Mark scheme

Space physics

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

82

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
9	10	10	6	6	7	8	9	9	8	**82**

Question 1 [9]

1(a)	Venus Mars Jupiter all 3 in correct position – 2 marks 1 or 2 in correct position **OR** all 3 named – 1 mark	**B2**
1(b)(i)	hydrogen	**B1**
	helium	**B1**
1(b)(ii)	visible light **OR** infrared	**B1**
1(c)(i)	redshift	**B1**
1(c)(ii)	gas(es)	**B1**
	gravity	**B1**
	disc	**B1**

Question 2 [10]

2(a)(i)	Mercury (nearest to Sun)	**B1**
	Mars (between Earth and Jupiter)	**B1**
2(a)(ii)	(circular / oval) path round Jupiter	**B1**
2(a)(iii)	rocky **OR** furthest planets are gaseous owtte	**B1**
	small(er) **OR** furthest planets large(r)	**B1**
2(a)(iv)	(the) Milky Way	**B1**
	(the) Universe	**B1**
2(b)	(time =) distance ÷ speed in any form	**C1**
	$1.5 \times 10^{11} \div 3.0 \times 10^{8}$	**C1**
	500 (s)	**A1**

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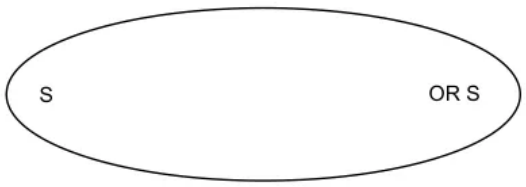
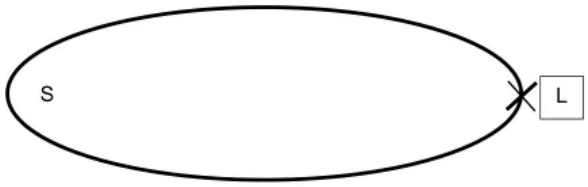
Question 3 [10]

3(a)(i)	Earth has greater mass ORA	**B1**
3(a)(ii)	243 (Earth days)	**A3**
	5832 ÷ 24	(C2)
	idea that one rotation on its axis equals one day	(C1)
3(a)(iii)	360 (s)	**A4**
	$108.2 \times 10^9 \div 3.0 \times 10^8$	(C3)
	speed = distance ÷ time **OR** (t =) $s \div v$	(C1)
	conversion 1 km = 1000 m	(C1)
3(b)	distance	**M1**
	travelled (in space) by light in one year owtte	**A1**

Question 4 [6]

4(a)	Venus	**B1**
4(b)	The larger the mass (of the planet), the larger the gravitational field strength (at the surface)	**B1**
4(c)	orbit of planets is elliptical / is not circular owtte	**B1**
4(d)	correct conversion of T into seconds i.e. $365.2 \times (24 \times 60 \times 60)$ **OR** 3.2×10^7	**B1**
	(v =) $\{2\pi r\} / T$	**B1**
	$2\pi \times 149.6 \times 10^6 / 365.2 \times 24 \times 60 \times 60$	**B1**

Question 5 [6]

5(a)		
	elliptical shape drawn	**B1**
	S at a focus of the ellipse by eye	**B1**
5(b)		
	L furthest away from their S / Sun	**B1**
5(c)	total energy = gravitational (potential) energy + kinetic energy	**B1**
	(energy stored as) GPE decreases and (energy stored as) KE increases closer to the Sun	**B1**
	when the comet has more kinetic energy it has a greater speed	**B1**

Question 6 [7]

6(a)(i)	1 Hubble constant	**B1**
	2 $H_0 = v / d$	**B1**
6(a)(ii)	per second **OR** s^{-1} **OR** 1 / s	**B1**
6(a)(iii)	4.5×10^{17} (s)	**A2**
	$d / v = 1 / H_0$ **OR** (age of Universe =) $1 / H_0$ **OR** (age of Universe =) d / v **OR** (age of Universe =) $1 / 2.2 \times 10^{-18}$	C1
6(b)	shortly after the Universe was formed **OR** shortly after the Big Bang	**B1**
	all points in space	**B1**

Question 7 [8]

7(a)	group / collection of (billions of) stars	**B1**
7(b)	9.5×10^{17} (km)	**A2**
	(1 light-year =) 9.5×10^{15} (m) **OR** (1 light-year =) $3 \times 10^8 \times 365 \times 24 \times 3600$	C1
7(c)(i)	increase in wavelength (of light from far galaxy) **OR** (amount of) redshift	**B1**
7(c)(ii)	brightness of a supernova	**B1**
7(c)(iii)	(their) speeds are (directly) proportional to distances (from Earth) **OR** $H_0 = v / d$	**B1**
7(c)(iv)	4.5×10^{17} (s)	**A2**
	(age of Universe =) $1 / H_0$ **OR** $1 / (2.2 \times 10^{-18})$	C1

Question 8 [9]

8(a)	$v = 2\pi r / T$	**B1**
	r = (average) radius of the orbit **AND** T = (orbital) period	**B1**
8(b)	rays from Sun strike the country at different angles through the year **OR** rays from Sun strike the country for different number of hours per day through the year	**B1**
8(c)	(first space:) red supergiant	**B1**
	(second space:) nebula	**B1**
	(3rd and 4th spaces:) neutron star	**B1**
	black hole	**B1**
8(d)	1.6×10^9 (light-years)	**A2**
	$H_0 = v / d$ **OR** (d =) v / H_0 **OR** (d =) $[33\,000 \times 10^3] / [2.2 \times 10^{-18} \times 9.5 \times 10^{15}]$	C1

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Question 9 [9]

9(a)(i)	Earth / Mars / Jupiter / Saturn / Uranus / Neptune	**B1**
9(a)(ii)	Mercury	**B1**
9(b)	3.6×10^4 (m / s)	**A3**
	(T =) $220 \times 24 \times 60 \times 60$ **OR** (T =) 1.9×10^7 (s)	C1
	(v =) $\frac{2\pi r}{T}$ **OR** (v =) $\frac{2\pi \times 1.1 \times 10^{11}}{220 \times 24 \times 60 \times 60}$	C1
9(c)	The further away from the Sun the slower the orbital speed / ORA	**B1**
9(d)	1 *any **one** from:* • comet has an elliptical orbit • speed of comet is faster when it closer to the Sun • speed of comet is slower when it is further away from the Sun	**B1**
	2 *any **one** from:* • (conservation of energy requires that) transfers between kinetic and gravitational stores (as comet changes speed) • total energy remains constant • energy cannot be created or destroyed	**B1**
	3 as radius of orbit decreases, gravitational energy decreases and kinetic energy increases ORA	**B1**

Question 10 [8]

10(a)	distance travelled (in the vacuum of space) by light in one year	**B1**
10(b)	1.5×10^{11} m	**A2**
	9.5×10^{15} (m) **OR** (c =) $3(.0) \times 10^8$ (m / s) **OR** $3(.0) \times 10^N \times 490$	C1
10(c)	2.5×10^{-18} per second	**A3**
	(Hubble's constant =) gradient **OR** (H_0 =) $v \div d$	C1
	$2.5 \times 10^4 (-0) \div \{100 \times 10^{20} (-0)\}$	C1
10(d)	electromagnetic radiation / light from (distant) galaxies	**B1**
	(observed) increase in wavelength (compared to wavelength measured on the Earth)	**B1**

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