

(ii) Calculate the temperature of the air when the pressure of the air in the balloon is 64 kPa.

Give your answer in kelvin.

(3)

temperature = K

(Total for Question 11 = 9 marks)

TOTAL FOR UNIT = 90 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Physics Unit 2 (Modular)
Mark Scheme

Question Number	Answer	Notes	Mark
1(a)	N on left pole and S on right pole;	allow north for N and south for S ignore attempt at labelling poles on far sides of magnets	1

Question Number	Answer	Notes	Mark
1(b)	idea that steel is a hard magnetic material;	allow steel keeps its magnetism/magnetic field allow steel is hard to demagnetise	1

Question Number	Answer	Notes	Mark
1(c)	any two from: MP1. (field) lines are straight; MP2. (field) lines are evenly spaced; MP3. (field) lines are parallel;	allow equivalent statements	2

Question Number	Answer	Notes	Mark
1(d)(i)	idea that wire cuts magnetic field lines;	allow wire passes through field lines ignore wire interacting with field lines	1

Question Number	Answer	Notes	Mark
1(d)(ii)	any two from: MP1. move wire faster; MP2. move magnets closer together; MP3. use stronger magnets; MP4. turn wire into a coil;	ignore "bigger" magnets ignore more turns on the coil	2

Question Number	Answer	Notes	Mark
2(a)(i)	idea that it decays very quickly / activity will be zero by the time it is injected / there will be no technetium-99m left;	ignore 'it has a short half-life'	1

Question Number	Answer	Notes	Mark
2(a)(ii)	any one from: <ul style="list-style-type: none"> idea that gamma can penetrate out of the body; idea that gamma can be detected outside the body; any one from: <ul style="list-style-type: none"> idea that half-life is long enough to complete the procedure; idea that activity will fall to safe level in a day / quickly; 	 marks must be from separate lists allow idea that technetium will not be in body for very long	2

Question Number	Answer	Notes	Mark
2(b)	harmful effect of gamma radiation given; idea that patient will have procedure very rarely / only when necessary (so risk is low); idea that doctor will administer procedure regularly (so risk is higher) / doctor limits time exposure to patient (to reduce risk);	e.g. <ul style="list-style-type: none"> cancer cell damage cell mutation allow suggestion that risk to patients is higher as they receive greater dose allow idea that doctor increases distance from patient (to reduce risk)	3

Question Number	Answer	Notes	Mark
3(a)	(nuclei with) the same number of protons; (but) different number of neutrons;	allow same atomic number / same element allow different nucleon / mass number / atomic mass	2

Question Number	Answer	Mark
3(b)	The only correct answer is A (82); <i>B is incorrect because this is the number of neutrons</i> <i>C is incorrect because this is the number of nucleons</i> <i>D is incorrect because this is double the proton number + nucleon number</i>	1

Question Number	Answer	Notes	Mark
3(c)(i)	evidence of 3 half-lives; correct evaluation; e.g. $240 \div 23 = 30$ $66 \div 3 = 22$ (years)	seen anywhere in working	2

Question Number	Answer	Notes	Mark
3(c)(ii)	correct atomic and mass numbers used for alpha particle; correct evaluation of number of beta particles; e.g. atomic number of alpha = 2, mass number = 4 (therefore) 2 beta decays (to get back to 82) ${}_{82}^{210}\text{Pb} \rightarrow {}_{82}^{206}\text{Pb} + {}_2^4\alpha + 2 {}_{-1}^0\beta$	seen anywhere in working	2

Question Number	Answer	Mark												
4(a)	<table border="1"> <thead> <tr> <th>Observation</th> <th>Supports the Big Bang theory</th> </tr> </thead> <tbody> <tr> <td>Black holes are formed from extremely massive stars</td> <td></td> </tr> <tr> <td>Cosmic microwave background radiation is seen in all directions</td> <td>✓</td> </tr> <tr> <td>Cosmic rays from space are detected at the Earth's surface</td> <td></td> </tr> <tr> <td>Each galaxy contains billions of stars</td> <td></td> </tr> <tr> <td>Most galaxies show a red-shift in the light detected from them</td> <td>✓</td> </tr> </tbody> </table> <p>1 mark for each correct tick; -1 for each additional tick if more than two ticks seen 5 ticks scores zero</p>	Observation	Supports the Big Bang theory	Black holes are formed from extremely massive stars		Cosmic microwave background radiation is seen in all directions	✓	Cosmic rays from space are detected at the Earth's surface		Each galaxy contains billions of stars		Most galaxies show a red-shift in the light detected from them	✓	2
Observation	Supports the Big Bang theory													
Black holes are formed from extremely massive stars														
Cosmic microwave background radiation is seen in all directions	✓													
Cosmic rays from space are detected at the Earth's surface														
Each galaxy contains billions of stars														
Most galaxies show a red-shift in the light detected from them	✓													

Question Number	Answer	Mark
4(b)	The only correct answer is B (decreases, increases); 1 <i>A is incorrect because a red giant is more powerful than a main sequence star</i> <i>C is incorrect because a red giant is cooler and more powerful than a main sequence star</i> <i>D is incorrect because a red giant is cooler than a main sequence star</i>	1

Question Number	Answer	Notes	Mark
4(c)	the brightness/luminosity (of an object); 2 idea of a standard distance;	allow 10 parsecs/32(.6) light years condone incorrect distance	2

Question Number	Answer	Notes	Mark
5(a)(i)	input power = output power; OR primary voltage × primary current = secondary voltage × secondary current;	allow <ul style="list-style-type: none"> • formula in words or symbols • standard abbreviations: i.e. s, p, in, out, 1, 2 	1

Question Number	Answer	Notes	Mark
5(a)(ii)	substitution; rearrangement; evaluation; e.g. $275\,000 \times I_p = 230 \times 95$ $(I_p =) 230 \times 95 / 275\,000$ $(I_p =) 0.079 \text{ (A)}$	-1 for POT error 79.45...(A) scores 2 marks allow 0.07945...	3

Question Number	Answer	Notes	Mark
5(b)	any five from: MP1. step-up transformer used before transmission; MP2. voltage is increased before transmission; MP3. current is reduced before transmission; MP4. less heating in transmission cables; MP5. less energy wasted in transmission cables; MP6. step-down transformer used after transmission; MP7. voltage is decreased after transmission for safety;	allow any mark if clear from diagram	5

Question Number	Answer	Mark
6(a)(i)	The only correct answer is C (white); <i>A is incorrect because its temperature is the second lowest</i> <i>B is incorrect because its temperature is the lowest</i> <i>D is incorrect because its temperature is the second highest</i>	1

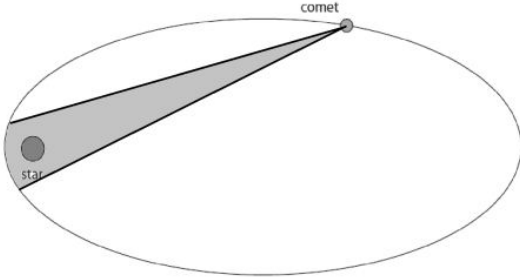
Question Number	Answer	Mark
6(a)(ii)	The only correct answer is C (supernova); <i>A is incorrect because the main sequence is not at the end of the stars life</i> <i>B is incorrect because a protostar is not at the end of the stars life</i> <i>D is incorrect because the star is too massive enough to form a white dwarf</i>	1

Question Number	Answer	Mark
6(b)(i)	(nuclear) fusion;	1

Question Number	Answer	Notes	Mark
6(b)(ii)	Sun becomes a red giant; (then) a white dwarf;	allow planetary nebula reject mention of supernova, neutron star or black hole for this mark	2

Question Number	Answer	Notes	Mark
6(c)(i)	(mass =) 5×10^{29} (kg);	Allow 5.3×10^{29} , 5.2×10^{29} , 5.25×10^{29} (kg)	1

Question Number	Answer	Notes	Mark
6(c)(ii)	evaluation of time; answer to 1 significant figure; e.g. (time = $5.25 \times 10^{29} / 9 \times 10^{19}$ =) 5.8×10^9 (years) (time =) 6×10^9 (years)	allow ecf from (c)(i) allow 5.56×10^9 (years) allow 6 000 000 000, 6 billion years	2

Question Number	Answer	Notes	Mark
6(d)	arrow pointing from the comet to the star; force labelled 'gravitational'; 	accept any arrow pointing from comet to star within shaded area ignore starting position of arrow allow 'gravity' or 'weight'	2

Question Number	Answer	Mark
7(a)	arrows drawn on sides WX and YZ one up, one down; 2 arrow on WX down, arrow on YZ up;	2

Question Number	Answer	Notes	Mark
7(b)	any four from: MP1. magnetic field around the wire; MP2. interaction between this field and the field from the magnet; MP3. (produces) a force on wire / coil; MP4. forces on opposite sides of the coil are in opposite directions; MP5. coil starts to rotate;	allow magnetic field overlap also scores MP3 allow coil rotates / turns / spins	4

Question Number	Answer	Notes	Mark
7(c)	force (on wire/coil) increases; (therefore) rotation speed is greater;	allow strong magnetic field around wire/coil allow coil spins faster	2

Question Number	Answer	Notes	Mark
8(a)	<p>any five from MP1-MP7:</p> <p>apparatus: MP1. method of creating thin beam of light; MP2. protractor;</p> <p>method: MP3. draw round the block; MP4. shine light into the block at an angle to the normal; MP5. mark incident and refracted rays; MP6. measure angles from the normal;</p> <p>MP7. repeat for different angles of incidence;</p> <p>PLUS</p> <p>MP8. graph of $\sin(i)$ and $\sin(r)$ with n found from gradient</p>	<p>allow marking points from diagram</p> <p>e.g. laser, ray box etc. ignore torch</p> <p>however expressed</p> <p>allow simple use of $n = \sin(i)/\sin(r)$</p>	6

Question Number	Answer	Mark
8(b)	optical fibres; named prismatic use e.g. cats eye reflector, binoculars, periscope etc;	2

Question Number	Answer	Mark
9(a)(i)	amplitude in the range of 0.8 – 0.9 (cm);	1

Question Number	Answer	Mark
9(a)(ii)	wavelength in the range 3.9 – 4.0 (cm);	1

Question Number	Answer	Notes	Mark
9(b)(i)	radio (waves);	allow radio frequency reject radioactive (waves), radiation (waves)	1

Question Number	Answer	Notes	Mark
9(b)(ii)	substitution; rearrangement; evaluation; e.g. $3.0 \times 10^8 = \text{frequency} \times 0.027$ (frequency =) $3.0 \times 10^8 / 0.027$ (frequency =) 1.1×10^{10} (Hz)	allow wavelength substitution in cm or m -1 if POT error allow $1.11\dots \times 10^{10}$ (Hz)	3

Question Number	Answer	Mark
9(c)(i)	68;	1

Question Number	Answer	Notes	Mark
9(c)(ii)	relationship is not inversely proportional; correct calculation of constant for one pair of readings correct calculation of constant for second pair of readings; statement to show meter reading \times distance is not constant;	allow conclusion is incorrect	4

The graph plots Meter readings in arbitrary units against Distance in cm. The y-axis ranges from 0 to 100 with major grid lines every 20 units and minor grid lines every 5 units. The x-axis ranges from 10 to 50 with major grid lines every 5 units and minor grid lines every 1 unit. A smooth curve is drawn through the following approximate data points:

Distance in cm	Meter readings in arbitrary units
10	100
15	60
20	40
25	25
30	15
35	10
40	7
45	5
50	4

Question Number	Answer	Notes	Mark
10(a)	<p>any five from:</p> <p>MP1. outlines a viable method;</p> <p>MP2. realistic values suggested for experiment to work;</p> <p>MP3. suitable measuring instrument named;</p> <p>MP4. further detail of setup;</p> <p>MP5. idea of repeats AND average;</p> <p>MP6. Correct formula for described method;</p>	<p>a fully labelled diagram can score all the marks</p> <p>e.g.</p> <ul style="list-style-type: none"> • measuring time for a known distance • measuring wavelength for a known frequency <p>e.g.</p> <ul style="list-style-type: none"> • at least 1m for microphones/sound sensors and oscilloscope/data logger method • at least 100m for seeing and hearing a clap method • at least 50m for wall and echo method <p>wavelength measured at least 10cm</p> <p>e.g. stop clock, stopwatch, ruler, tape measure, oscilloscope, trundle wheel, timer</p> <p>e.g.</p> <ul style="list-style-type: none"> • start timing when see a clap and stop when hear it • clap by wall and time how long for clap to come back • moving a microphone until waveforms line up on oscilloscope • for echo method, idea time and distance is “there and back” <p>allow repeats AND identifying anomalies</p> <p>e.g. • speed = distance / time • speed = frequency × wavelength</p>	5

Question Number	Answer	Notes	Mark
10(b)(i)	<p>period represented by 4 squares;</p> <p>correct use of x-scale;</p> <p>correct evaluation;</p> <p>e.g. period = 4 squares period = $4 \times 5.0 (\times 10^{-3})$ period = 20 ms = 2.0×10^{-2} (s)</p>	<p>allow ECF from wrong number of squares if clear in working -1 POT error answer of 0.01, 0.04 (s) scores 2 marks</p> <p>allow 0.02(s)</p>	3

Question Number	Answer	Notes	Mark
10(b)(ii)	<p>substitution into given formula;</p> <p>correct evaluation;</p> <p>e.g. frequency = $1 / 0.02$ frequency = 50 (Hz)</p>	allow ECF from (i)	2

Question Number	Answer	Notes	Mark
11(a)(i)	<p>rearrangement OR substitution into given formula;</p> <p>evaluation;</p> <p>e.g. $V_2 = p_1 \times V_1 / p_2$ OR $120 \times 92 = 64 \times V_2$ (volume =) 170 (m³)</p>	allow 172, 173, 172.5	2

Question Number	Answer	Notes	Mark
11(a)(ii)	constant temperature / amount of air / mass of air;	however expressed e.g. number of particles constant	1

Question Number	Answer	Notes	Mark
11(b)(i)	<p>any three from:</p> <p>MP1. (reduction in temperature) reduces speed/KE of particles;</p> <p>MP2. idea of fewer collisions with walls per unit time;</p> <p>MP3. idea of each collision with wall being less 'hard';</p> <p>MP4. force (per unit area) on the container decreases;</p>	allow particles collide with walls less often	3

Question Number	Answer	Notes	Mark
11(b)(ii)	substitution into given formula; rearrangement; evaluation; e.g. $120 / 290 = 64 / T_2$ $T_2 = (64 \times 290) / 120$ (temperature =) 150 (K)	allow 155, 154.6... (K)	3

For information about Pearson Qualifications, including Pearson Edexcel, BTEC and LCCI qualifications visit [qualifications.pearson.com](https://www.pearson.com/qualifications)

Edexcel and BTEC are registered trademarks of Pearson Education Limited

Pearson Education Limited. Registered in England and Wales No. 872828
Registered Office: 80 Strand, London WC2R 0RL

VAT Reg No GB 278 537121

Getty Images: Alex Belmonlinsky

