 22
	b		Black (dark(er) colours) absorbs heat (better)/white reflects heat(1)	1	<b>allow</b> soaks up heat (1) <b>not</b> attracts heat / traps heat (0) <b>allow</b> black is a good absorber of heat /ORA(1) <b>allow</b> black does not reflect (heat away) /ORA(1)
			<b>Total</b>	<b>4</b>	

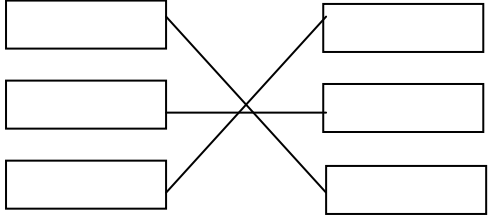
2	a	i	security lights / burglar alarms / automatic doors (1)	1	any reasonable suggestion or description(1)
		ii	remote controls (1)	1	<b>allow</b> cooking / mobile phones / computer links / communication / data transfer / physiotherapy / sports injury / thermal imaging / night sights / astronomy (1) <b>allow</b> answers from a(i) if not previously used
	b		digital (1) reflection (1)	2	correct order needed
	c		narrow / concentrated / parallel / focussed (1) visible (light) / infrared ( radiation) (1)	2	<b>allow</b> higher level answers one colour (or named colour) / frequency / wavelength (1) coherent / in phase / trough meets trough (1)
			<b>Total</b>	<b>6</b>	

Question			Expected Answers	Marks	Additional Guidance
3	a		seismometer (1)	1	more than 1 answer scores (0) if the answer is blank allow correct answer ticked, circled or underlined
	b	i	(p-waves) → solid and liquid (1)	1	more than 1 answer scores (0) if the answer is blank allow correct answer ticked, circled or underlined
		ii	(s-waves) → solid (1)	1	more than 1 answer scores (0) if the answer is blank allow correct answer ticked, circled or underlined
		iii	A (is correct) / p-waves travel faster (1)	1	more than 1 answer scores (0) if the answer is blank allow correct answer ticked, circled or underlined
			<b>Total</b>	<b>4</b>	

4	a	i	15 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
		ii	50 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
		iii	100 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
	b		idea of air is a good insulator /air is trapped(1)	1	<b>allow</b> air pockets / stop convection currents (1) <b>not</b> traps heat / stops heat (0)
	c		reflects (1) heat back in(to room or radiator) / away (from wall) AW (1) Stops heat escaping / going into wall AW / keeps heat in (1)	2	<b>ignore</b> bounces <b>not</b> refracts (0) <b>allow</b> heating not needed as often / as much AW(1)
			<b>Total</b>	<b>6</b>	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	no wires (from external power source) needed / no fuel needed (1)	1	<b>allow</b> low maintenance / cheap to run / long life / rugged / idea of renewable <b>energy</b> / can be used in remote locations / AW / idea of no / less pollution given out eg no / fewer emissions (1) <b>ignore</b> just environmentally friendly <b>ignore</b> portable <b>not</b> just no / less pollution <b>not</b> just cheap / cost effective / reliable <b>not</b> just re-usable or renewable
		ii	no power in poor light / night / only work when it is light / low power or energy output / ORA (1)	1	<b>allow</b> does not work in bad weather / dull / when sun is not shining / cloudy <b>allow</b> power / energy needs to be stored in battery <b>ignore</b> reference to cost <b>ignore</b> visual pollution
	b		solar heating (panels) / wind (1)	1	<b>allow</b> can be absorbed and transferred to heat / solar panel / produce convection currents / wind / wind turbines / hydro / biomass or named example / photosynthesis / concentrated by mirrors for heating
	c		dc / direct current (1)	1	
			<b>Total</b>	<b>4</b>	

6	a	i	(national) grid (1)	1	<b>allow</b> electrical or electricity <b>grid</b>
		ii	change voltage / AW (1)	1	<b>allow</b> changing current / step up / step down voltage / current <b>not</b> change current / voltage <b>type</b> / step down / up electricity <b>not</b> change power
	b		coal / oil / gas / uranium / plutonium / straw / rubbish / wood / paper / manure / peat (1)	1	
	c		= 805 (watts) (2)  <b>but</b> if answer incorrect 230 x 3.5 (1)	2	<b>allow</b> 800 watts (2) <b>allow</b> 23 x 35 (1)
			<b>Total</b>	<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance	
7	a	 <p style="text-align: right;">(2)</p>	2	1 or 2 correct = 1 mark 3 correct = 2 marks  If more than one line <b>from</b> any box then deduct 1 mark down to zero	
	<b>b</b>	<b>i</b>	treats cancer / non destructive testing / tracers / smoke detectors / paper thickness gauges /sterilizing (food / medical equipment) AW (1)	1	
		<b>ii</b>	damage cells / cause cancer (1)	1	<b>allow</b> radiation sickness
<b>Total</b>			<b>4</b>		



Question			Expected Answers	Marks	Additional Guidance
8	a		<b>any two from:</b> water (1) food (1) oxygen / air (1)	2	<b>allow</b> higher level answers eg space suit / shielding from cosmic rays / method of keeping warm / enough fuel
	b		telephone / weather forecasting / spying / global positioning / mapping (1)	1	<b>allow</b> military / transmit messages / astronomy <b>not</b> transmit television or radio
	c		collision of planet / large body with the earth / other planet (1)	1	<b>not</b> dust ejected from the earth / planet
	d	i	rock (1)	1	<b>allow</b> iron <b>not</b> ice / fire <b>ignore</b> stone / rubble / dust
		ii	<b>any two from:</b> crater (1) ejection of hot rocks (1) fires (1) sunlight blocked by dust (1) climate change / nuclear winter(1) extinction of species / death of large number of animals / humans (1) severe damage to property like explosion (1)	2	<b>allow</b> higher level answers tsunami / tidal wave (1)
			<b>Total</b>	<b>7</b>	

Question			Expected Answers	Marks	Additional Guidance
9	a		(measuring) tape / trundle wheel (1)	1	<b>allow</b> metre wheel <b>not</b> metre rule / metre stick
	b	i	between A and B (1)	1	if the answer is blank allow correct answer ticked, circled or underlined
		ii	between B and C (1)	1	if the answer is blank allow correct answer ticked, circled or underlined
		iii	B (1)	1	
			<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
10	a	change in speed / speeding up / slowing down / AW (1)	1	
	b	= 3.3(3) OR 3 1/3 (2) if answer is incorrect acceleration = 10/3 (1)	2	3=(2) <b>allow</b> any number of decimal places
	c	idea of greater speed change (in same time / 3 seconds) (1)	1	<b>allow</b> travels 22.5 metres rather than 10 metres (in 3 seconds) <b>allow</b> reaches / gets to a greater / higher speed / reaches 15 (m/s) (in 3 seconds) but <b>not</b> just travels at a greater / higher speed / travels more distance in the same time <b>allow</b> acceleration = $15/3 = 5 / 5 \div 3$ (m/s <sup>2</sup> )
	d	i	1	<b>allow</b> description of the two distances (eg thinking distance = distance travelled whilst reacting / before putting brakes on) but both needed
		ii	2	any one but a list containing any incorrect answers = 0 <b>allow</b> increased / older age <b>allow</b> named examples of distractions eg passengers/phone/radio/etc.  any one but a list containing any incorrect answers = 0 <b>allow</b> other road conditions eg leaves on road <b>allow</b> greater mass / load in car <b>ignore</b> unqualified references to weather / road conditions / brakes / tyres eg because of the tyres = 0 but tyres have poor grip = 1 eg weather conditions = 0 but it is raining = 1
		<b>Total</b>	<b>7</b>	

Question		Expected Answers	Marks	Additional Guidance
11		down: 1 kinetic (1) 5 solar (1)  across: 2 height / weight (1) 3 (converts) 4 diesel (1)	4	<b>allow</b> incorrect spelling if answer is recognisably correct  For 4 allow diesel in body of question if not in crossword
		<b>Total</b>	<b>4</b>	

12	a	distance (moved) (1)	1	<b>allow</b> height / length / how far / movement
	b	any example where a force moves an object (1)	1	eg lifting weights / pushing a shopping trolley / pulling a sledge / running / kicking football <b>not</b> someone else walking (up stairs) or idea of walking (down stairs)
	c	Joules (1)	1	<b>allow</b> J <b>allow</b> kilojoules / kJ
		<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
13	a	crumple zones (1)	1	if the answer is blank allow correct answer ticked, circled or underlined
	b	idea of absorb energy / decrease kinetic energy (1)	1	<b>ignore</b> change shape / absorb shock / force / impact / pressure <b>allow</b> idea of increased stopping distance / time OR smaller acceleration / force (1) <b>allow</b> higher level answers eg increases collision time / reduces acceleration
		<b>Total</b>	<b>2</b>	
		<b>Section Total</b>	<b>60</b>	

## B651/02 Physics B: Unit 1 Modules P1, P2, P3 Higher Tier

Question			Expected Answers	Marks	Additional Guidance
1	a	i	15 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
		ii	50 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
		iii	100 (1)	1	<b>allow</b> correct answer in table if answer line is blank or crossed out
	b	i	maximum temperature = 70(°C) (3)  but if answer is incorrect temp rise = 50(°C) (2)  or (for correct substitution) 2 100 000 = 10 x 4 200 x T / AW (1)	3	<b>use ticks in this question</b>
		ii	<b>any two from:</b> steel / heater gets hot or uses energy /AW (1)  heat (transferred) to room / atmosphere / surroundings / AW (1)  convection current set up in the <b>room</b> (1)  heater radiates (heat into the room) (1)	2	<b>allow</b> heat is conducted but <b>not</b> 'just' heat loss through steel  <b>ignore</b> heat escapes
		iii	lower SHC / AW / (1)	1	<b>allow</b> less energy / heat / Joules / J to heat 1 kg (of oil) by 1° (C) <b>allow</b> ORA <b>ignore</b> lower boiling point
		<b>Total</b>		<b>9</b>	

Question		Expected Answers	Marks	Additional Guidance
2	a	water (particles) (1)	1	<b>ignore</b> fat / starch <b>ignore</b> molecules / atoms
	b	(metal) reflects microwaves / waves / radiation / glass allows microwaves / radiation to pass through (1)	1	<b>not</b> just dangerous <b>not</b> glass / metal absorbs (microwaves) <b>not</b> just heat stays in the oven / stop heat escaping / heat reflected / energy reflected <b>not</b> refracted <b>allow</b> metal stops microwaves / waves / radiation (1) <b>allow</b> microwaves / waves / radiation cannot escape (1)
	c	particles vibrate / have <u>kinetic energy (KE)</u> (1)  vibrations / (kinetic) energy passed between particles / AW (1)  but particles / vibrations pass on <u>kinetic energy (KE)</u> (2)	2	<b>ignore</b> collisions unless qualified  no need to specify kinetic for this mark <b>ignore</b> heat
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
3	a	total internal <u>reflection</u> / TIR (1)	1	<b>allow</b> correct description / diagram of multiple reflections (1) <b>allow</b> in a zig zag path (1) <b>not</b> just 'reflection' do not penalise if all rays in a diagram do not strike sides of the fibre <b>but</b> side of fibre must be shown
	b	<b>any one from:</b> multiplexing / interleaving of signals (1)  less / no interference (1)  less information loss (1)  less need to amplify signals (1)  harder to tap into (1)	1	<b>allow</b> more information /more signals carried <b>ignore</b> speed and cost  <b>allow</b> less energy loss but <b>ignore</b> stops / no energy loss <b>not</b> no information loss  <b>ignore</b> carries information further <b>allow</b> fibres can be thinner
		<b>Total</b>	<b>2</b>	



Question			Expected Answers	Marks	Additional Guidance
4	a	i	(p-waves) → solid and liquid (1)	1	more than one answer (0) if answer line is blank allow correct answer ticked, circled or underlined
		ii	(s-waves) → solid only (1)	1	more than one answer (0) if answer line is blank allow correct answer ticked, circled or underlined
		iii	A / p waves travel faster (1)	1	more than one answer (0) if answer line is blank allow correct answer ticked, circled or underlined
	b	i	(p-waves) → <u>longitudinal</u> (1)	1	<b>ignore</b> primary / pressure <b>ignore</b> diagrams
		ii	(s-waves) → <u>transverse</u> (1)	1	<b>ignore</b> secondary / shear <b>ignore</b> diagrams
			<b>Total</b>	<b>5</b>	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	no wires from external power source needed / no fuel needed (1)	1	<b>allow</b> low maintenance / cheap to run / long life / rugged / idea of renewable <b>energy</b> / can be used in remote locations / AW / idea of no / less pollution given out eg no / fewer emissions <b>ignore</b> just environmentally friendly <b>ignore</b> portable <b>not</b> just no / less pollution <b>not</b> just cheap / cost effective / reliable <b>not</b> reusable or merely renewable
		ii	no power in poor light / night / only work when its light / low power or energy output / ORA (1)	1	<b>allow</b> does not work in bad weather / dull / when sun is not shining / cloudy <b>allow</b> power / energy needs to be stored in battery <b>ignore</b> reference to cost <b>ignore</b> visual pollution
	b		<b>any three from:</b> energy / light / photons absorbed / enters / taken in by (photo)cell / silicon / crystal (1)  electrons knocked loose (from atoms) in the photocell / silicon / crystal (1)  electrons able to flow (freely) / there are free electrons (1)  idea that increased light (intensity) / energy means increased electricity / current / moving electrons (1)	3	<b>use ticks in this question</b> <b>not</b> just sun or sunshine is absorbed <b>not</b> just light hits the photocell  <b>allow</b> higher level answers for p and n type material  <b>allow</b> electrons move but not just vibrate  <b>allow</b> large surface area increases electricity <b>ignore</b> increased energy produced
			<b>Total</b>	<b>5</b>	

Question		Expected Answers	Marks	Additional Guidance
6	a	the magnetic field or flux cuts the coil / magnetic field or flux is changing / AW (1)  AC produced because the magnet changes direction (1)	2	<b>ignore</b> magnet moves up and down  <b>ignore</b> references to emf across the coil
	b	B and D (1)		both needed in any order if answer line is blank allow correct answers ticked, circled or underlined on diagram
<b>Total</b>			<b>3</b>	

7	a	805 (W) (2)  but if answer is incorrect $P = 3.5 \times 230$ (1)	2	<b>allow</b> 800 (1) <b>allow</b> $35 \times 23$ (1)
	b	3.6 (pence) (2)  but if answer is incorrect $200/1000 \times 1.5 (x12) / 0.3$ (1)		2
<b>Total</b>			<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
8	a		2	1 or 2 correct (1) all correct (2)  <b>if</b> more than one line from any box deduct one mark down to zero
	b	charged particle (1)  particle / atom has lost or gained electron(s) (1)	2	look at both answers together  <b>allow</b> charged molecule / charged atom (1) <b>allow</b> positive / +ve / negative / -ve particle (1)  <b>ignore</b> reference to collisions eg alpha particle hits an atom (0) <b>but</b> alpha particle hits an atom and removes electron (1)
<b>Total</b>			<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
9	a	idea that it provides evidence that all the galaxies are moving away from us / each other / AW (1)	1	<b>allow</b> stars <b>not</b> planets <b>ignore</b> universe / galaxies expanding <b>ignore</b> references to frequency / wavelength of light
	b	<b>any two from:</b> large mass / density (1)  large gravity / gravitational pull (1)  can prevent light / other wave from E-M spectrum escaping (1)	2	<b>not</b> just dense  <b>ignore</b> sucks everything in / nothing comes out <b>ignore</b> absorbs matter / stars / planets / light  <b>ignore</b> invisible / cannot be seen
	c	<u>distance</u> that light / it travels in one year / AW (1)	1	<b>allow</b> a calculation eg $365 \times 24 \times 60 \times 60 \times 300\,000\,000$ metres a measure of distance alone is not enough for a mark any reference to time scores (0)
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
10	a	15 (seconds) (1)	1	<b>allow</b> B if answer line is blank allow correct answer ticked, circled or underlined on graph
	b	6.66 / 6.67 / 6.7 / 6.6 / 6 2/3 (2)  but if answer is incorrect speed = 100/15 (1)	2	<b>allow</b> any number of correct decimal places <b>allow</b> 7 (2)  if zero scored on calculation $\Delta t = 15$ gains (1)
	c	steeper gradient described or drawn on the graph (1)	1	<b>allow</b> curve if finish time is between 15 and 30 seconds  if line drawn on graph must start at B but may go beyond the dotted line  if there is an answer on the answer line and a line drawn on the graph and one is incorrect this is a CON and scores zero
		<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
11	a	speed / velocity (per) unit time / seconds / minutes / hours / AW (1)	1	Idea of speed and time are <b>both</b> needed <b>allow</b> change of direction per unit time <b>not</b> days / weeks/ months / years
	b	3.3 / 3.33 / $3 \frac{1}{3}$ (2)  if answer incorrect 10 / 3 (1)	2	<b>allow</b> 3 (2) <b>allow</b> any number of correct decimal places
	c	idea of greater speed change (in same time / 3 seconds) (1)	1	<b>allow</b> travels 22.5 metres rather than 10 metres (in the 3 seconds) <b>allow</b> reaches / gets to a greater / higher speed / reaches 15 (m/s) (in 3 seconds) but <b>not</b> just travels at a greater / higher speed / travels more distance in the same time <b>allow</b> acceleration of B = $5 / 15 \div 3 \text{ (m/s}^2\text{)}$
	d	<b>thinking distance</b> ... driver tiredness / alcohol, drinking or drugs / <b>greater</b> speed / distractions / <b>lack</b> of concentration (1)  <b>braking distance</b> ..... slippery road / wet or icy road / poor brakes / <b>greater</b> speed / worn tyres (1)	1         1	any one but a list containing any incorrect answers = 0 <b>allow</b> increased / older age <b>allow</b> named example of distraction eg passengers / phone / radio etc  any one but a list containing any incorrect answers = 0 <b>allow</b> other road conditions eg leaves on road <b>allow</b> greater mass / load in car <b>ignore</b> unqualified references to weather / road conditions / brakes / tyres eg the weather = 0 but its raining = 1 eg because of the tyres = 0 but tyres have poor grip = 1

Question		Expected Answers	Marks	Additional Guidance
11	e	<p>for <b>increased</b> braking distance:</p> <p>greater mass in car / greater weight in car / idea of greater (kinetic) energy to be dissipated (1)</p> <p>idea of less deceleration (1)</p> <p>or for <b>decreased</b> braking distance:</p> <p>greater braking force / stopping force / more friction (1)</p> <p>idea of greater deceleration (1)</p>	2	<p><b>increase (not just changes)</b> must be clearly stated for the marking points on the left hand side <b>not</b> just more objects / passengers / heavier</p> <p><b>allow</b> slows down the deceleration (1)</p> <p><b>decrease (not just changes)</b> must be clearly stated for the marking points on the left hand side <b>allow</b> grip for friction</p>
		<b>Total</b>	<b>8</b>	
12	a	idea of no pollution <b>at point of use</b> / emission of (greenhouse) gases / named greenhouse gas / quieter / AW (1)	1	<p><b>ignore</b> just pollution / less pollution / harmful / damage <b>allow</b> renewable / cheaper to run <b>not</b> just cheaper <b>ignore</b> references to conservation of fuels or need to refuel</p>
	b	<p>25 600 (J) (2)</p> <p>but if answer is incorrect KE = <math>\frac{1}{2} 800 \times 8^2</math> (1)</p>	2	<b>allow</b> $400 \times 8^2$ (1)
		<b>Total</b>	<b>3</b>	



Question		Expected Answers	Marks	Additional Guidance
13		4 (seconds) (2)  but if answer is incorrect time = 2000/500 / work/power (1)	2	<b>not</b> just power = work/time / 2000 = time x 500 (must be the re-arrangement of the equation)
		<b>Total</b>	<b>2</b>	
14	a	idea of absorb energy / decrease kinetic energy (1)	1	<b>ignore</b> changes shape / absorbs force / absorbs impact / absorbs pressure / absorbs shock <b>allow</b> idea of increased stopping distance / time OR smaller acceleration / force (1) <b>allow</b> higher level answers eg increases collision time / idea of reduced acceleration
	b	<b>any two from:</b> the stopping time is increased / longer / AW (1)  the stopping distance is increased / AW (1)  idea of a decreased acceleration / AW (1)	2	must be clear that it's not the car <b>allow</b> slows down collision (between air bag & passenger) (1)  <b>allow</b> mention of $F = ma$ (1) <b>ignore</b> cushions impact / force / collision <b>allow</b> slows down the deceleration (1) <b>allow</b> greater time for KE to be dissipated (2)
		<b>Total</b>	<b>3</b>	
		<b>Section Total</b>	<b>60</b>	

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

Question			Expected Answers	Marks	Additional Guidance
1	a	i	becomes charged / increased electrons / decreased electrons (1)	1	<b>allow</b> higher level answers in terms of electron transfer
		ii	paint spraying / starting heart / dust precipitation in chimneys / photocopiers / printers (1)	1	
	b	i	insulator (1) charged (1) earth (1)	3	
		ii	attracting dust to tv / monitors / plastic surfaces (1)	1	<b>allow</b> (minor) shock eg getting out of car <b>allow</b> damage to electronic components by charged worker <b>allow</b> hair sticking up <b>allow</b> lightning <b>allow</b> sparks
			<b>Total</b>	<b>6</b>	

2	a		increased (1)	1	mark answer on line first. more than one answer on line scores [0] if no answer on line mark indicated answer ringed, underlined, etc from choices above
	b		4 (2)  BUT 10/2.5 (1)	2	ignore units
			<b>Total</b>	<b>3</b>	

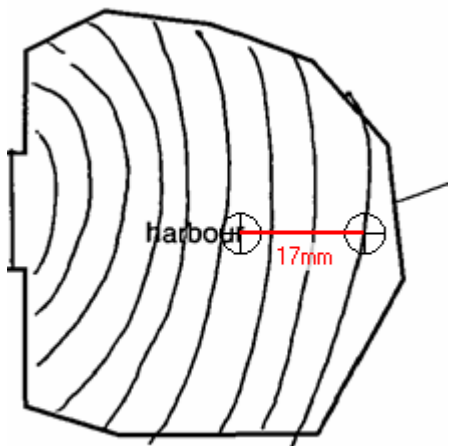
Question			Expected Answers	Marks	Additional Guidance
3	a		beta and gamma (1)	1	both needed, any order <b>allow</b> correct symbols
	b	i	radiation can damage cells / cause cancer / hair loss / reduction in white blood cell count / burns / damage to central nervous system / death (1)	1	<b>allow</b> specific type of cancer <b>not</b> skin cancer
		ii	treat cancer / sterilize hospital equipment / energy generation / power source / pacemaker / bomb (1)	1	<b>allow</b> higher level answers eg tracers / smoke alarms / thickness gauge <b>ignore</b> harming people
	c		rocks / sun / space (1)	1	<b>allow</b> cosmic rays and other answers such as nuclear industry, medical <b>allow</b> radon gas <b>not</b> Earth / Earth's core / atmosphere / building materials <b>allow</b> living things / food
			<b>Total</b>	<b>4</b>	

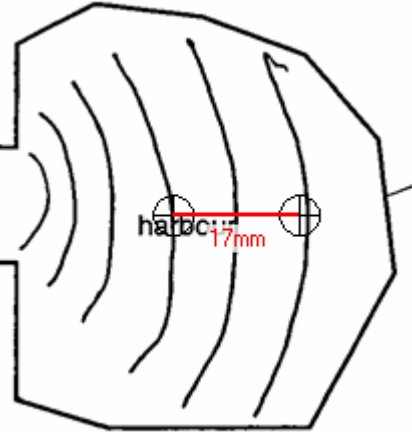
4	a	i	D (1)	1	
		ii	A and C (1)	1	any order
	b		scans / breaking kidney stones / cleaning delicate equipment / measuring speed of blood flow in the body (1)	1	<b>allow</b> distance measuring and examples / muscular treatment <b>allow</b> reference to looking at fetus
			<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
5	a	uranium (1)	1	<b>allow</b> plutonium
	b	<b>any three from:</b> nuclear fuel (1) heat / energy produced (1) water boiled steam made (1) spins <u>turbine</u> (1) drives <u>generator</u> (1)	3	<b>allow</b> higher level answers in terms of fission / nuclear reaction physics must be correct for a particular marking point eg heating radioactive source to produce energy = 0; steam turns generator = 0 detail within a stage not required eg electromagnet turns within coils
		<b>Total</b>	<b>4</b>	

6	a	bottom diagram (1)	1	
	b	✓Denise (1) ✓Sally (1) ✓Sally (1)	3	additional tick in any row fails to score mark for that row
	c	80 N to right (1)	1	if more than one ticked, no marks
		<b>Total</b>	<b>5</b>	

7		the loudness of the sound he hears is sometimes louder (1) the loudness of the sound he hears is sometimes quieter (1) there is interference between the sound waves from the two loudspeakers (1)	3	
		<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
8	a	1.5 km (1)	1	
	b	radio waves are reflected by the Earth's upper atmosphere (1)	1	if more than one ticked, no marks
	c	dish (1)	1	
	d	straight (by inspection) wave <b>with some curve at end</b> (1)  wavelengths consistent with incident wave (1)	2	<p><b>NOT</b> just straight wave Incorrect curve [0] <b>allow</b> completely curved wave focussed / originated (by inspection) on gap</p> <p>Allow tolerance of +/- 25%. (The use of ruler tool 17mm may be useful here)</p>  <p>scores (1) because between 3 and 5 wavefronts consistently within the 17 mm ruler but waves not centred on gap</p>

Question		Expected Answers	Marks	Additional Guidance
8	d			 <p>scores (0) because only 2 wavefronts within the 17 mm ruler and waves not centred on gap</p>
		<b>Total</b>	<b>5</b>	

9	a	<u>real</u> (1)	1	
	b	on the film (1)	1	<b>allow</b> screen or other AW
	c	convex (1)	1	
		<b>Total</b>	<b>3</b>	

10	a	Hugh moves to the left / AW (1) Hannah moves to the right / AW (1) every action has equal and opposite reaction / owtte (1)	3	<b>allow</b> Hugh is pulled off the skateboard
	b	tennis ball and racket / golf ball and club / football and boot / rounders ball and bat / volleyball ball and hand / rugby one player with another etc (1)	1	<b>allow</b> any suitable sporting combination <b>ignore</b> sport, pair must be correct
		<b>Total</b>	<b>4</b>	

Question			Expected Answers	Marks	Additional Guidance
11	a		circuit C (1)	1	
	b		temperature (1)	1	
	c		resistance decreases with light intensity (1) <b>BUT</b> smooth curve with decreasing negative gradient (2)	2	
			<b>Total</b>	<b>4</b>	

12	a	i	capacitor (1)	1	
		ii	diode (1)	1	
	b	i	diode (1)	1	
		ii	full wave <u>rectification</u> (1)	1	
			<b>Total</b>	<b>4</b>	

13	a		A magnet (1) B coil (1) C commutator (1)	3	
	b		voltage / pd (1)	1	<b>allow</b> emf <b>allow</b> current
	c		an electromagnet rotates inside coils of wire (1)	1	if more than one ticked, no marks
			<b>Total</b>	<b>5</b>	

Question			Expected Answers	Marks	Additional Guidance
14	a		0 1 (1) 1 0 (1)	2	<b>allow</b> off on on off <b>not</b> X ✓ no yes true false ✓ X yes no false true
	b	i	A / B / C (1)	1	all 3 or any two (1)
		ii	D (1)	1	
		iii	first four column D reads 0 1 1 1 (1) last four column D reads 0 0 0 0 (1)	2	
	c		maintain output / keep alarm sounding / owtte (1)	1	<b>not</b> set off alarm owtte
			<b>Total</b>	<b>7</b>	
			<b>Section Total</b>	<b>60</b>	



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

Question			Expected Answers	Marks	Additional Guidance
1	a	i	becomes charged (1)	1	<b>Allow</b> loss or gain of charge <b>allow</b> higher level answers in terms of movement of electrons
	b	i	remove any charge / voltage from lorry / owtte (1) so no chance of spark / igniting gas / explosion / (1)	2	<b>Allow</b> current (to earth) <b>Allow</b> stops build up of charge  Ignore reference to 'lorry not live
		ii	attracting dust to tv / monitors / plastic surfaces (1)	1	<b>allow</b> (minor) shock e.g. getting out of car <b>allow</b> damage to electronic components by charged worker allow hair sticking up allow lightning allow sparks if in different context to previous question allow clothes clinging
			<b>Total</b>	<b>4</b>	

Question		Expected Answers	Marks	Additional Guidance
2	a	increased (1)	1	Mark answer on line 1 <sup>st</sup> . More than one answer on line scores [0] If no answer on line mark indicated answer ringed, underlined, etc from choices above
	b	4 (2)  BUT 10/2.5 (1)	2	Ignore units
	c	<b>any one from:</b> (earth) prevents case becoming live / <b>large</b> current blows fuse / current or electricity moves (safely) to earth / AW (1)  provides <b>low resistance</b> route (to earth) (1)	2	<b>ignore</b> electric shocks <b>not</b> just blows fuse <b>allow</b> power for current mark  award maximum 2 marks only if low resistance idea given NOT merely 'easy route to earth' <b>BUT</b> easy route <b>for current</b> to earth [1]
		<b>Total</b>	<b>5</b>	

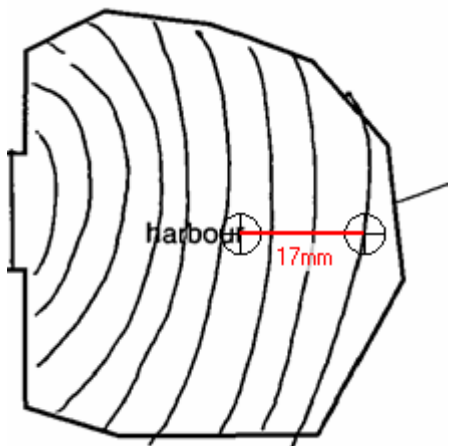
Question		Expected Answers	Marks	Additional Guidance
3	a	beta and gamma (1)	1	both needed, any order allow correct symbols
	b	<p><b>any two from:</b> idea that beam spread (not concentrated) through healthy tissue (1)</p> <p>rotated round (the body) or fired from different positions / multiple sources (1)</p> <p>beam concentrated on tumour (1)</p>	2	<p><b>allow</b> time between treatments helps healthy cells recover (1) allow shielding / masking as a way of protection (for patient) Ignore protection of staff</p> <p><b>allow</b> diagrams and award marking points as explained</p> <p><b>allow</b> beam focused on tumour (1)</p> <p>for isotope implant idea the concentration mark and healthy tissue marks and time mark can still be awarded</p>
		<b>Total</b>	<b>3</b>	

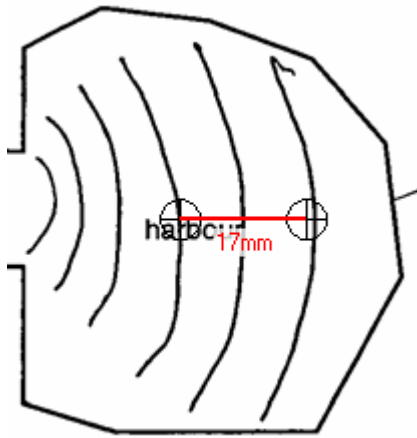
Question			Expected Answers	Marks	Additional Guidance
4	a	i	background radiation (1)	1	
		ii	rocks / sun / space (1)	1	<b>allow</b> cosmic rays and other answers such as nuclear industry, medical allow radon gas NOT earth / earth's core / atmosphere Allow living things / food
	b	i	(high speed) <b>electrons</b> (1)	1	<b>allow</b> e (as symbol for electron)
		ii	<b>5</b> (minutes) (1)	1	Allow 4.9 → 5.1
		iii	similar shaped <b>curved</b> line below original graph starting from the same point (1) passing close to 60,3 (1)	2	Correct plot but joined by straight lines scores [1]  Close to = +/- 1 square
<b>Total</b>				<b>6</b>	

Question		Expected Answers	Marks	Additional Guidance
5		nuclear reaction takes place heat produced water boils (1)	2	first three correct, in correct order (1)
		turbine spins generator spins (1)		second two correct in correct order (1)
<b>Total</b>			<b>2</b>	

## Section B

6	a	80 N to right (1)	1	If more than 1 tick [0]
	b	i		
		Denise (1) Sally (1) Sally (1)	3	additional tick in any row fails to score mark for that row
		ii		
		7 (2) BUT $(2 \times 2.5) + 2$ (1)	2	correct answer with no working scores full marks incorrect answer with correct working [1]
	c	5 (2)  BUT 3 4 5 triangle / Pythagoras / scale drawing (1)	2	<b>allow</b> answer in range 4.8 to 5.2 if scale drawing  incorrect answer with correct working / method [1]
<b>Total</b>			<b>8</b>	

Question		Expected Answers	Marks	Additional Guidance
7	a	<p>straight (by inspection) wave <b>with some curve at end</b> (1)</p> <p>wavelengths consistent with incident wave (1)</p>	2	<p><b>NOT</b> just straight wave Incorrect curve [0] <b>allow</b> completely curved wave focussed / originated (by inspection) on gap</p> <p>Allow tolerance of +/- 25%. (The use of ruler tool 17mm may be useful here)</p>  <p>scores (1) because between 3 and 5 wavefronts consistently within the 17 mm ruler but waves not centred on gap</p>

				 <p>scores (0) because only 2 wavefronts within the 17 mm ruler and waves not centred on gap</p>	
	<b>b</b>	<b>i</b>	more diffraction/ more curvature/ AW (1)	1	
		<b>ii</b>	most diffraction when gap similar as wavelength / <b>10m</b> (1)	1	NOT smaller gap than wavelength
			<b>Total</b>	<b>4</b>	

<b>8</b>		crumple zone means longer time to decelerate (1) (longer time means) less force on body (1) force = momentum change/time (1)	3	<b>allow</b> sensible high level answers relating to energy
		<b>Total</b>	<b>3</b>	

Question		Expected Answers	Marks	Additional Guidance
9	a	(RED) – orange yellow green [1] (...) - blue indigo violet [1]	2	all correct (2)
	b	i & ii Maximum 3: different colours have different: refractive indices (1) speeds / AW (1) wavelength / frequency (1)  <b>BUT</b> red light: has longer wavelength / lower frequency[2] is fastest / AW (2) has lower refractive index [2]	3	Look for concise answers covering more than one marking point Eg blue light is slower than red light [2] (ie different speeds) [1] and red is faster [1] Eg blue light has higher refractive index as it is slower than red [3]
<b>Total</b>			<b>5</b>	

## Section C

10	a	9 (2) BUT output = $(12 \times 1500)/(500 + 1500)$ (1)	2	correct answer with no working scores full marks incorrect answer with correct working / method [1]
	b	resistance decreases with light intensity (1)  <b>BUT</b> smooth curve with decreasing negative gradient (2)	2	
<b>Total</b>			<b>4</b>	



Question			Expected Answers	Marks	Additional Guidance
11	a		Spin / move coil (1)	1	<b>allow</b> move magnets [1] allow move magnets <b>relative</b> to coil [1] NOT merely 'spin it' (where <b>it</b> refers to the whole generator)
	b	i	an electromagnet rotates inside coils of wire (1)	1	If more than 1 tick [0]
		ii	Mark as separate points frequency increases (1) voltage increases (1)	2	Eg frequency increases and voltage decreases scores [1]  Both increase scores [2]
		iii	reduces voltage / AW (1)	1	
			<b>Total</b>	<b>5</b>	
12	a		first four column D reads 0 1 1 1 (1)  last four column D reads 0 0 0 0 (1)	2	
	b	i	relay (1)	1	
		ii	only small current / voltage from logic gate / AW (1) isolates low voltage / current from the mains / AW (1)	2	Ignore reference to ac
			<b>Total</b>	<b>5</b>	

Question			Expected Answers	Marks	Additional Guidance
13	a		absence of electron (1) positive charge (1)	2	
	b	i	Maximum 2: Diode lets current pass one way [1] Diodes work in pairs [1] BUT 1 & 4 work together or 2 & 3 work together [2]	2	Opposite diodes work together [1] (OK for working in pairs but too vague for identified pair)
		ii	Humps: same side of axis with no gaps (1)  BUT same side of axis with no gaps <b>and</b> same height (voltage) scores (2)	2	signal must touch time axis <b>Ignore</b> type of signal (eg sine waves)  <b>Ignore</b> frequency / time period  If no marks in this section look for answers in part bi – particularly in the diagram.
			<b>Total</b>	<b>6</b>	
			<b>Section Total</b>	<b>60</b>	

# Grade Thresholds

General Certificate of Secondary Education  
Physics B (Specification Code J645)  
June 2008 Examination Series

## Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B651/01	Raw	60	-	-	-	38	30	23	16	9	0
	UMS	69	-	-	-	60	50	40	30	20	0
B651/02	Raw	60	45	38	30	23	16	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B652/01	Raw	60	-	-	-	28	23	19	15	11	0
	UMS	69	-	-	-	60	50	40	30	20	0
B652/02	Raw	60	44	37	30	23	16	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B655/01	Raw	60	53	49	44	40	35	30	25	20	0
	UMS	100	90	80	70	60	50	40	30	20	0
B656/01	Raw	60	52	47	41	36	30	24	18	12	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 2008. 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
<b>J645</b>	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
<b>J645</b>	23.6	53.9	78.9	93.7	98.1	99.3	99.7	99.9	100.0	8818

**8906 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](http://www.ocr.org.uk/learners/ums_results.html)

Statistics are correct at the time of publication.

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