

MARKING KEY

DRAFT

PHYSICS

SECTION ONE: SHORT ANSWER

Question 1(a) Heat vs. temperature

Description	Mark
Heat is thermal or internal energy being transferred because of a difference in temperature.	1
Temperature is the average kinetic energy of the molecules that a substance is made of.	1

Question 1(b) Effects of heat

Description	Mark
NO	1
Temperature rise is determined by $Q = mc\Delta T$	1
Both m and c differ in this case.	1

Question 2 Kinetic energy

Description	Mark
E_p on roof = E_k at ground	1
$E_p = mg\Delta h$ $= (2 \text{ kg})(9.8 \text{ m s}^{-2})(4.5 \text{ m})$	1
$E_k = 88.2 \text{ J}$.	1

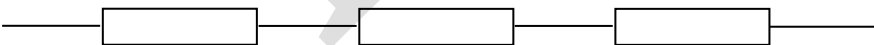
Question 3 Galaxy distance

Description	Mark
$v = \frac{s}{t}$	1
$s = v \cdot t = (3 \times 10^8)(3600 \times 24 \times 365) = 9.46 \times 10^{15} \text{ m}$.	1

Question 4 Lamps in a room

Description	Mark
All will be the correct brightness.	1
If one fails, the others keep working.	1

Question 5 Series resistors

Description	Mark
	1

Question 6
Nuclear equation

Description	Marks
${}^{10}_5\text{B} + {}^1_0\text{n} \rightarrow {}^4_2\alpha + {}^{11}_3\text{Li}$	1

Question 7
Resistance calculation

Description	Mark
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$	1
$\frac{1}{R_T} = \frac{1}{5} + \frac{1}{2} = \frac{7}{10}$	1
$R_T = \frac{10}{7} \Omega = 1.43 \Omega$	1

Question 8
Half-life

Description	Mark
$n^\circ \text{ of half lives} = \frac{\text{age of Earth}}{\text{half life}}$	1
$\frac{5 \times 10^9}{7 \times 10^8} = \text{about } 7 \text{ half lives}$	1

Question 9
Geiger counter

Description	Mark
Radiation spreads out from the source.	1
Beta radiation is absorbed (attenuated) by air.	1

Question 10(a)
Total energy radiated

Description	Mark
Energy radiated remains constant over one year $E = 10^{-9} \times 3600 \times 24 \times 365 = 0.0315 \text{ J}$	1

Question 10(b)
Absorbed dose

Description	Mark
$\text{absorbed dose} = \frac{\text{energy absorbed}}{\text{body mass}}$	1
$\text{absorbed dose} = \frac{0.031536 \text{ J}}{75 \text{ kg}} = 4.20 \times 10^{-4} \text{ J kg}^{-1}$	1

Question 11(a)**Volt definition**

Description	Mark
Volt.	1
The potential difference between two points is one volt if one joule of energy is needed to move one coulomb of charge from one point to the other.	1

Question 11(b)**Emf calculation**

Description	Mark
$\text{emf} = \frac{\text{energy}}{\text{charge}}$	1
$\text{emf} = \frac{15 \text{ J}}{2.5 \text{ C}} = 6.00 \text{ volt}.$	1

Question 12(a)**Reflective insulation**

Description	Mark
Silver surfaces reflect emr well.	1
This would insulate against radiant heat such as infrared.	1

Question 12(b)**Batt-type insulation**

Description	Mark
Glass is a poor thermal conductor	1
The trapped air is also a poor thermal conductor	1

Question 13(a)**Melting ice**

Description	Mark
Must convert mass into kilograms $m=0.360 \text{ kg}$	1
$Q = mL$	1
$Q = (0.36)(3.34 \times 10^5) = 1.20 \times 10^5 \text{ J}$	1

Question 13(b)**Energy transfer**

Description	Mark
INTO	1

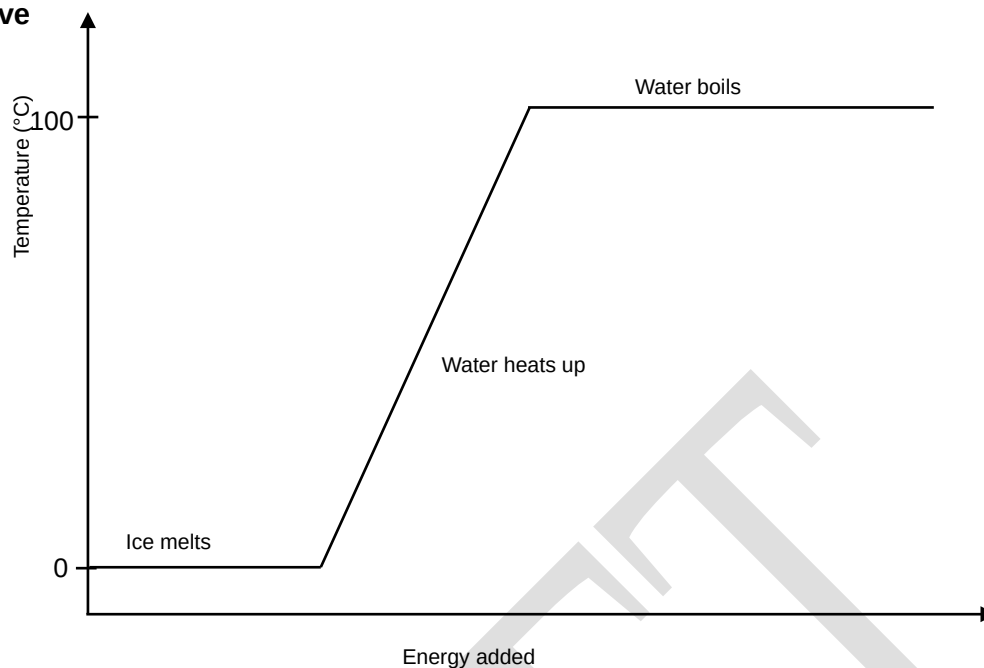
Question 14**Hypothesis test**

Description	Mark
B: Weighing the toast before and after it was on the plate.	1

Question 15**Water heaters**

Description	Mark
Heat spreads through water by convection	1
Convection works best when the heat source is at the base of the convection cell.	1

Question 16
Heating curve

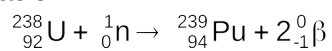


Description	Mark
Shape of graph	1
Melting section smaller than boiling section	1
Caption: Ice melts (or equivalent)	1
Caption: Water heats up (or equivalent)	1
Caption: Water boils (or equivalent)	1

Question 17
Properties of radiation

	ALPHA	BETA	GAMMA
Formula	${}^4_2\alpha$	${}^0_{-1}\beta$	${}^0_0\gamma$
Ability to ionise matter	High	Moderate	Low
Ability to penetrate matter	Low	Moderate	High

Description	Mark
Formula of beta is ${}^0_{-1}\beta$	1
Ionising ability of gamma is low	1
Penetrating ability of beta is moderate	1
Penetrating ability of gamma is high	1

Question 18**Write and balance a nuclear equation**

Description	Mark
Neutron included on left	1
Betas shown as products on right	1

Question 19**Density of water**

Description	Mark
C: 277 K	1

SECTION TWO: PROBLEM-SOLVING

Question 20(a) Maximum height

Description	Mark
At max height, $v = 0$	1
If direction of u (upwards) is positive, then g (downwards) is negative.	1
$v^2 = u^2 + 2gs$	1
$s = \frac{v^2 - u^2}{2g} = \frac{0 - 10.24}{2(-9.8)} = \frac{10.24}{19.6} = 0.522 \text{ m above Geraldine's hand.}$	1

Question 20(b) Final velocity

Description	Mark
$v^2 = u^2 + 2gs$	1
Since $s = 0$, $v^2 = u^2$ Thus, final velocity = 3.20 m s^{-1} downwards.	1

Question 20(c) Momentum explained

Description	Mark
Momentum is the product of an object's mass and its velocity.	1

Question 20(d) Momentum calculation

Description	Mark
$p = mv$	1
$p = (2.2 \text{ kg})(3.2 \text{ m s}^{-1})$	1
Momentum = 7.04 kg m s^{-1} .	1
Direction is upwards.	1

Question 21(a) Power output

Description	Mark
$P = VI$	1
$P = (250)(4.2) = 1050 \text{ W}$	1

Question 21(b) Energy transferred

Description	Mark
Must convert time taken = 10 minutes = 600 seconds	1
$P = \frac{\Delta E}{t}$	1
$\Delta E = Pt$	1
$E = (1050)(600) = 6.30 \times 10^5 \text{ J}$	1

Question 21(c)
Temperature rise

Description	Mark
$Q = mc\Delta T$	1
$\Delta T = \frac{Q}{mc}$	1
$\Delta T = \frac{6.3 \times 10^5}{(2)(4180)} = 75.4^\circ \text{C}$	1

Question 22(a)
Velocity from graph

Description	Mark
12 m s ⁻¹ .	1

Question 22(b)
Acceleration from graph

Description	Mark
gradient = $\frac{\text{rise}}{\text{run}}$	1
gradient = $\frac{10 - 0}{3 - 0} = 3.3$	1
Acceleration is 3.3 m s ⁻² .	1

Question 22(c)
Displacement from graph

Description	Mark
displacement from 0 to 4s = area of triangle = $\frac{1}{2}(\text{base} \times \text{height})$ = (0.5)(4)(12) m = 24 m	1
displacement from 4 to 10s = area of rectangle = (base x height) = (4)(12) m = 48 m	1
Total displacement = displacement (0 to 4s) + displacement (4 to 8s) Total displacement = 24 m + 48 m = 72 m.	1

Question 22(d)
Direction of travel

Description	Mark
No.	1

Question 23(a)
Bequerel

Description	Mark
1.03 x 10 ¹⁵ Bq	1

Question 23(b)(i)**Mass defect**

Description	Mark
Difference between the mass of a nucleus and the masses of its components.	1

Question 23(b)(ii)**Binding energy**

Description	Mark
Energy released when the components of a nucleus come together; OR energy needed to break up a nucleus into its components.	1

Question 23(b)(iii)**Relationship between mass defect and binding energy**

Description	Mark
Binding energy is the potential energy decrease when the parts of a nucleus come together.	1
Energy and mass are equivalent through the relationship $\Delta E = (\Delta m)c^2$.	1
Mass therefore decreases when the potential energy of a nucleus decreases.	1

Question 23(c)**Decay releases energy**

Description	Mark
Mass LHS = 31.973 907 u	1
Mass RHS = 31.972 071 + 0.000 549 u = 31.972 620 u	1
Mass LHS > mass RHS.	1
The 'lost' mass is replaced by energy.	1

Question 24(a)**Weight of lift**

Description	Mark
$F_w = mg$	1
weight = $(2000 \text{ kg})(9.8 \text{ m s}^{-2}) = 19.6 \text{ kN}$.	1

Question 24(b)**Tension when moving at constant speed**

Description	Mark
19.6 kN.	1

Question 24(c)**Free body diagram—moving**

Description	Mark
Upward force.	1
Downward force.	1
Same size (19.6 kN).	1

Question 25(a)
Resistance of hot lamp

Description	Mark
$P = \frac{V^2}{R}$	1
$R = \frac{V^2}{P} = \frac{240^2}{60}$	1
$R = 960 \, \Omega$.	1

Question 25(b)
Resistance of cold lamp

Description	Mark
$R_{\text{cold}} = \frac{R_{\text{hot}}}{10} = \frac{(\text{answer from 21a})}{10} = 96 \, \Omega$.	1

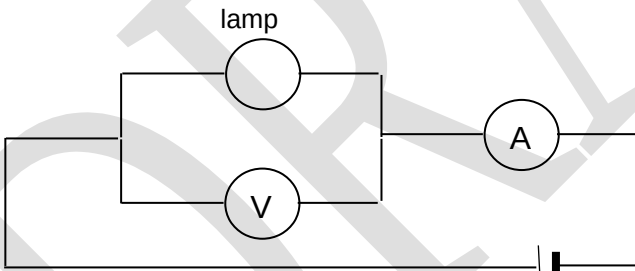
Question 25(c)
Ohmic vs non-ohmic conductors

Description	Mark
Resistance is constant in ohmic conductors.	1
Resistance changes with current (or temperature) in non-ohmic conductors.	1

Question 25(d)
Lamps

Description	Mark
No.	1

Question 25(e)
Measuring resistance

Description	Mark
	1
Turn on and allow the lamp to heat up.	1
Measure V and I.	1
Use Ohm's law to calculate resistance.	1

SECTION THREE: Comprehension section

Question 26(a)

Variables

Description	Mark
They measured: thinking time OR braking distance.	1
They controlled: [any two of] type of vehicle, daylight, condition of road, stimulus.	2

Question 26(b)

Experimental design

Description	Mark
This would reduce the uncertainty in their measurements.	1
By averaging out human errors by any one driver.	1

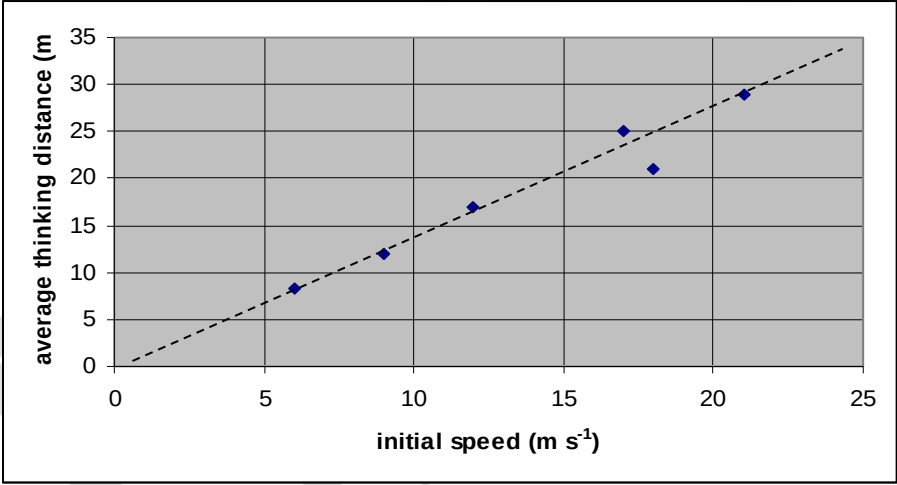
Question 26(c)

Error reduction

Description	Mark
Having trials for each driver at each speed reduces possible errors/uncertainties.	1
By allowing for people applying the brakes differently at different speeds (and so biasing the data).	1

Question 26(d)(i)

Line of best fit

Mark	Description
1	

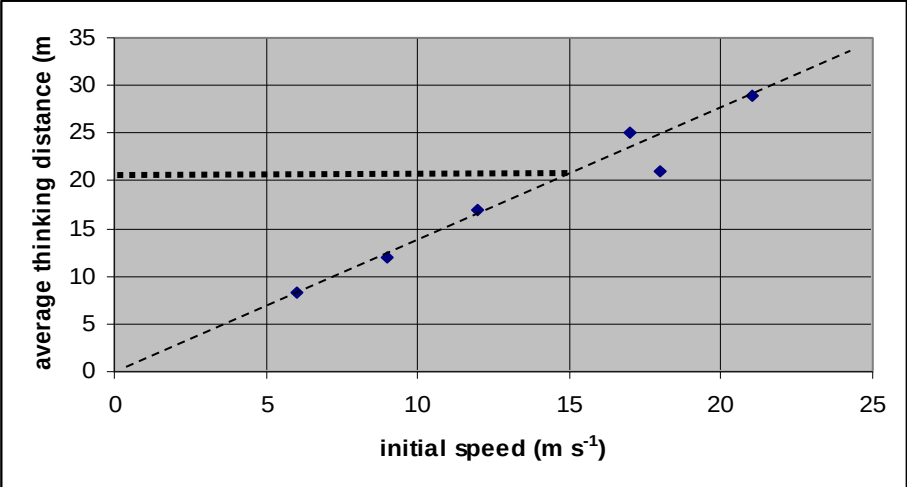
Question 26(d)(ii)

Thinking distance and initial speed

Description	Mark
Thinking distance increases regularly as the initial speed increases.	1

Question 26(d)(iii)

Thinking distance from graph

Mark	Description
1	About 20.5 m.
1	

Question 26(e)

Conclusion

Description	Mark
The distance required to stop increases as the initial speed increases.	1
The stopping distance increases faster than the initial speed increases.	1
There would probably be fewer accidents if people drove more slowly.	1

Physics Stage 2 exam

	2A				2B		
	Working in physics	Motion and forces	Nuclear physics		Working in physics	Heating and cooling	Electrical fundamentals
SECT A							
1						X	
2		X					
3		X					
4							X
5							X
6			X				
7							X
8			X				
9			X				
10			X				
11							X
12						X	
13						X	
14					X	X	
15						X	
16					X	X	
17			X				
18			X				
19	X						
SECT B							
20		X					
21						X	
22	X	X					
23			X	X			
24		X		X			
25				X			X
SECT C							
26	X	X					