Mark Scheme 2825/01
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COSMOLOGY

1	(a)(i)	**Any two from:**			
		Sun in centre			
		Circular planetary orbits			
		Planets move at constant speed			
		Moons orbiting Jupiter			
		Fewer epicycles (accept no epicycles)			2
	(a)(ii)	**Any one from:**			
		Motion of planet would cause wind to blow			
		Motion of planet would prevent objects falling vertically			
		Stellar parallax expected but not observed		1	
	(b)	$(5.2 \times 1.5 \times 10^{11}) = 7.80 \times 10^{11}$m			1
				Total	4
2.	(a)	**Any two from:**			
		Surface Area/ Volume	1		
		Mass		1	
		Temperature		1	2
	(b)(i)	(Atair) 0.98			1
		(Castor) - 1.03			1
	(b)(ii)	Plot points correctly		1	
	(b)(iii)	Best straight line			1
	(b)(iv)	b = 4.8 from intercept on M axis			1
		correct calculation of gradient			1
		a = - 2.5			1
	(b)(v)	log(star luminosity/Sun luminosity) = 1			1
		absolute magnitude of Sun = 4.8			1
	(b)(vi)	**Any 3 from:**			
		Surface area increases		1	
		Temperature decreases		1	
		Absolute magnitude increases negatively	1		
		Larger surface area raises luminosity/ lower temperature decreases luminosity	1	3	
				Total	14

3. Hydrogen atoms/particles 1
Collapse under gravity/ decrease of gpe 1
Increase in kinetic energy/ temperature 1
Fusion of protons 1
Energy released/ ref. to $E = \Delta mc^2$ 1

Total 5

4. (a)(i) **any 2 from**
dark lines from absorption of wavelengths 1
by atoms/particles in Sun's atmosphere 1
re-radiation in all directions 1 2

(a)(ii) dark lines correspond to known spectra 1

(b)(i) wavelength has undergone Doppler/red shift 1
star is receding 1

(b)(ii) $v/c = \Delta\lambda / \lambda$ 1
$\Delta\lambda = 1.4nm$ 1
$v = 1.4 \times 10^{-9} \times 3 \times 10^{8} / 119.5 \times 10^{-9}$ 1
$v = 3.51 \times 10^{6}\ ms^{-1}$ 1

Total 9

5. (a) A gamma (accept X ray) 1
B ultra violet 1
C visible 1
D radio 1

(b)(i) uniform intensity in all directions 1
when Universe became transparent/ big bang 1

(b)(ii) **any 1 from:**
intensity of microwaves on Earth's surface is small 1
ripple in intensity is very small/too small for accurate measurement on Earth's surface 1 1

Total 7

6.	(a)	$v \propto r$ / $v = H_o \times r$			1
		labels (including one reference to Earth/Sun/Galaxy)			1
	(b)	infinite Universe			1
		all lines of sight end on star		1	
		so night sky should be bright/ not dark			1
		either			
		expanding Universe/light undergoes red shift		1	
		more distant galaxies have greater red shift	1		
		or			
		age of Universe is finite		1	
		light from distant stars not yet reached Earth	1	2	
				Total	7
7.	(a)(i)	**accept description of plan view or side view.**			
		side: central bulge		1	
		galactic disc <u>each side</u>		1	
		plan: accumulation of stars in centre.		1	
		spiral arms (minimum of 2 arms)		1	2
	(a)(ii)	correct position of Sun (accept 28000ly from centre)			1
	(b)(i)	hydrogen / helium gas			1
		formed after big bang/ remnants of supernovas			1
		critical density is condition for flat Universe.		1	
		dark matter increases density of Universe.		1	
		density greater than critical density.		1	
		Universe will contract/ big crunch.			1
				Total	9

8.	(a)	where Newton's first law is followed (all valid equivalent descriptions accepted.)	1	
	(b)	**any 5 from** a valid thought experiment described eg train, tunnel, lamps. observer A at rest (at mid-point of tunnel) 1 observer B in moving frame (at constant velocity) 1 A measures train equal in length to tunnel from lamps flashing simultaneously B measures train to be longer than tunnel from lamps flashing at different times symmetry, detail of experimental arrangement.	1 1 1 1	5
	(c)	$l = l_o (1 - v^2/c^2)^{½}$ $v^2/c^2 = (1 - l^2/l_o^2)$ $v = 4.46 \times 10^7$ ms^{-1}		1 1 1
			Total	9
9.	(a)(i)	acceleration		1
	(a)(ii)	speed of light constant frequency is decreased		1 1
	(b)(i0	gravitational fields and acceleration are indistinguishable	1	
	(b)(ii)	wavelength remains increased downward gravitational field has same effect as acceleration		1 1
			Total	6