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Further guidance

P2 Radiation and life – Foundation Workbook answers

1	a	i	Visible light – is detected by eyes – allows people to see Infrared – makes you feel warm ultraviolet – damages cells and can cause skin cancer
		ii	From the top: ultraviolet, visible light, infrared
		iii	Glass – transmit, paper – reflect, body – absorb
	b		<ul style="list-style-type: none"> • Benefits – makes me feel good, makes vitamin D • Risks – can start skin cancer, can damage retina
	c	i	<ul style="list-style-type: none"> • Outcomes – do better in exams, have a car accident • Possible factors – polite, drinking alcohol
		ii	Correct bold words: correlation, cause
	d	i	Missing words: sun protection factor Correct bold words: ultraviolet, high, increase, decrease
		ii	For example: cover up with clothing, stay in the shade during early afternoon
2	a	i	Missing words: atmosphere, transmits plants, absorbs ozone layer, absorbs
		ii	The atmosphere is a mixture of gases that surrounds the Earth; it transmits sunlight – This allows life to continue. A plant produces starch when it absorbs sunlight – This is photosynthesis. The ozone layer is part of the atmosphere which absorbs ultraviolet radiation – This protects living organisms.
	b		Where ozone is found – in atmosphere, thin layer, 20 km up What ozone protects us from – ultraviolet radiation What ozone is – O ₃ molecules, made from 3 oxygen molecules What CFCs do – banned chemicals that harm ozone, destroy ozone molecules UN action – Montreal Protocol 1987
3	a	i	<ul style="list-style-type: none"> • infrared • human bodies • camera
		ii	<ul style="list-style-type: none"> • e.g. steel • e.g. air
	b		Correct bold words: Sun, emits, atmosphere, absorbed, skin
4	a		Correct bold words: heat up, more, high, ionization, molecules, ions, chemical

Further guidance

	b	List A: electromagnetic List B: spectrum
	c	Photon
	d	i From least energy to most energy: radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays
		ii Ionizing radiation: gamma, X-raysultraviolet
		iii H next to all the boxes except radio waves
5	a	Metal – reflect – protective casing
	b	i 100 watts
		ii Less
	c	i Risks: e.g. electric shock, can burn yourself, can burn toast Benefits: e.g. toasts bread, easy to use, convenient
		ii Benefits outweigh risks
		iii It makes you think carefully about factors and their relative importance/weightings.
6	a	i Microwaves
		ii Reduces the intensity of radiation reaching the brain
		iii To reduce the risk of brain tumour
		iv Correct bold words: safe, sorry
	b	i For example: <ul style="list-style-type: none"> • Enables you to keep in touch with family and friends • Available in emergencies • Other features, e.g. games
		ii For example: <ul style="list-style-type: none"> • Limit use, or use with a hands-free set • Text rather than use voice communication
		iii They have no control over their exposure from masts
	c	For example: Things happen, e.g. you could walk in front of a moving car because using your phone distracted you.
7	a	i 1, 3
		ii 1, 3
		iii Correct bold words: probably just chance

Further guidance

	b	i	B, C, F, G						
		ii	Yes						
		iii	Correct bold words: probably just chance						
		iv	For example: eye colour, time of day						
	c	i	None, none						
		ii	Correct bold words: more, decreased						
8	a		<p>When energy carried by microwaves is absorbed... it causes a heating effect.</p> <p>Radiation is called 'ionizing' if... it causes ionization.</p> <p>If ionizing radiation damages a cell's DNA... it may start a cancer tumour.</p> <p>When large amounts of ionising radiation strike living cells... it kills the cells.</p>						
	b		<table border="1"> <tbody> <tr> <td>e.g. good shoe fit</td> <td>e.g. gives doctor information that will be used to plan treatment</td> </tr> <tr> <td>no</td> <td>yes</td> </tr> <tr> <td>e.g. no, checking shoe fit can be done equally well without using X-rays</td> <td>e.g. yes, risk is small compared to the benefits</td> </tr> </tbody> </table>	e.g. good shoe fit	e.g. gives doctor information that will be used to plan treatment	no	yes	e.g. no, checking shoe fit can be done equally well without using X-rays	e.g. yes, risk is small compared to the benefits
e.g. good shoe fit	e.g. gives doctor information that will be used to plan treatment								
no	yes								
e.g. no, checking shoe fit can be done equally well without using X-rays	e.g. yes, risk is small compared to the benefits								
	c		<p>For example:</p> <ul style="list-style-type: none"> • leave the room before activating the X-ray machine • use barriers that absorb X-rays, e.g. lead apron • wear badges to monitor their exposure 						
9	a		<p>The Sun – a white hot star – emits a mixture of high-energy electromagnetic radiation (up to ultraviolet)</p> <p>The Earth – a warm planet – transmits visible light but absorbs low-energy infrared and some ultraviolet</p> <p>The Earth's atmosphere – a mixture of gases that surrounds the Earth – emits low-energy electromagnetic radiation (mainly low-energy infrared)</p>						
	b		<p>Sun's radiation: the whole box shaded</p> <p>Earth radiates: the right-hand third of the box (infrared end) is shaded</p>						
	c		The energy radiated by the Earth into space = the energy of the Sun's radiation absorbed by the Earth						
	d	i	Carbon dioxide, water vapour						
		ii	Correct bold words: increasing, increase, raise, change						

Further guidance

	e	<p>Columns from left to right:</p> <ul style="list-style-type: none"> • 15°C, liquid, life can exist • –18°C, solid, life cannot exist • 17°C, the climate will change
10	a	<ul style="list-style-type: none"> • Labels in boxes: atmosphere and oceans, fossil fuels, plants, animals • Labels by arrows: (top right) respiration, (middle left) photosynthesis, (middle right) eating, (bottom) decomposing • blue ring: photosynthesis • green ring: respiration (x2), decomposing • red ring: burning fuels
	b	Correct bold words: decomposers, releasing, carbohydrates
	c	<ul style="list-style-type: none"> • Missing words: (left) photosynthesis; (right) respiration, decomposing (error in workbook – should be two missing words in the right-hand box) • Correct bold word: equalled
	d	<ul style="list-style-type: none"> • Burning fuels has hugely increased • Forests have been destroyed
	e	<ul style="list-style-type: none"> • is less than • increases it
	f	Missing words: energy, photosynthesis. Correct bold words: small, uses up
	g	Missing words: carbon dioxide, water, energy, oxygen, glucose
11	a	Weather, climate, climate, weather
	b	<p>Rings round all items in the list</p> <p>Underlined: data from ice cores, growth rings in trees</p>
	c	<p>Rising sea levels – low-lying cities flooded and farmland covered</p> <p>Extreme weather including heavy rains and flooding – damage to property and rising insurance premiums</p> <p>Disruption to the warm air and ocean currents from the tropics – temperatures drop in UK and northern Europe</p> <p>Average temperature rises – mosquitoes carrying malaria move to currently temperate areas</p>
12	a	<p>Scientists agree about this:</p> <ul style="list-style-type: none"> – The Earth is warming up... – Human activities contribute... – To stabilize climates... <p>Scientists do not all agree about this:</p> <ul style="list-style-type: none"> – Future emissions... – The UK will have... – Global warming...

Further guidance

b	<ul style="list-style-type: none">• e.g. travel less by air, use less energy at home, use cars less• e.g. increase taxation on fuels, pass laws about energy efficiency of buildings and appliances, invest in alternative was of producing energy
c	Correct bold words: decades, more difficult, test the theories, more difficult, long

Further guidance

P2 Radiation and life – Higher Workbook answers

1	a	i	Visible light – is detected by eyes – allows people to see Infrared – makes you feel warm ultraviolet – damages cells and can cause skin cancer
		ii	From the top: ultraviolet, visible light, infrared
		iii	Glass – transmit, paper – reflect, body – absorb
	b		<ul style="list-style-type: none"> • Benefits – makes me feel good, makes vitamin D • Risks – can start skin cancer, can damage retina
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		ii	Correct bold words: correlation, cause, A
	d	i	Missing words: sun protection factor Correct bold words: ultraviolet, high, increase, decrease
		ii	For example: cover up with clothing, stay in the shade during early afternoon
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		ii	The atmosphere is a mixture of gases that surrounds the Earth; it transmits sunlight – This allows life to continue. A plant produces starch when it absorbs sunlight – This is photosynthesis. The ozone layer is part of the atmosphere which absorbs ultraviolet radiation – This protects living organisms.
	b		Where ozone is found – in the atmosphere, a thin layer, 20 km up What ozone protects us from – ultraviolet radiation What ozone is – O ₃ molecules, made from 3 oxygen molecules What CFCs do – banned chemicals that harm the ozone layer /destroy ozone molecules UN action – Montreal Protocol 1987 Oxygen to ozone – free atoms of oxygen combine with oxygen molecules to make ozone Ozone to oxygen – ultraviolet radiation breaks ozone molecules into oxygen molecules and oxygen atoms (also breaks oxygen molecules into oxygen atoms)
3	a	i	<ul style="list-style-type: none"> • infrared • human bodies • camera
		ii	<ul style="list-style-type: none"> • e.g. steel • e.g. air

Further guidance

	b	Correct bold words: Sun, emits, atmosphere, absorbed, skin
	c	4, 2, 3, 1, 5
4	a	Correct bold words: heat up, more, high, ionization, molecules, ions, chemical
	b	List A: electromagnetic List B: spectrum
	c	Photon
	d	i From least energy to most energy: radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays
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5	a	Metal – reflect – protective casing
	b	i 100 watts
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	c	i Risks: e.g. electric shock, can burn yourself, can burn toast Benefits: e.g. toasts bread, easy to use, convenient
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6	a	i Microwaves
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		iii To reduce the risk of brain tumour
		iv Correct bold words: safe, sorry
	b	For example: Things happen, e.g. you could walk in front of a moving car because using your phone distracted you.
	c	A – top left and right P – bottom left and right
7	a	i 1, 3
		ii 1, 3

Further guidance

	iii	With a small sample of people, the results that Frances obtains might simply be a result of chance. Georgia shows this by flipping coins, getting the same results as Frances. In both cases, the chances of getting a correct answer each time are 50:50.						
b	i	B, C, F, G						
	ii	Yes						
	iii	Her results seem to confirm the link, but are probably only due to chance – a sample of four is not big enough to test Frances's claim.						
	iv	For example: eye colour, time of day						
	v	Dark hair enables a person to emit 'tele-waves'.						
c	i	None, none						
	ii	Correct bold words: more, decreased						
8	a	When energy carried by microwaves is absorbed... it causes a heating effect. Radiation is called 'ionizing' if... it causes ionization. If ionizing radiation damages a cell's DNA... it may start a cancer tumour. When large amounts of ionising radiation strike living cells... it kills the cells.						
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no	yes							
e.g. no, checking shoe fit can be done equally well without using X-rays	e.g. yes, risk is small compared to the benefits							
	c	i As Low As Reasonably Achievable						
		ii For example: handling radioactive wastes, medical procedures, road safety measures						
9	a	The Sun – a white hot star – emits a mixture of high-energy electromagnetic radiation (up to ultraviolet) The Earth – a warm planet – transmits visible light but absorbs low-energy infrared and some ultraviolet The Earth's atmosphere – a mixture of gases that surrounds the Earth – emits low-energy electromagnetic radiation (mainly low-energy infrared)						
	b	Sun's radiation: the whole box shaded Earth radiates: the right-hand third of the box (infrared end) is shaded						
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Further guidance

12	a	<p>Scientists agree about this:</p> <ul style="list-style-type: none"> – The Earth is warming up... – Human activities contribute... – To stabilize climates... – Weather conditions... <p>Scientists do not all agree about this:</p> <ul style="list-style-type: none"> – Future emissions... – The UK will have... – Global warming... – If carbon dioxide concentrations...
	b	<ul style="list-style-type: none"> • e.g. travel less by air, use less energy at home, use cars less • e.g. increase taxation on fuels, pass laws about energy efficiency of buildings and appliances, invest in alternative was of producing energy
	c	<ul style="list-style-type: none"> • This makes it more difficult for scientists to agree on the causes because it takes longer to test the theories. • It is more difficult to test the effectiveness of remedies because scientists have to wait a long time to measure the effects.