

Mark Scheme November 2007

IGCSE

IGCSE Physics (4420)

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November 2007

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PHYSICS 4420, November 2007, MARK SCHEME

Key

- / indicates alternatives
 eq allow for correct equivalent
 — word underlined means no alternatives allowed

Paper 1F

Question Number	Question		
1	(a)		
	Acceptable Answers	Reject	Mark
	red (1) violet (1) Notes (red) at the top at the bottom accept 'purple' or 'mauve'		(2)

Question Number	Question		
1	(b)		
	Acceptable Answers	Reject	Mark
	(i) decreases (1) (ii) increases (1) (iii) stays the same (1) Notes allow any clear indication		(3)

Total 5 marks

Question Number	Question		
2	(a)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • (electric) fire • (electric) toaster • soldering iron • hair drier • etc. <p>Notes accept any example which is clear and correct</p>	(electric) heater lamp TV	(2)

Question Number	Question		
2	(b)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • earthing/earth wire/green and yellow wire • insulation • double insulation • circuit breakers 	'fuses'	(2)

Question Number	Question		
2	(c)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • (electric) shock • (electric) burn • water is a conductor • electricity passes through you to earth 		(2)

Question Number	Question		
2	(d)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • (electric) shock • (electric) burn • metal/screwdriver is a conductor • electricity passes through you to earth Notes credit should be given even if the same point(s) has/have been credited in part (c)		(2)

Total 8 marks

Question Number	Question		
3	(a)		
	Acceptable Answers	Reject	Mark
	heat (1) sound (1) Notes either order accept 'noise' or 'vibration'		(2)

Question Number	Question		
3	(b)		
	Acceptable Answers	Reject	Mark
	useful Notes accept if meaning clear e.g. 'functional'		(1)

Question Number	Question		
3	(c)		
	Acceptable Answers	Reject	Mark
	(i) chemical (energy) (1) (ii) nuclear/atomic (energy) (1) Notes (ii) accept 'fission' (energy)		(2)

Question Number	Question		
3	(d)		
	Acceptable Answers	Reject	Mark
	<p>(i) bow (and arrow) / cross bow / catapult / (stretched/wound up) spring / etc (1)</p> <p>(ii) water behind a dam / counterweight / drop hammer / pile driver / etc (1)</p> <p>Notes (i) & (ii) accept any clear and correct response</p>		(2)

Total 7 marks

Question Number	Question		
4	(a)		
	Acceptable Answers	Reject	Mark
	<p>(i) 3 ½ / 3.50 / 3.5 / 3.30 hours (1)</p> <p>Notes allow '210 minutes' if correct unit given</p> <p>(ii) half an hour / ½ / 0.5 / 0.50 / 0.30 (1)</p> <p>Notes allow '30 minutes' if correct unit given</p> <p>(iii) 45 (kilometres) (1)</p> <p>(iv) graph/line/slope (1) steeper/greater (1)</p>	3.3	(5)

Question Number	Question		
4	(b)		
	Acceptable Answers	Reject	Mark
	(i) (average) speed = distance (moved) ÷ time (taken) (1) Notes or any correctly transposed version (ii) metres per second (1) Notes or m/s	'mps'	(2)

Total 7 marks

Question Number	Question		
5	(a)		
	Acceptable Answers	Reject	Mark
	(i) equally in all directions (1) (ii) equally in all directions (1) Notes (i) & (ii) allow any clear indication		(2)

Question Number	Question		
5	(b)		
	Acceptable Answers	Reject	Mark
	pressure = force ÷ area Notes or any correctly transposed version		(1)

Question Number	Question		
5	(c)		
	Acceptable Answers	Reject	Mark
	square metre / metre square / accept any measure of area (1) m ² (1) pascal / any measure of pressure (1) Pa (1)		(4)

Question Number	Question		
5	(d)		
	Acceptable Answers	Reject	Mark
	<p><u>area</u> in contact with/ touching the floor is less (1) (same) <u>force</u> acts on this area (1)</p> <p><i>or <u>force</u> remains the same</i> <i>or <u>force</u> due to weight (of student and chair)</i></p> <p>(so) <u>pressure</u> (on floor) increase (1)</p> <p><i>or</i> <i><u>force</u> acting on each leg increases from $w \div 4$ to $w \div 2$</i> <i>(and) <u>area</u> in contact with the floor is less</i> <i>(so) <u>pressure</u> (on the floor) increases</i></p> <p>Notes underlined word must be used correctly in the correct context to gain credit</p>		(3)

Total 10 marks

Question Number	Question		
6	(a)		
	Acceptable Answers	Reject	Mark
	<p>(i) time (1)</p> <p>(ii) isotopes (1)</p>		(2)

Question Number	Question		
6	(b)		
	Acceptable Answers	Reject	Mark
	<p>(i) 50 (years) (1)</p> <p>(ii) October 2057 (1) ecf</p> <p>Notes both month and year required</p> <p>(iii) Bq (1)</p> <p>Notes must be correct in every detail</p>		(3)

Question Number	Question	
6	(c)	
	Acceptable Answers	Reject
	tracers (1) specimens (1) radiotherapy (1) allow 'tracers' if not previously offered Notes must be in correct order	
		(3)

Total 8 marks

Question Number	Question	
7	(a)	
	Acceptable Answers	Reject
	(magnetic) field	
		(1)

Question Number	Question	
7	(b)	
	Acceptable Answers	Reject
	(i) N at the left end and S at the right end (1) (ii) near horizontal lines between the faces (1) at least three and at least one marked with arrow from N to S no ecf (1)	any contradiction e.g. lines crossing negates this mark any contradiction negates this mark
		(3)

Question Number	Question	
7	(c)	
	Acceptable Answers	Reject
	steel	
	Notes accept any clear indication	
		(1)

Total 5 marks

Question Number	Question		
8			
	Acceptable Answers	Reject	Mark
	plastics (1) friction (1) electrons (1) electrons (1) attraction (1)		(5)

Total 5 marks

Question Number	Question		
9	(a)		
	Acceptable Answers	Reject	Mark
	(directly) proportional		(1)

Question Number	Question		
9	(b)		
	Acceptable Answers	Reject	Mark
	(i) tension / weight / gravitational force (1) (ii) 2.5 (N) (1) (iii) 4.0 - 5.0 (1)		(3)

Question Number	Question		
9	(c)		
	Acceptable Answers	Reject	Mark
	(i) A (1) (ii) B (1) (iii) large extension for small increase in force (1)		(3)

Total 7 marks

Question Number	Question		
10	(a)		
	Acceptable Answers	Reject	Mark
	(i) decreases (1) (ii) increases (1) Notes (ii) e.c.f		(2)

Question Number	Question		
10	(b)		
	Acceptable Answers	Reject	Mark
	(i) $V = I \times R$ (1) (ii) Increases (1) not dop no ecf (iii) R (almost) same (1) I bigger (1) Notes (iii) potential divider idea can score 2		(4)

Question Number	Question		
10	(c)		
	Acceptable Answers	Reject	Mark
	voltmeter connected in parallel across buzzer or R.		(1)

Total 7 marks

Question Number	Question		
11	(a)		
	Acceptable Answers	Reject	Mark
	(i) number of cycles (or waves) in unit time (1) (ii) time for one cycle (period) (1)		(2)

Question Number	Question		
11	(b)		
	Acceptable Answers	Reject	Mark
	(i) $72 / 60 = 1.2$ (Hz) (1) (ii) $1 / 1.2 = 0.833$ (s) (1) ecf		(2)

Question Number	Question		
11	(c)		
	Acceptable Answers	Reject	Mark
	(i) points plotted (2), curve (1) blobs (-1) (ii) off the graph (1)		(4)

Total 8 marks

Question Number	Question		
12	(a)		
	Acceptable Answers	Reject	Mark
	(i) proton number (1) (ii) number of protons and neutrons (1) (iii) same number of protons / different number of neutrons (1)		(3)

Question Number	Question		
12	(b)		
	Acceptable Answers	Reject	Mark
	(i) 11 (1) (ii) 12 (1) (iii) 11 (1)		(3)

Question Number	Question		
12	(c)		
	Acceptable Answers	Reject	Mark
	gamma	gamma particle	(1)

Question Number	Question		
12	(d)		
	Acceptable Answers	Reject	Mark
	mutations, cancer, damage tissue, cells, waste problems allow deforming		(1)

Total 8 marks

Question Number	Question		
13	(a)		
	Acceptable Answers	Reject	Mark
	not close-packed Notes regular arrangement		(1)

Question Number	Question		
13	(b)		
	Acceptable Answers	Reject	Mark
	(i) particles leave (surface) (1) (ii) move around freely (1) far apart (1)		(3)

Total 4 marks

Question Number	Question		
14	(a)		
	Acceptable Answers	Reject	Mark
	shape of lines (1) correct direction (1) at least three lines (1) dop Notes on at least one line		(3)

Question Number	Question		
14	(b)		
	Acceptable Answers	Reject	Mark
	(i) (soft) iron (1) (ii) soft magnetic material easy to magnetise easy to demagnetise (2) Notes		(3)

Total 6 marks

Question Number	Question		
15	(a)		
	Acceptable Answers	Reject	Mark
	(i) recall formula (1) 40 x (36/12) (1) = 120 (V) (1) (ii) a.c. (1) Notes		(4)

Question Number	Question		
15	(b)		
	Acceptable Answers	Reject	Mark
	D left U right Notes		(1)

Total 5 marks

Total for the paper 100 marks

Paper 2H

Question Number	Question		
1	(a)		
	Acceptable Answers	Reject	Mark
	(directly) proportional		(1)

Question Number	Question		
1	(b)		
	Acceptable Answers	Reject	Mark
	(i) tension / weight / gravitational force (1)		(3)
	(ii) 2.5 (N) (1)		
	(iii) 4.0 - 5.0 (1)		

Question Number	Question		
1	(c)		
	Acceptable Answers	Reject	Mark
	(i) A (1)		(3)
	(ii) B (1)		
	(iii) large extension for small increase in force (1)		

Total 7 marks

Question Number	Question		
2	(a)		
	Acceptable Answers	Reject	Mark
	(i) decreases (1)		(2)
	(ii) increases (1)		
	Notes (ii) e.c.f		

Question Number	Question		
2	(b)		
	Acceptable Answers	Reject	Mark
	(i) $V = I \times R$ (1) (ii) Increases (1) not dop no ecf (iii) R same (1) I bigger (1) Notes (iii) potential divider idea can score 2		(4)

Question Number	Question		
2	(c)		
	Acceptable Answers	Reject	Mark
	voltmeter connected in parallel across buzzer or R		(1)

Total 7 marks

Question Number	Question		
3	(a)		
	Acceptable Answers	Reject	Mark
	(i) number of cycles (or waves) in unit time (1) (ii) time for one cycle (period) (1)		(2)

Question Number	Question		
3	(b)		
	Acceptable Answers	Reject	Mark
	(i) $72 / 60 = 1.2$ (Hz) (1) (ii) $1 / 1.2 = 0.833$ (s) (1)		(2)

Question Number	Question		
3	(c)		
	Acceptable Answers	Reject	Mark
	(i) points plotted (2), curve (1) blobs(-1) (ii) off the graph (1)		(4)

Total 8 marks

Question Number	Question		
4	(a)		
	Acceptable Answers	Reject	Mark
	(i) proton number (1) (ii) number of protons and neutrons (1) (iii) same number of protons different number of neutrons (1)		(3)

Question Number	Question		
4	(b)		
	Acceptable Answers	Reject	Mark
	(i) 11 (1) (ii) 12 (1) (iii) 11 (1)		(3)

Question Number	Question		
4	(c)		
	Acceptable Answers	Reject	Mark
	gamma	Gamma particles	(1)

Question Number	Question		
4	(d)		
	Acceptable Answers	Reject	Mark
	mutations, cancer, damage tissue, cells, waste problems allow deforming Notes		(1)

Total 8 marks

Question Number	Question		
5	(a)		
	Acceptable Answers	Reject	Mark
	not close-packed		
	Notes regular arrangement		(1)

Question Number	Question		
5	(b)		
	Acceptable Answers	Reject	Mark
	(i) particles leave (surface) (1)		
	(ii) move around freely (1) far apart (1)		(3)

Total 4 marks

Question Number	Question		
6	(a)		
	Acceptable Answers	Reject	Mark
	shape of lines (1) correct direction (1) at least three lines (1)		
	Notes on at least one line		(3)

Question Number	Question		
6	(b)		
	Acceptable Answers	Reject	Mark
	(i) (soft) iron (1)		
	(ii) soft magnetic material easy to magnetise easy to demagnetise (2)		(3)

Total 6 marks

Question Number	Question		
7	(a)		
	Acceptable Answers	Reject	Mark
	(i) recall formula (1) 40 x (36/12) (1) = 120 (V) (1)		
	(ii) a.c. (1)		(4)

Question Number	Question		
7	(b)		
	Acceptable Answers	Reject	Mark
	D left U right		(1)

Total 5 marks

Question Number	Question		
8			
	Acceptable Answers	Reject	Mark
	acceleration (1) force (1) velocity (1)		
	Notes accept any clear indication	deduct (1) for each ticked after three until a minimum total of zero	(3)

Total 3 marks

Question Number	Question		
9	(a)		
	Acceptable Answers	Reject	Mark
	voltage / potential difference / pd (1) charge (1)		
	.		(2)

Question Number	Question		
9	(b)		
	Acceptable Answers	Reject	Mark
	charge (1) current (1)		
			(2)

Total 4 marks

Question Number	Question		
10	(a)		
	Acceptable Answers	Reject	Mark
	(cathode ray) oscilloscope Notes or CRO		(1)

Question Number	Question		
10	(b)		
	Acceptable Answers	Reject	Mark
	(i) twice the amplitude (1) (ii) is quieter / has less energy (1) Notes		(2)

Question Number	Question		
10	(c)		
	Acceptable Answers	Reject	Mark
	the frequency (of the vibration of the source)		(1)

Total 4 marks

Question Number	Question		
11	(a)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • establish/reliable technology • (still) large reserves of coal • coal available in many parts of the world • the process(es) (mining/ transportation/ generation) employ(s) large numbers of people Notes these are just examples accept any clear and correct advantage(s) other than cost n.b. two points may be combined to give a (2) mark answer		(2)

Question Number	Question		
11	(b)		
	Acceptable Answers	Reject	Mark
	any two of <ul style="list-style-type: none"> • uses a non-renewable (energy) resource • uses a resource which might be put to a better purpose (in the future) • results in (atmospheric) pollution • causes acid rain • (may) enhance greenhouse effect • (may) cause global warming • results in large quantities of (solid) waste • (some) waste is (slightly) radioactive <p>Notes these are just examples accept any clear and correct disadvantage(s) other than cost</p> <p>n.b. two points may be combined to give a (2) mark answer</p>		(2)

Total 4 marks

Question Number	Question		
12	(a)		
	Acceptable Answers	Reject	Mark
	(i) weight down(wards) (1) 'or' (force of) gravity down(wards) (water) resistance / drag / friction up(ward) (1) 'or' in opposite direction (to the movement / motion) Notes - both force and direction for each either order (ii) (water) resistance / drag / friction increases (1) as speed/velocity increases (1) (depends on previous so do not credit unless first mark gained)		(4)

Question Number	Question		
12	(b)		
	Acceptable Answers	Reject	Mark
	1.25 (2) 'or' $F = ma$ (1) 'or' $a = 15 \div 12$ (1) m/s^2 or ms^{-2} (1)		(3)

Question Number	Question		
12	(c)		
	Acceptable Answers	Reject	Mark
	(i) down(wards) (1) at a steady speed (1) 'or' no acceleration / deceleration (2) 'or' constant velocity (2) (ii) zero/0(N) (1)		(3)

Total 10 marks

Question Number	Question		
13	(a)		
	Acceptable Answers	Reject	Mark
	1.5 (V)	do not credit just '9 ÷ 6'	(1)

Question Number	Question		
13	(b)		
	Acceptable Answers	Reject	Mark
	charge / electrons / ions		(1)

Question Number	Question		
13	(c)		
	Acceptable Answers	Reject	Mark
	19 440 (2) 'or' (energy =) $0.2 \times 9 \times 3 \times 60 \times 60$ (1) joules/J (1) note '5.4 J' is (2) 3240 J is (2) 324 J is (2)		(3)

Question Number	Question		
13	(d)		
	Acceptable Answers	Reject	Mark
	flow/movement of (free) electrons (1) from negative to positive (1) 'or' through lattice of ions / charged atoms		(2)

Question Number	Question		
13	(e)		
	Acceptable Answers	Reject	Mark
	direct current		(1)

Question Number	Question		
13	(f)		
	Acceptable Answers	Reject	Mark
	ANY TWO (1 each) mains supply is alternating current (1) 'or' mains is a.c. mains supply is at a (much) higher voltage / 230 V (1) supply from battery is limited/battery has to be replaced/recharged		(2)

Total 10 marks

Question Number	Question		
14	(a)		
	Acceptable Answers	Reject	Mark
	Communication / endoscope / decorative lighting / etc Notes accept any suitable use e.g. taking light from a central unit (to various outlets)		(1)

Question Number	Question		
14	(b)		
	Acceptable Answers	Reject	Mark
	(i) perpendicular at point of incidence (1) angle of incidence clearly shown as angle between incident ray and normal (1) Notes - angles of incidence and reflection must look fairly equal depends on previous mark. (ii) total internal reflection/ t.i.r. (1) (iii) angle of incidence is greater than the critical angle (1) Notes - or angle $i >$ angle c		(4)

Question Number	Question		
14	(c)		
	Acceptable Answers	Reject	Mark
	(i) sine critical angle = $1 \div$ refractive index (1) 'or' the converse 'or' $\sin c = 1/n$ (ii) 1.51 (3) 'or' or 1.508..... (2) 'or' $1 \div 0.67$ (1) 'or' other value calculated but given 'correctly' to two places of decimals (1) (d) total internal reflection occurs (1) angle of incidence = 45° (1) so critical angle $< 45^\circ$ (1)		(7)

Total 12 marks

Question Number	Question		
15	(a)		
	Acceptable Answers	Reject	Mark
	<p>(i) any three points (1) each</p> <ul style="list-style-type: none"> • high speed • random/erratic • frequent collisions (with each other) • translational <p>(ii) (very) large number/millions/billions of them (1) collide with/hit (1) walls of the container (1)</p>	just 'collisions'	(6)

Question Number	Question		
15	(b)		
	Acceptable Answers	Reject	Mark
	<p>(i) 100 (kPa) (2) 'or' (pressure) = $500 \times 1.2 \div 6$ (1)</p> <p>(ii) no change in temperature (1) no leaks/no loss of mass /no loss of weight (1)</p>		(4)

Total 10 marks

Question Number	Question		
16	(a)		
	Acceptable Answers	Reject	Mark
	<p>(i) (nuclear) fission (1)</p> <p>(ii) hit other uranium/ nuclei (1) neutrons emitted which go on to hit other nuclei and so on (1) Notes - or words to that effect but must convey the idea that the process goes on and on also depends on the previous mark</p> <p>(iii) kinetic energy (of the fission products) (1) 'or' kinetic energy of the (daughter) nuclei and neutrons Notes - allow 'heat' or 'thermal energy' or 'internal kinetic energy'</p> <p>(iv) alpha particle has positive charge (1) is repelled (by the positively charged nucleus) (1) (but) neutron has no charge (so it is not repelled) (1)</p>	any suggestion that the neutron is attracted	(7)

Question Number	Question		
16	(b)		
	Acceptable Answers	Reject	Mark
	<p>(i) any two of</p> <ul style="list-style-type: none"> • slows neutrons • neutron(s) more likely to hit/split nucleus/nuclei (of U235) • so the reactor works more efficiently <p>(ii) to control the speed/rate of the (fission) reaction (1) prevent overheating/reaction getting out of control / meltdown (1)</p>	<p>'.... of U238'</p> <p>just 'they are moved in and out'</p> <p>just 'control reaction'</p>	(4)

Total 11 marks

Question Number	Question		
17	(a)		
	Acceptable Answers	Reject	Mark
	(i) kinetic energy = $\frac{1}{2} \times m \times v^2$ 'or' correctly transposed version 'or' in words but do not accept '...velocity squared' for '... speed squared' (1) (ii) 11 (m/s) (2) or $v^2 = 26.62 \div 0.22$ or $v = \sqrt{121}$ (1)		(3)

Question Number	Question		
17	(b)		
	Acceptable Answers	Reject	Mark
	(i) gravitational/potential energy = mgh (1) 'or' in words (ii) 6.05 (m) (2) 'or' (max) height = $26.62 \div 4.4$ (1) (iii) any one of <ul style="list-style-type: none"> • ball went straight up • all the k.e. transferred as g.p.e. • energy transfer 100% efficient • no friction/(air) resistance/drag • no energy transferred as heat • no energy transferred as sound 		(4)

Total 7 marks
Total marks for paper 120

Paper 03

Question Number	Question		
1	(a)		
	Acceptable Answers	Reject	Mark
	(i) 13 - 14 (1) Notes Allow 11 (ii) 11 (1) (iii) 39 - 40 (1) (iv) vertically upwards (1) same length (1)		(5)

Question Number	Question		
1	(b)		
	Acceptable Answers	Reject	Mark
	(i) points plotted (2) blobs (-1) curve (1) (ii) 72 - 76 (1)		(4)

Question Number	Question		
1	(c)		
	Acceptable Answers	Reject	Mark
	<ul style="list-style-type: none"> • steps equal length (1) • only three (or four) possible directions (1) • can not go backwards over previous step (1) Notes ora		(3)

Total 12 marks

Question Number	Question		
2	(a)		
	Acceptable Answers	Reject	Mark
	water (spillage) near electrical connection		(1)

Question Number	Question		
2	(b)		
	Acceptable Answers	Reject	Mark
	(i) wavelengths not clearly defined, smudgy etc (1)		
	(ii) measure several wavelengths (1)		
	take average (1)		(3)

Question Number	Question		
2	(c)		
	Acceptable Answers	Reject	Mark
	(i) 29 - 30 (mm) (1)		
	(ii) 17 - 18 mm (1)		
	(iii) continue one line (1)		
	continue other line until they meet (1)		
	measure angle 26° - 28° (1)		
	Notes maximum of (2) if no lines shown		(2)

Question Number	Question		
2	(d)		
	Acceptable Answers	Reject	Mark
	(i) James (1) (ii) wavelength decreases with increase in change of direction (1) dop (iii) yes or no (1) reason (1) dop Notes (ii) varies inversely		(4)

Total 13 marks

Question Number	Question		
3	(a)		
	Acceptable Answers	Reject	Mark
	place rod in flame (1) place rod in water (1) note highest temperature of water / rise in temperature/ compare temperature readings (1) repeat for another part of flame (1)		(4)

Question Number	Question		
3	(b)		
	Acceptable Answers	Reject	Mark
	ANY FOUR amount of water in beaker (1) (initial) temperature of water (1) time of rod in flame (1) size of flame (1) same (metal) rod (1) Notes award if any seen in (a)		(4)

Question Number	Question		
3	(c)		
	Acceptable Answers	Reject	Mark
	(i) lagging, stirrer, stopwatch, measuring cylinder (1) (ii) gloves, pliers, tongs (1)		(2)

Question Number	Question		
3	(d)		
	Acceptable Answers	Reject	Mark
	54 - 28 (1) = 26 (1)		(2)

Total 12 marks

Question Number	Question		
4	(a)		
	Acceptable Answers	Reject	Mark
	(i) <i>correct connection of :</i> power supply to form any complete circuit (1) ammeter in series (1) variable resistor in series (1) both rods connected (1) <i>using correct symbols</i> (ii) arrows from + of power supply (1) arrows consistent throughout in circuit containing both rods (1) Notes ecf from first mark (iii) attract because currents in same direction (1) or not attract because currents in opposite directions		(7)

Question Number	Question		
4	(b)		
	Acceptable Answers	Reject	Mark
	(i) 15 - 16 mm (1) (ii) 3.4 - 3.5 A (1) (iii) Less than 16 mm (1) or less than value in (i) (iv) centre (of rod) (1) of rod (1) top rod remains horizontal / same extension in both springs (1)		(6)

Total 13 marks

Total marks for paper 50

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