



GCSE MARKING SCHEME

SUMMER 2012

SCIENCE - PHYSICS

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - PHYSICS. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

PHYSICS 1
FOUNDATION TIER

Question			Marking details	Marks Available
1.	(a)	(i)	<u>Step-down transformer</u>	1
		(ii)	Ticks in box 2, 4 & 5 [for each extra tick – 1 mark]	3
	(b)	(i)	700 [MJ]	1
		(ii)	lost as <u>heat</u>	1
		(iii)	equation (1) correct subs of 1000 & 300 (1) 30[%] (1)	3
			Question total	[9]
2.	(a)	(i)	4 [m]	1
		(ii)	50 [cm]	1
	(b)	Correct substitution (1) answer 0.7 [Hz] (1) ecf for wavelength	2	
(c)	Subs of 2.8 (1) answer 280 [m] (1)	2		
			Question total	[6]
3.	(a)	Travel at the same speed [in a vacuum] / transverse waves / transfer energy / can be reflected / refracted / are not ionising	1	
	(b)	Different wavelength / frequency / energy	1	
	(c)	Infra red/visible (1) microwaves,(1) microwaves/infra red (1)	3	
			Question total	[5]
4.	(a)	(i)	<u>Gas</u>	1
		(ii)	Use of 800 and 2 (1) = 400 (1)	2
		(iii)	<u>Generating</u> costs are cheaper or cost per unit is cheaper (1) <u>output</u> power is more (1) [or compare using numbers]	2
(b)	Containment (1) to absorb radiation (1) or <u>Containment</u> of the <u>waste</u> (1) because it remains radioactive for a long time (1) The 2nd mark must be linked to the 1st mark.	2		
			Question total	[7]
5.	(a)	Easily replaced / replenished / will not run out / sustainable Don't accept can use it again – treat this as neutral with other acceptable answer	1	
	(b)	(i)	[£] 2000	1
		(ii)	Wind - variable wind speed (1) Solar - hours of sunshine / roof may not face South or intensity of Sun (1) Fuel costs could change (1)	2
(c)	Reduces CO ₂ (1) which reduces the greenhouse effect / global warming (1) or Less SO ₂ (1) which results in less acid rain (1) or Use less fossil fuels (1) so less extraction needed / less CO ₂ / less SO ₂ (1) Don't accept less pollution. The 2nd mark must be linked to the 1st mark.	2		
			Question total	[6]

Physics 1 Foundation Tier (Contd.)

Question		Marking details	Marks Available	
6.	(a)	Subs (1) answer 2000 [W] (1)	2	
	(b)	Units used = power x time $\frac{100 \times 5(1)}{1000(1)}$ 0.5 ecf x 12 (1) 6 [p] (1) If convert to £ must be correct and no p present. If no workings shown: £0.06 (4 marks) 6000 p (3 marks), £60 (3 marks), 0.06 p (3 marks), 6 000 000 p (2 marks), 60 p (2 marks), 120 p (2 marks) If kettle used award a maximum of 2 marks	4	
	(c)	(i)	All plots correct (2), 4 plots correct (1), 3 or less plots correct (0), line of best fit that passes through the origin (1)	3
		(ii)	Economy plan ecf (1) cheaper (1)	2
		(iii)	240[kWh] ecf accept 235 - 245	1
		Question total	[12]	
7.	(a)	(i)	380[units]	1
		(ii)	$\frac{10}{5}$ (1) = 2 [mm] (1) [$\frac{1}{5} = 0.2$ Award 1 mark only]	2
	(b)	(i)	Big Bang	1
		(ii)	Universe started at one point / singularity (1) [matter thrown out] by an <u>explosion</u> (1)	2
		Question total	[6]	

Physics 1 Foundation Tier (Contd.)

Question		Marking details	Marks Available
8.	(a)	<p>Indicative content:</p> <p>The count rate due to background radiation needs to be determined first. This is 0.5 counts per second. The paper absorber reduces the count rate showing that alpha radiation must be emitted, since it will be blocked by paper. The aluminium absorber does not affect the count rate so beta radiation cannot be present. Thick lead reduces the count rate, but it still remains above the background level, showing that gamma radiation must also be emitted.</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
	(b)	<p>(i) Stored in a <u>lead</u> [lined] container</p> <p>(ii) To absorb / block radiation (1) which would be harmful / to prevent exposure (1) The 2nd mark must be linked to the 1st mark.</p> <p>Question total</p>	1 2 [9]
Total For Foundation Tier paper			60

PHYSICS 1
HIGHER TIER

Question		Marking details	Marks Available
1.	(a)	Easily replaced / replenished / will not run out / sustainable Don't accept can use it again – treat this as neutral with other acceptable answer	1
	(b)	(i) [£] 2000	1
		(ii) Wind - variable wind speed (1) Solar - hours of sunshine / roof may not face South or intensity of Sun (1) Fuel costs could change (1) Award a maximum of 2 marks only	2
	(c)	$\frac{5400}{1800}$ (1) = 3 x 4 = 12 [m ²] (1)	2
(d)	Reduces CO ₂ (1) which reduces the greenhouse effect / global warming (1) or Less SO ₂ (1) which results in less acid rain (1) or Use less fossil fuels (1) so less extraction needed / less CO ₂ / less SO ₂ (1) Don't accept less pollution. The 2nd mark must be linked to the 1st mark.	2	
Question total			[8]
2.	(a)	Subs (1) answer 2000 [W] (1)	2
	(b)	Units used = power x time $\frac{100 \times 5(1)}{1000(1)}$ 0.5 ecf x 12 (1) 6 [p] (1) If convert to £ must be correct and no p present. If no workings shown: £0.06 (4 marks) 6000 p (3 marks), £60 (3 marks), 0.06 p (3 marks), 6 000 000 p (2 marks), 60 p (2 marks), 120 p (2 marks) If kettle used award a maximum of 2 marks	4
Question total			[6]
3.	(a)	(i) 380 [units]	1
		(ii) $\frac{10}{5}$ (1) = 2 [mm] (1) [$\frac{1}{5} = 0.2$ Award 1 mark only]	2
	(b)	(i) Big Bang	1
		(ii) Universe started at one point / singularity (1) [matter thrown out] by an <u>explosion</u> (1)	2
(c)	(i) Wavelength increasing / [spectral] lines or light shift to the red end (ii) How far away/ from us the galaxy is (1) how fast the galaxy is moving <u>away</u> (1) [moving away can be implied in part (i)]	2	
Question total			[9]

Physics 1 Higher Tier (Contd.)

Question		Marking details	Marks Available
4.	(a)	<p>Indicative content: The count rate due to background radiation needs to be determined first. This is 0.5 counts per second. The paper absorber reduces the count rate showing that alpha radiation must be emitted, since it will be blocked by paper. The aluminium absorber does not affect the count rate so beta radiation cannot be present. Thick lead reduces the count rate, but it still remains above the background level, showing that gamma radiation must also be emitted.</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
	(b)	<p>More harmful inside because alpha [particles](1) are more ionising / are unable to leave the body (1) or more harmful outside because gamma [rays] (1) can penetrate into the body (1) Any reference to beta only award 0 marks. The 2nd mark must be linked to the 1st mark.</p> <p>Question total</p>	2
			[8]

Physics 1 Higher Tier (Contd.)

Question		Marking details	Marks Available	
5.	(a)	$P = V \times I$ (1) $190 \times 10^6 = V \times 400$ sub / manip (1) MW conversion $V = 475\,000$ [V] (1) [0.475 or 475 Award 2 marks]	3	
	(b)	[Large V] gives low I (1) So less heat / energy / power losses / more efficient (1) The 2nd mark must be linked to the 1st mark.	2	
	(c)	Steps down / decreases <u>voltage</u>	1	
	(d)	(i)	Lagging of pipe / insulation (1) makes the external surface temperature lower / it reduces the effect of air being heated by the pipe (1) The 2nd mark must be linked to the 1st mark.	2
		(ii)	Shiny surface / painted in a light colour (1) so less heat emitted [from outer surface] / heat reflected off the [inner surface] (1) The 2nd mark must be linked to the 1st mark.	2
		Question total	[10]	
6.	(a)	<p>Indicative content:</p> <p>The advantages of nuclear are it produces no air pollution and it produces a high power output from steady and reliable sources. The advantages of gas are the supply is piped and it produces no solid waste alongside it does not contribute to acid rain. The disadvantages of nuclear are the disposal of the radioactive waste and the possibility of radioactive leaks from natural disasters occurring. Acts of terrorism are also a potential threat and the decommissioning process is long and costly. The disadvantages of gas are the supply of gas is insecure and limited and burning the gas causes air pollution.</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6	
	(b)	$\text{Output energy} = 34$ [MJ] (1) $\text{Efficiency} = \frac{34}{120} \times 100\%$ (sub) (1) $= 28.3\%$ / 28% (1)	3	
		Question total	[9]	

Physics 1 Higher Tier (Contd.)

Question		Marking details	Marks Available	
7.	(a)	$v = f \lambda$ $v = 4 \times 10^{14} \times 5 \times 10^{-7}$ $v = 2 \times 10^8 \text{ [m/ s]}$ $t = \frac{4.5 \times 10^5}{2 \times 10^8} \text{ ecf for } v$ $t = 2.25 \times 10^{-3} \text{ [s]}$	Substitution (1) Answer (1) Manipulation(1) Answer (1)	4
	(b)	(i) $v = \frac{d}{t}$ $d = \frac{3 \times 10^8 \times 0.24}{2} = 3.6 \times 10^7 \text{ [m]}$	Substitution (1) Use of 2 (or 0.5) (1) Answer (1)	3
		(ii) Satellite needs to be above a fixed point on the Earth (1) so satellite dishes do not have to be moved (1) The 2nd mark must be linked to the 1st mark.		2
	(c)	Much less time taken or quicker or faster by the optical fibre / not affected by the weather		1
		Question total		[10]

PHYSICS 2
FOUNDATION TIER

Question		Marking details	Marks Available	
1.	(a)	Isotope	1	
	(b)	4	1	
	(c)	[Very] high temperatures are reached [inside the vessel] (1) [Very] high pressure [inside vessel] (1)	2	
		Question total	[4]	
2.	(a)	$P = 230 \times (10 (1)) = 2300 (1) \text{ W[atts]} (1)$ accept 2.3 kW	3	
	(b)	32 A	1	
	(c)	230 [V]	1	
		Question total	[5]	
3.	(a)	The line is not straight	1	
	(b)	Any 2 marks from 3: [Overall] stopping distance reduced / 20 [m] / 10 [m] (1) OR halved (2 marks)	2	
	(c)	(i)	Overall stopping distance = 100 [m] (1) Speed = 30 [m/s] (1). (Allow ecf from stopping distance)	2
		(ii)	Mobile phone (1), drunk driver (1)	2
		Question total	[7]	

Physics 2 Foundation Tier (Contd.)

Question		Marking details	Marks Available
4.	(a)	$\frac{50000}{20}$ (substitution (1)) = 2 500 [m/s] (1)	2
	(b)	EITHER: Every object continues its motion in a straight line (1) unless acted upon by an (external) force (1) OR There is no air resistance / friction / gravity [in space] (1), so no force is needed to equal / overcome it (1) The 2nd mark must be linked to the 1st mark.	2
	(c)	Speed increases / force is produced (1) momentum = mass x speed / which causes a change in momentum (1) OR momentum given to burnt fuel (1) = momentum supplied to rocket (1) The 2nd mark must be linked to the 1st mark.	2
	(d)	$F = \frac{360000 - 200000}{8} =$ (substitution (1)) = 20 000 [N] (1)	2
Question total			[8]

Physics 2 Foundation Tier (Contd.)

Question			Marking details	Marks Available
5.	(a)		Imbalance between numbers of protons and neutrons	1
	(b)	(i)	5 [hours]	1
		(ii)	50 [counts per minute]	1
		(iii)	Yes (1), short [enough] half life [so decays from the body in a few days] (1) and [gamma emitter] so it can escape the body [for detection] (1)	3
	Question total			[6]
6.	(a)		0.6 A	1
	(b)		Symbol in parallel with the lamp (1) circle with V in anywhere (1)	2
	(c)		Answer = 15 [Ω]	1
	(i)	(i)	Increases	1
		(ii)	Decreases / halves	1
Question total			[6]	
7.			<p>Indicative content:</p> <p>The absorption of slow neutrons can induce fission of Uranium-235 nuclei, releasing energy and the emission of neutrons from such fission can lead to a sustainable chain reaction. The moderator slows down the neutrons for fission to occur. The control rods control the rate of fission by absorbing a proportion of the neutrons.</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p>	6

Physics 2 Foundation Tier (Contd.)

Question		Marking details	Marks Available
7.		<p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p> <p>Question Total</p>	[6]
8.	(a) (b) (c)	<p>[High energy] / [fast moving] electron</p> <p>Beta absorbed / can't get out of the body (1) so damages / ionises cells (1) The 2nd mark must be linked to the 1st mark.</p> <p>Both nuclei contain the same number of (53) protons / proton number (1) different numbers of neutrons / mass number / nucleon number (1) 78 neutrons in I-131 & 74 in I-127 / difference of 4 neutrons (1)</p> <p>Question Total</p>	1 2 3 [6]
9.	(a) (b) (i) (ii) (iii) (c) (i) (ii) (d)	<p>0.2 [s]</p> <p>Line is steepest</p> <p>$a = \frac{8(1)}{(2 - 0.2)(1)}$ allow ecf from (a) = [4.44] (1) m/s² (1)</p> <p>Subs 4.44 x 94 (1) = 417.36 (accept 417 - 418) [N] (1) Allow ecf from (b)(ii)</p> <p>C to D because longest time (1) at highest velocity (1) OR area under graph (1) with the term "is greatest" or equivalent (1) The 2nd mark must be linked to the 1st mark.</p> <p>Straight line from D to axis (1) final coordinate (12.5, 0) (1) Allow $\pm \frac{1}{2}$ square.</p> <p>Question Total</p>	1 1 3 2 1 2 2 [12]
		Foundation Tier Total	60

PHYSICS 2

HIGHER TIER

Question		Marking details	Marks Available
1.	(a)	<p>Indicative content:</p> <p>The absorption of slow neutrons can induce fission of Uranium-235 nuclei, releasing energy and the emission of neutrons from such fission can lead to a sustainable chain reaction. The moderator slows down the neutrons for fission to occur. The control rods control the rate of fission by absorbing a proportion of the neutrons</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p>	6
	(b)	<p>97 added to Kr, 56 added to Ba</p> <p>Question total</p>	2 [8]
2.	(a)	(i) [High energy] / [fast moving] electron	1
		(ii) ${}^0_{-1}\beta$ or ${}^0_{-1}e$	1
	(b)	(i) Beta absorbed / can't get out of the body (1) so damages / ionises cells (1) The 2nd mark must be linked to the 1st mark.	2
		(ii) Both nuclei contain the same number of (53) protons / proton number (1) different numbers of neutrons / mass number / nucleon number (1) 78 neutrons in I-131 & 74 in I-127 / difference of 4 neutrons (1)	3
(c)	Calculation of number of half lives -5 (1) x 8 (1)	2	
		Question total	[9]

Physics 2 Higher Tier (Contd.)

Question		Marking details	Marks Available	
3.	(a)	0.2 [s]	1	
	(b)	(i)	Line is steepest	1
		(ii)	$a = \frac{8(1)}{(2-0.2)(1)}$ allow ecf from (a) = [4.44] m/s ² (1)	3
		(iii)	Subs 4.44 x 94 (1) = 417.36 (accept 417 - 418) [N] (1) Allow ecf from (b)(ii)	2
	(c)	(i)	C to D	1
		(ii)	because longest time (1) at highest velocity (1) OR area under graph (1) with the term “is greatest” or equivalent (1) The 2nd mark must be linked to the 1st mark.	2
	(d)	Straight line from D to axis (1) final coordinate (12.5, 0) (1) Allow $\pm \frac{1}{2}$ square.	2	
	(e)	(i)	Calculation of area under BC – 30.75/30.8 [m] (1); calculation of area under CD – 62.5 [m]; (1) total = 93.3 [m] (1) OR area under AB = 7.2 (1) and 100 (1) – 7.2 = 92.8 [m] (1) Any attempt at area calculation = 1 mark only.	3
		(ii)	$\frac{(d)(i)(ecf)}{8}$ (1) = 11.66 - 11.8 [m/s] (1)	2
	Question Total			[17]
4.	(a)	(i)	750 [N]	1
		(ii)	Calculation of resultant force: 750 (ecf) – 300 = 450 [N] (1) $\frac{450}{75} = 6$ [m/s ²] (1)	2
(b)	<p>Indicative content: During free fall, sky diver acted on by 2 forces; these are weight and air resistance; the weight remains constant throughout the fall; the air resistance increase with speed; eventually the air resistance becomes equal to the weight; the resultant force is zero; the skydiver stops accelerating.</p> <p>5 – 6 marks The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3 – 4 marks The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p>		6	

Physics 2 Higher Tier (Contd.)

Question		Marking details	Marks Available
4.		<p>1 – 2 marks The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.</p> <p>Question total</p>	[9]
5.	(a)	<p>Calculation of braking distance: Calculation of KE: use of $\frac{1}{2}mv^2$; (1) subs $\frac{1}{2} \times 1000 \times 18^2$; (1) answer of 162 000 [J]; use of $WD = F \times s$; (1) answer for s of 24 [m]; (1) Alternatively, accept this method: First step find deceleration: use of $a = \frac{F}{m}$ (1), subs $\frac{6750}{1000} = 6.75$ [m/s²]; (1) Now braking time: braking time = $\frac{18.6}{6.75} = 2.67/2.7$ [s]; (1) braking distance = mean speed x time = $9 \times 2.67 = 24$ [m]; (1) So overall stopping distance = 24 (ecf) + 12 = 36 [m] (1)</p>	5
	(b)	<p>Thinking distance halves / 6 [m]; (1) braking distance decreases to a quarter / 6 [m]; (1) overall stopping distance of 12 [m] is less than 15 [m] view of the school (1)</p> <p>Question total</p>	3
		Question total	[8]

Physics 2 Higher Tier (Contd.)

Question		Marking details	Marks Available	
6.	(a)	Same voltage across each (Accept can be switched separately)	1	
	(b)	(i)	Use of $P=VI$; (1) Method 1 : calculation of current through quantity of each type of lamp: 0.05 x 20, 0.08 x 6, 0.22 x 6 (1) for currents and (1) for multiples; Answer of 2.8 [A] gains 3 marks. Alternatively: total power = ((20 x 11) + (6 x 50) + (6 x 18))= 628 [W] (1); Current = $\frac{628}{230} = 2.73$ or 2.80 [A] (1)	3
		(ii)	Use of $P=I^2R$; (1) $19 = 2.7^2 \times R$; (1 mark – substitution, 1 mark – manipulation) $R = [2.6 \Omega]$ (answer of $83 \Omega = 2$ marks)	3
	(c)	Use of $P=I^2R$ (no credit); $50=0.048$ (ecf) x R (1) so $R = 1040 [\Omega]$ (1)	2	
Question total			[9]	
Higher Paper Total			60	



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