Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **March 2019**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: • the specific content of the mark scheme or the generic level descriptors for the question • the specific skills defined in the mark scheme or in the generic level descriptors for the question • the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: • marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate • marks are awarded when candidates clearly demonstrate what they know and can do • marks are not deducted for errors • marks are not deducted for omissions • answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	Rate of change of speed OR change of speed / time OR $\Delta v / t$ OR $(v – u) / t$	B1
1(b)(i)	**1** Acceleration OR increasing speed OR going faster	B1
	2 Constant speed OR steady speed	B1
	3 Deceleration OR decreasing speed OR slowing down	B1
1(b)(ii)	**1** Total distance / total time OR 300 / 40	C1
	7.5 m / s	A1
	2 Change of distance / change of time OR (250 – 70) / (30 – 15) OR 180 / 15	C1
	12 m / s	A1

Question	Answer	Marks
2(a)	<u>Advantage</u>: No fossil fuel used OR No fuel costs OR No pollution of air / water OR No polluting gases OR is a renewable energy source OR doesn’t contribute to global warming / greenhouse effect	B1
	<u>Disadvantage</u>: Wind not always blowing OR causes noise pollution OR causes visual pollution OR is danger to wildlife OR is expensive to build	B1
2(b)(i)	**1** d = m / V in any form, symbols or words OR $24\,000 \times 1.3$	C1
	31 000 kg	A1
	2 KE = ½ mv^2 OR $½ \times 31\,200 \times 16^2$	C1
	4.0×10^6 J	A1

Question	Answer	Marks
2(b)(ii)	Speed of air not reduced to zero (in passing through turbine) OR some air passes through blade area without change of speed OR without hitting blades OR not all k.e. of air transfers to blades OR air retains some of its k.e. OR friction in bearings of blades	**B1**

Question	Answer	Marks
3(a)	Accelerate or increase speed OR Decelerate or decrease speed OR Change speed	**B1**
	Change direction OR causes rotation	**B1**
3(b)	Sensible scale stated	**B1**
	T vectors, labelled T or with arrow, both of same length, drawn at right angles (any orientation)	**B1**
	Triangle or parallelogram completed using candidate's T vectors	**B1**
	Correct orientation vector diagram with 360 N vector vertical	**B1**
	T value stated: 250 or 260 N	**B1**

Question	Answer	Marks
4(a)(i)	Vacuum OR nothing OR mercury vapour	**B1**
4(a)(ii)	$P = h\rho g$ in any form OR $(h =)\ P/\rho g$ OR $1.02 \times 10^5 / (13600 \times 10)$	**C1**
	0.75 m	**A1**

Question	Answer	Marks
4(a)(iii)	Same vertical height (of mercury)	**M1**
	Pressure due to column of liquid depends on vertical height OR in formula P = hρg, h is vertical height OR the pressure remains constant because ρ and g don't change, nor does h.	**A1**
4(b)	Air is present in the space labelled S OR above the mercury in the tube	**M1**
	This air exerts a (downward) pressure on the mercury	**A1**

Question	Answer	Marks
5(a)	0 °C and 100 °C	**B1**
5(b)(i)	**1** Has uniform / linear expansion OR Has equal expansion for each degree of temperature rise	**B1**
	2 Has <u>capillary</u> / <u>tube</u> of constant cross-sectional area / diameter / radius / bore / width / thickness	**B1**
5(b)(ii)	(Compared with thermometer B) A has a <u>capillary</u> / <u>tube</u> of greater cross-section / diameter / radius / width OR A contains a liquid with less expansion per degree / unit temp. rise OR A is longer than B OR A has a smaller bulb	**B1**
5(b)(iii)	(Compared with thermometer D) C (has capillary / tube that is) narrower / of smaller cross-section / thinner OR has a larger bulb OR bulb containing more liquid OR contains a liquid with greater expansion per degree / unit temp. rise OR contains alcohol instead of mercury	**B1**

Question	Answer	Marks
5(c)(i)	Diagram to show: Three wires labelled e.g. copper, iron, copper or with symbols for metals OR metal A, metal B, metal A	**B1**
	One junction between different metals	**B1**
	Connections to voltmeter / ammeter / galvanometer identified by V, A, G, mV, mA or arrow in a circle	**B1**
5(c)(ii)	Measurement of: a (very) high or (very) low temperature OR a rapidly varying temperature OR a high range of temperature If values given, more than 300 °C; less than –200 °C	**B1**

Question	Answer	Marks
6(a)	Convection	**B1**
6(b)(i)	(E =) $mc\Delta\theta$ OR $65 \times 720 \times 7$	**C1**
	3.3×10^5 (J)	**C1**
	P = E / t in any form OR (t=) E / P OR $3.3 \times 10^6 / 1.5 \times 10^3$	**C1**
	220 s	**A1**
6(b)(ii)	Two of: The heater warms walls, floor, ceiling, windows, furniture / objects. Thermal energy conducted through walls, floor, ceiling, windows (to exterior) Thermal energy used to raise temperature of air entering room via draughts / openings	**B2**

Question	Answer	Marks
7(a)	**1.** Solid to liquid	**B1**
	2. Liquid to gas / vapour	**B1**
7(b)	(Neighbouring) molecules of solid have (strong) forces of attraction between them OR Gas molecules have no / weak forces of attraction between them	**B1**
	Easier to increase separation of gas molecules (than solid molecules) (gas expands more easily so) gas molecules move farther apart	**B1**
7(c)	PV = constant OR $P_1V_1 = P_2V_2$ OR $0.012 \times 1.8 \times 10^6 = V_2 \times 1.0 \times 10^5$	**C1**
	$V_2 = 0.216\ m^3$ OR $0.22\ m^3$	**A1**
	(Volume of escaped gas = 0.22 – 0.012 =) 0.21 m^3	**B1**

Question	Answer	Marks
8(a)(i)	Wavefronts in the air: Parallel to each other	**B1**
	Make a larger angle with the boundary than wavefronts in ice and from top left to bottom right	**B1**
	At least one wavefront meets a wavefront in ice at the boundary	**B1**
8(a)(ii)	Arrows at right angles to wavefronts pointing away from boundary	**B1**
8(a)(iii)	Acute angle between any wavefront in ice and boundary marked *i* Acute angle between any wavefront in air and boundary marked *r*	**B1**
	OR In ice, normal at boundary and ray perpendicular to any wavefront both drawn. Angle between normal and ray in ice marked *i.* In air, normal at boundary and ray perpendicular to any wavefront both drawn. Angle between normal and ray in air marked *r.*	**(B1)**

Question	Answer	Marks
8(b)	n = speed in air / speed in ice OR $n = V_{AIR} / V_{ICE}$ OR $(V_{ICE}) = V_{AIR} / n$ OR $3.0 \times 10^8 / 1.3$	C1
	2.3×10^8 m / s	A1

Question	Answer	Marks
9(a)	I = V / R in any form OR (R=) V / I OR 7.0 / 4.6	C1
	1.5 Ω	A1
9(b)	Resistor: resistance is constant	B1
	Thermistor: resistance decreases	B1
9(c)(i)	4.6 + 4.6	C1
	9.2 A	A1
	OR Combined resistance = $(1.52^2 / (1.52 + 1.52) =)$ 0.76 Ω	(C1)
	(I =) 7.0 / 0.76 = 9.2 A	(A1)
9(c)(ii)	(E =) IVt OR in words OR $9.2 \times 7 \times 5 \times 60$	C1
	19 000 J	A1

Question	Answer	Marks
10(a)	If voltage is (very) high, current is (very) low **NOT** if resistance is low	**B1**
	(If current is low,)thermal energy generated / power loss is low	**B1**
	(If current is low:) thinner / lighter / cheaper transmission cables / cables with less resistance / cheaper pylons can be used / cheaper	**B1**
10(b)(i)	$V_p / V_s = N_p / N_s$ in any form OR $(N_s =)\ N_p V_s / V_p$ OR $4000 \times 9 / 120$	**C1**
	$(N_s =)$ 300	**A1**
10(b)(ii)	Iron or soft iron	**B1**

Question	Answer	Marks
11(a)(i)	Nucleon number for Pt: 194	**B1**
	Proton number for Pt: 78	**B1**
	Symbol for beta particle: ${}^{0}_{-1}\beta$	**B1**
11(a)(ii)	After 1 half-life / 19 hrs, count rate = 1100 / 2 = 550 counts / min	**C1**
	After 2 half-lives / 38 hrs, count rate = 550 / 2 = 275 counts / min	**A1**
	OR 38 hrs = 2 half-lives	**(C1)**
	After 38 hrs / 2 half-lives, count rate = 1100 / 4 = 275 counts / min	**(A1)**

Question	Answer		Marks
11(b)	Two of:		B2
	<u>γ-emission</u>	<u>β-emission</u>	
	electromagnetic radiation / travels at the speed of light	particles / electrons	
	uncharged	(negatively) charged	
	no mass	has mass	
	long range in air	shorter range in air	
	stopped by many cm of lead / very penetrating	stopped by a few mm of aluminium	
	low ionisation (of air)	higher ionisation (of air)	
	leaves proton number unchanged	proton number changes	
	not deflected in electric / magnetic field	deflected in electric / magnetic field	