

**Pearson Edexcel Level 1/Level 2 GCSE (9-1)**

**Monday 10 June 2019**

**Paper Reference 1AS0/02**

**Astronomy**

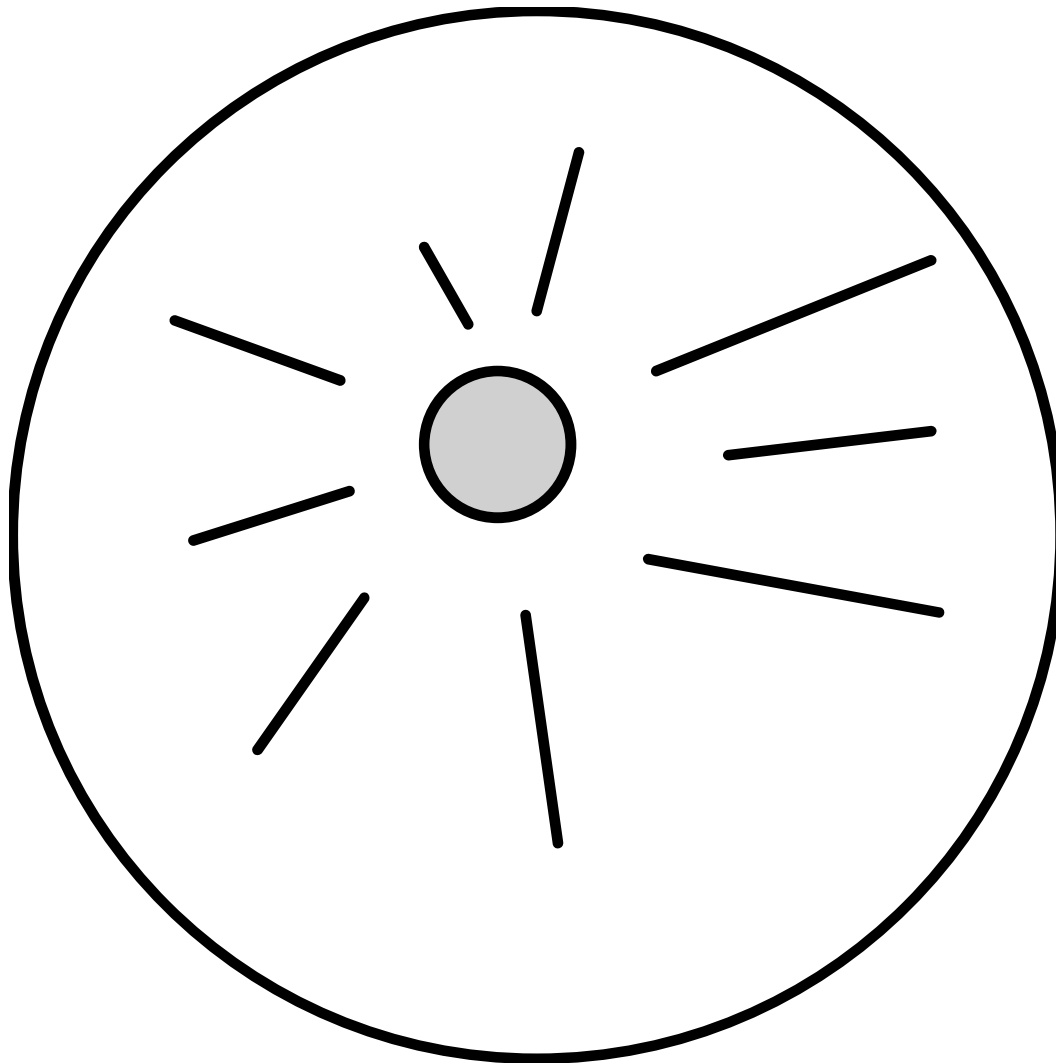
**Paper 2: Telescopic Astronomy**

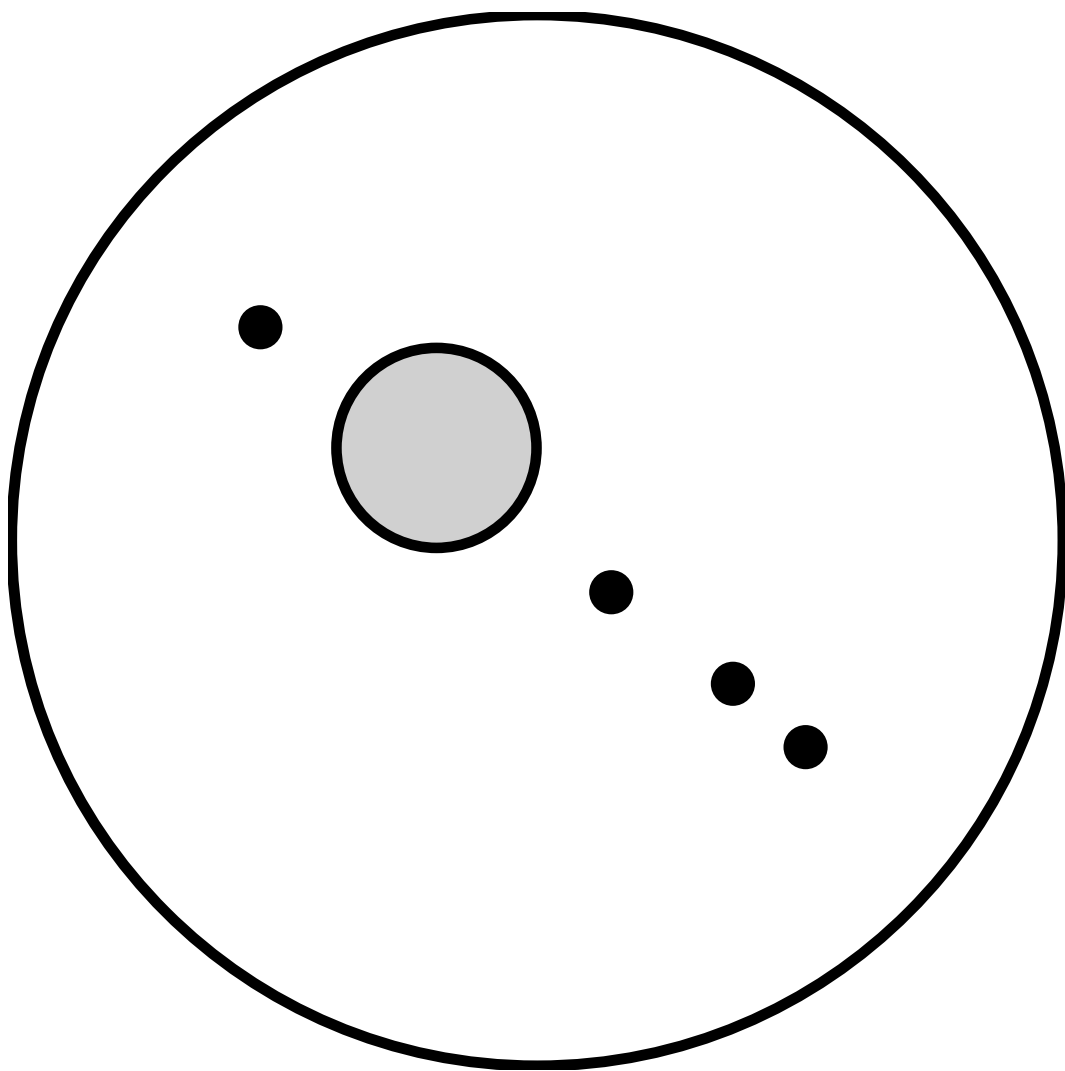
**DIAGRAM BOOKLET**

**Write your name, centre number and candidate number in the boxes below.**

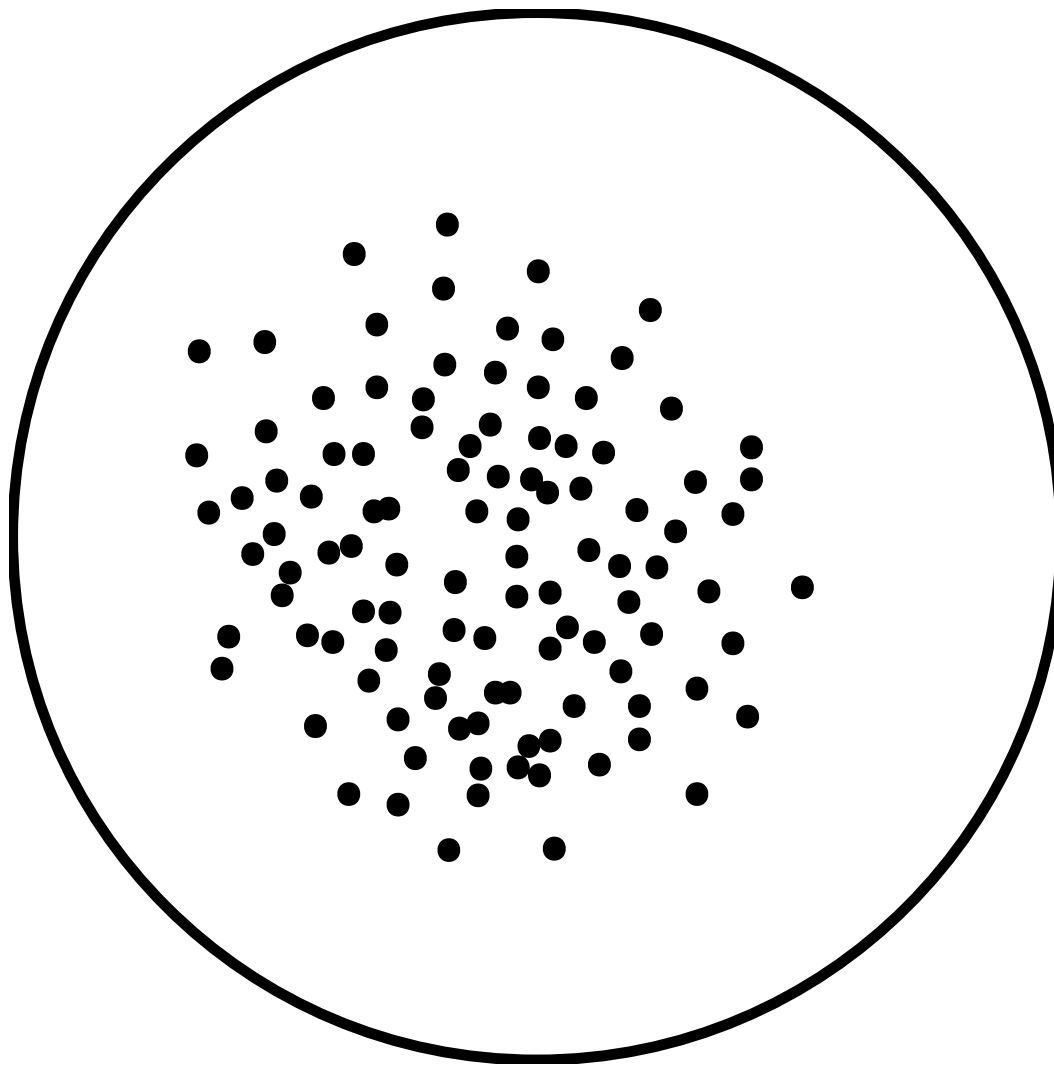
Candidate Surname					
Other names					
Centre No.					
Candidate No.					

## QUESTION 1 (a)(i)



**QUESTION 1 (a)(ii)**

## QUESTION 1 (a)(iii)



**QUESTION 1 (c)**

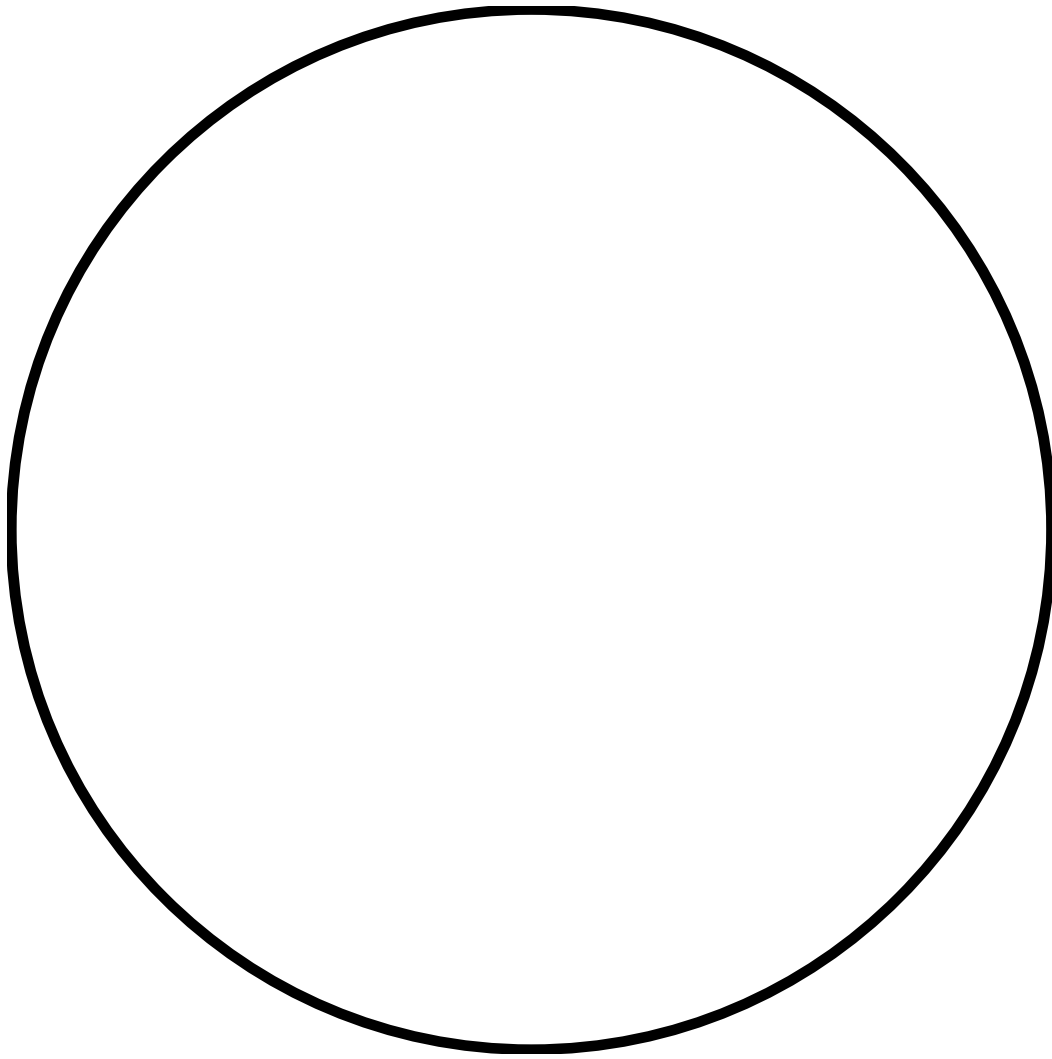


FIGURE 1

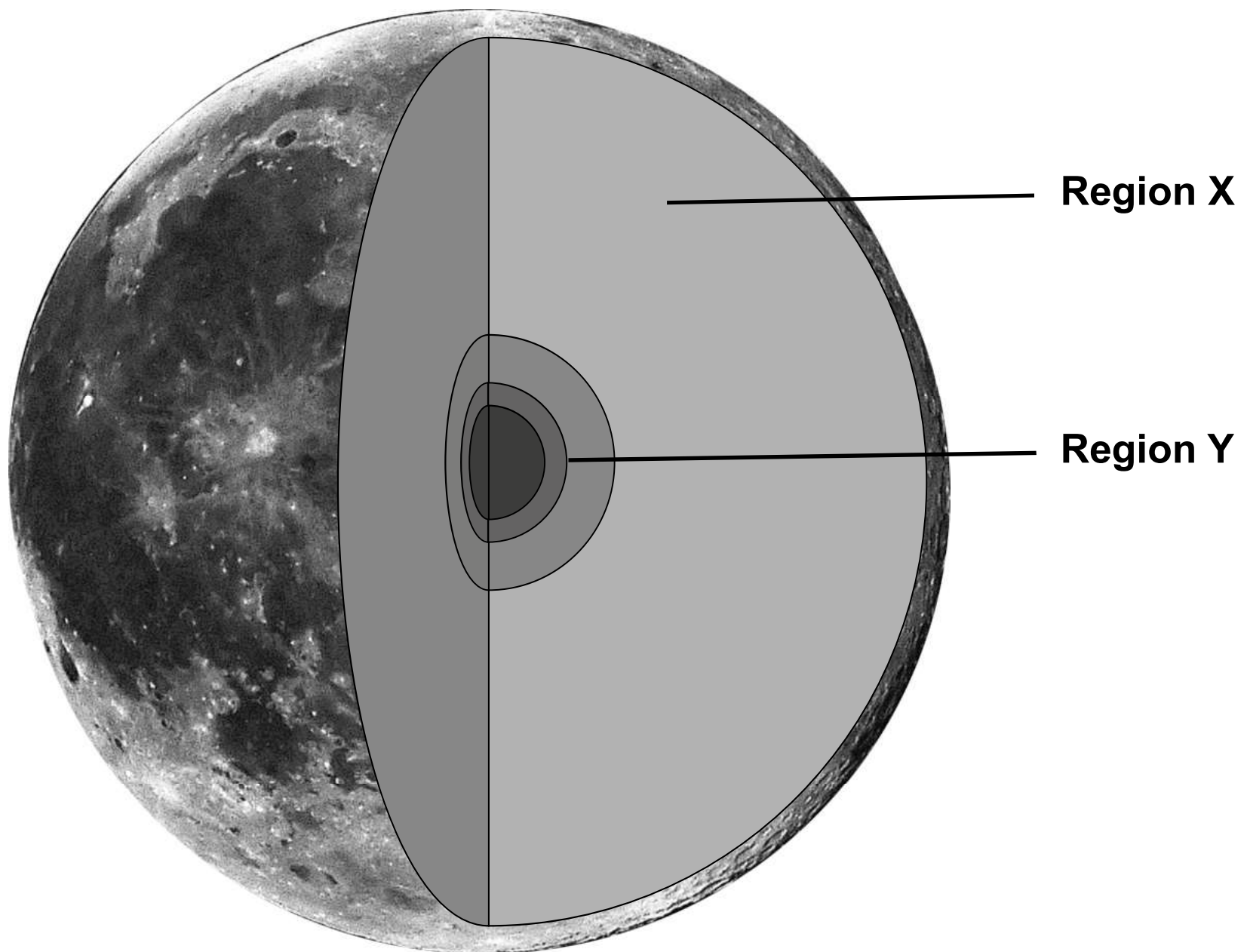


FIGURE 2

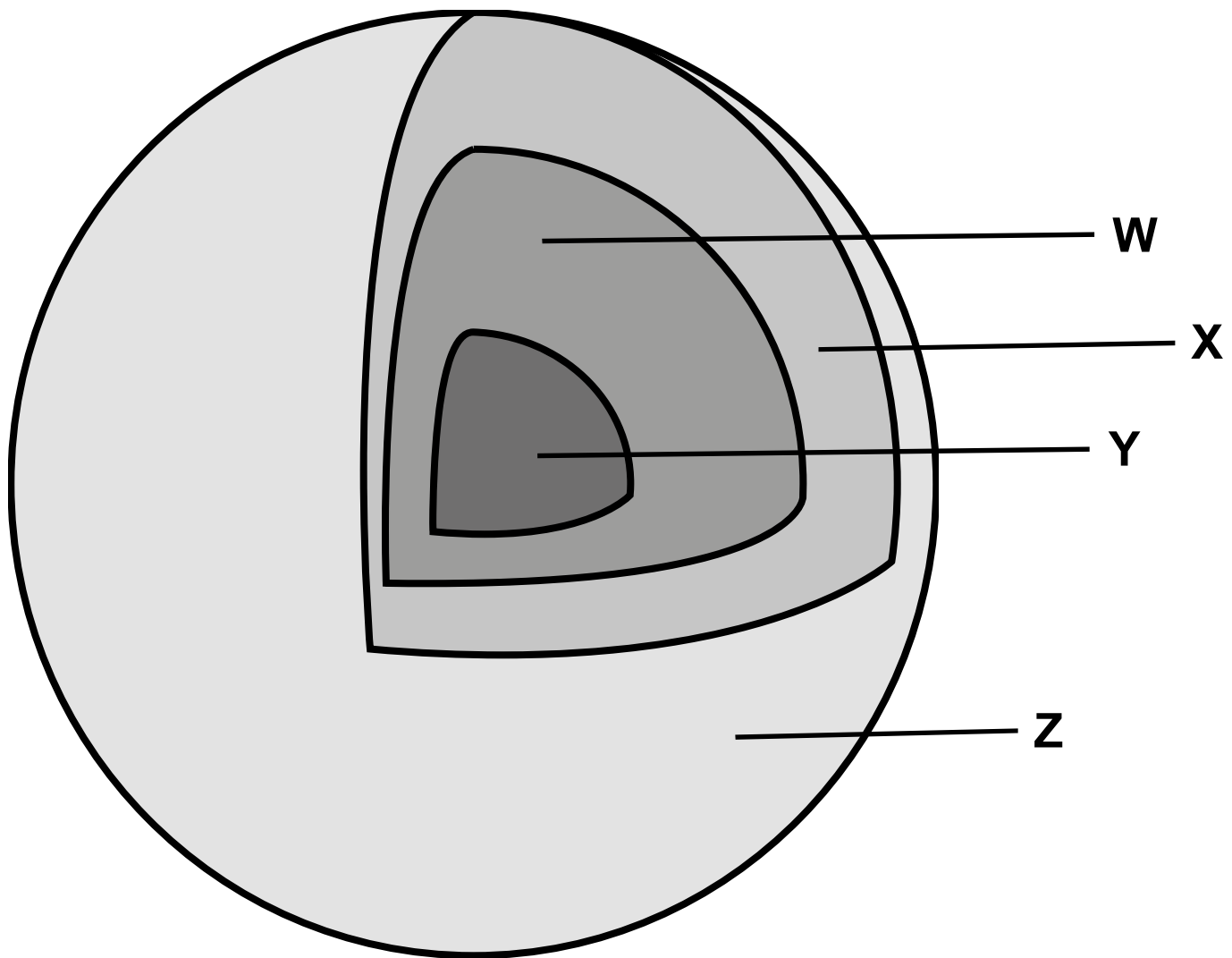


FIGURE 3

	FLY-BY	ORBITER	IMPACTOR
Journey time (days)	70	275	125
Journey distance (million km)	65	160	85
Distance at closest approach (km)	2500	300	0
Number of orbits around Mars	0	200	1



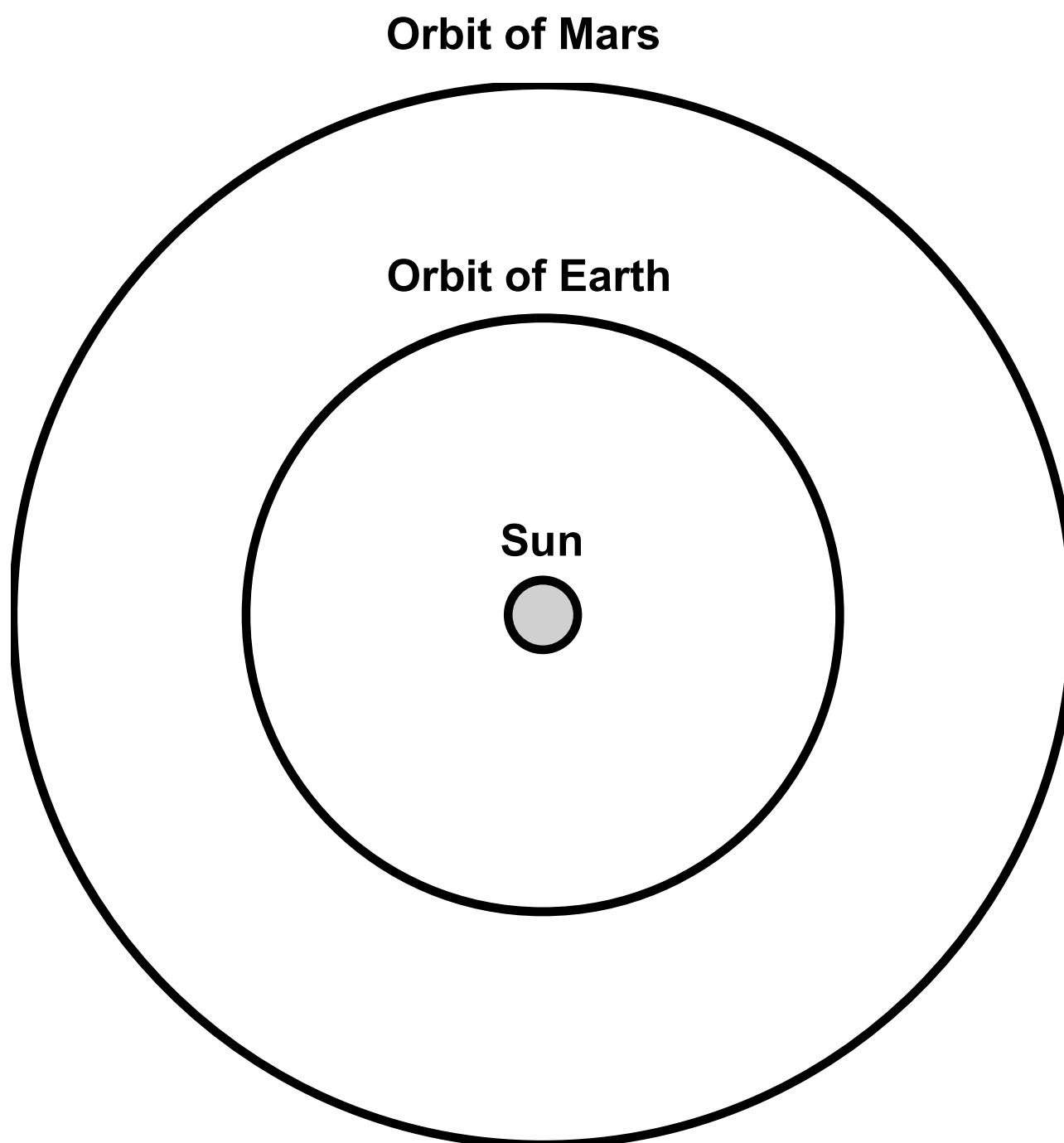
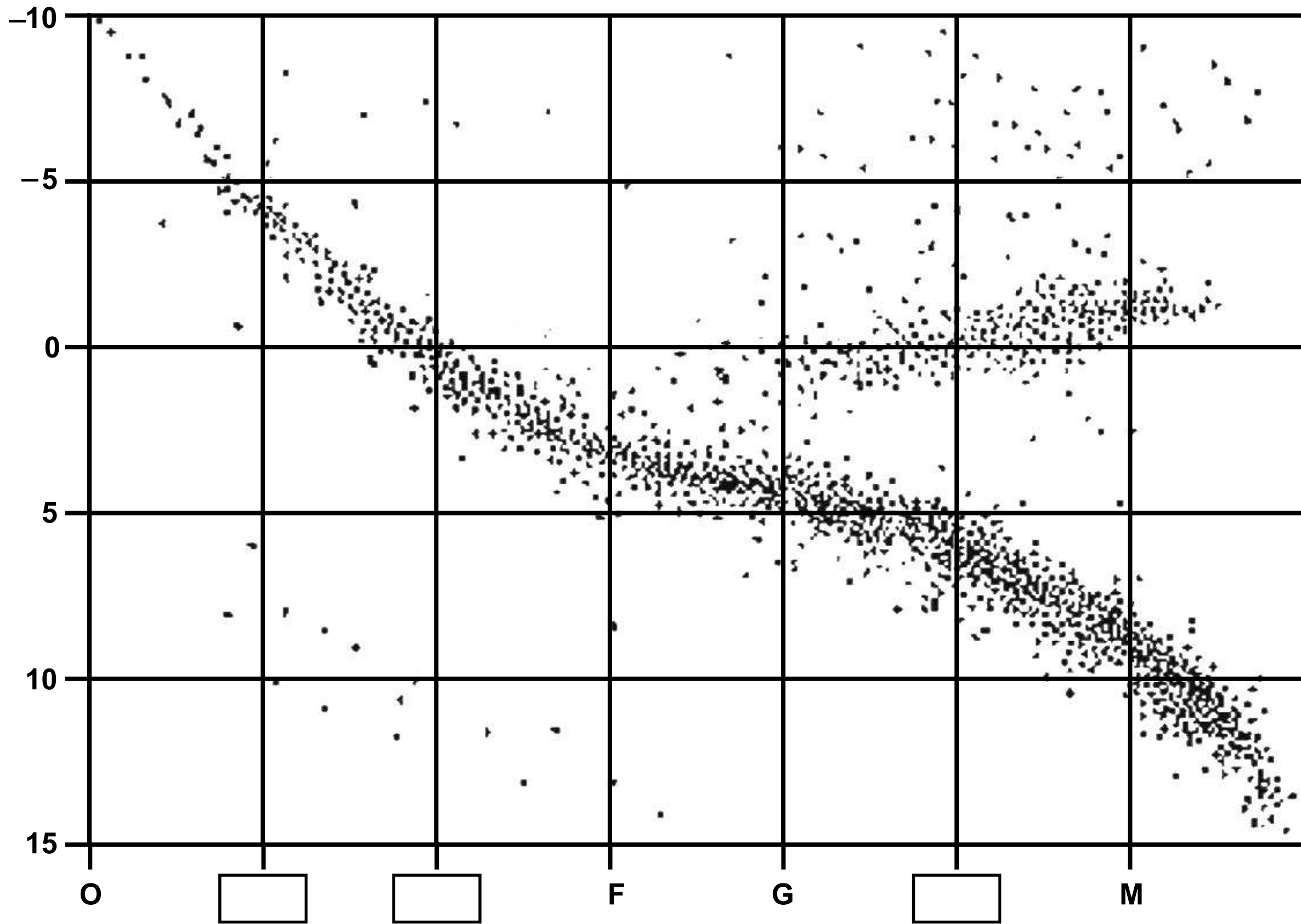
**QUESTION 4 (a)(iii)**

FIGURE 4

Absolute magnitude

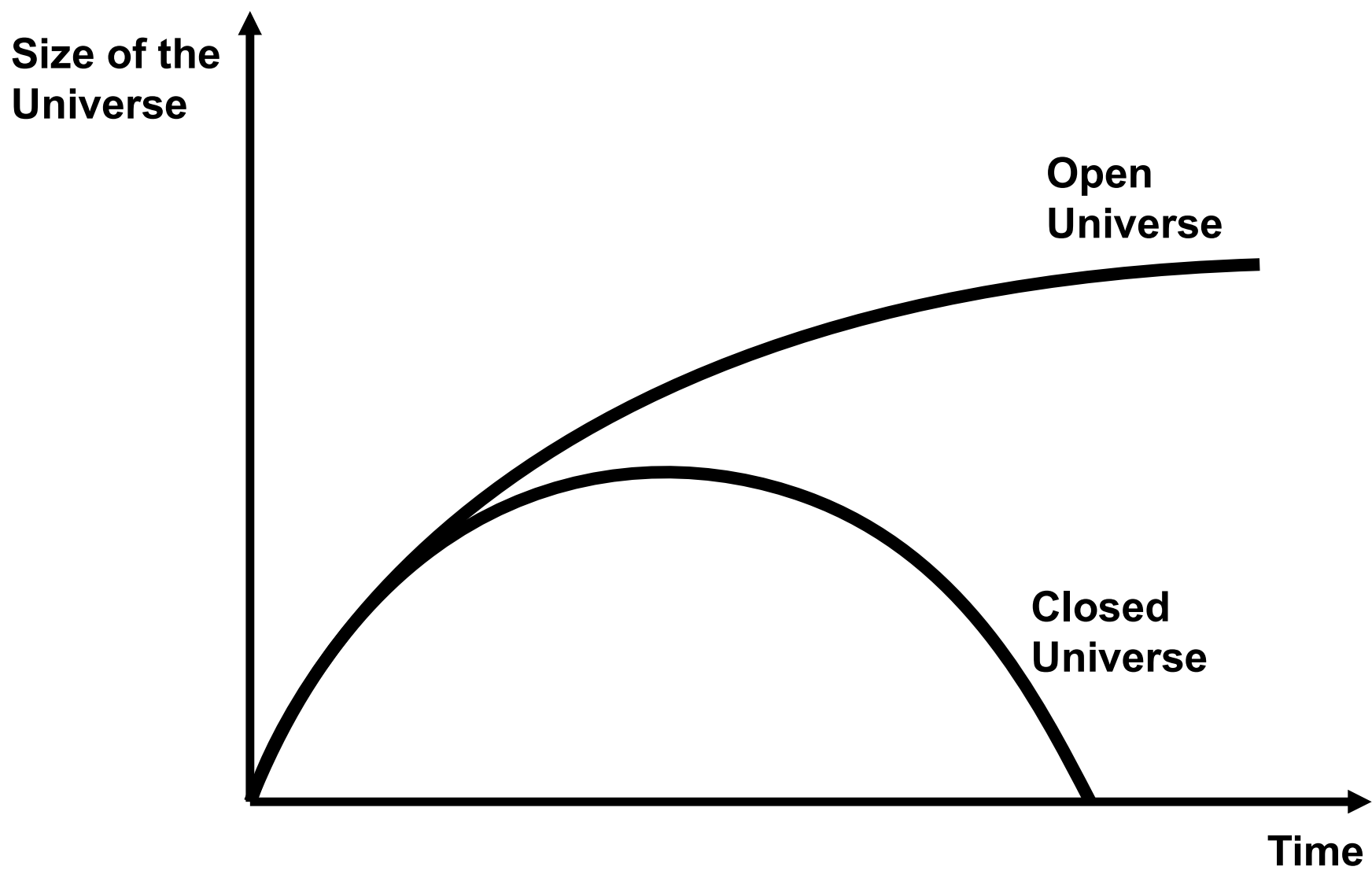


Spectral type

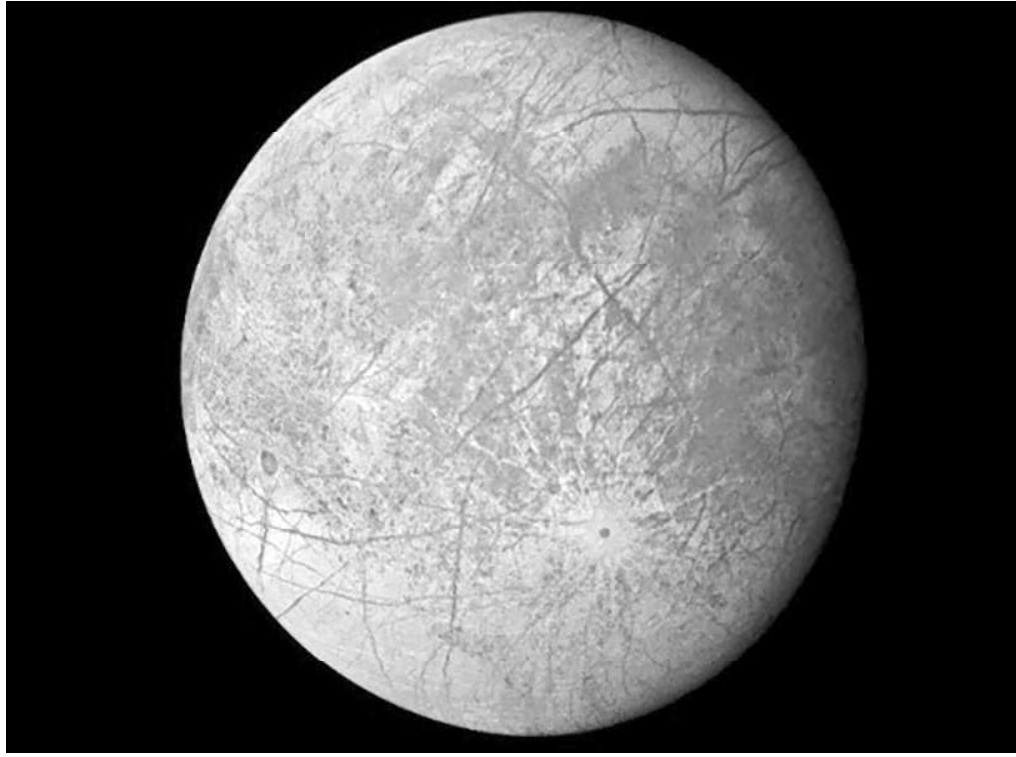
FIGURE 5

	OBSERVATIONAL EVIDENCE FOR THE STEADY STATE THEORY	OBSERVATIONAL EVIDENCE FOR THE BIG BANG THEORY
Hubble Deep Field image		
Quasars		
Redshift of distant galaxies		
The expanding Universe		

FIGURE 6

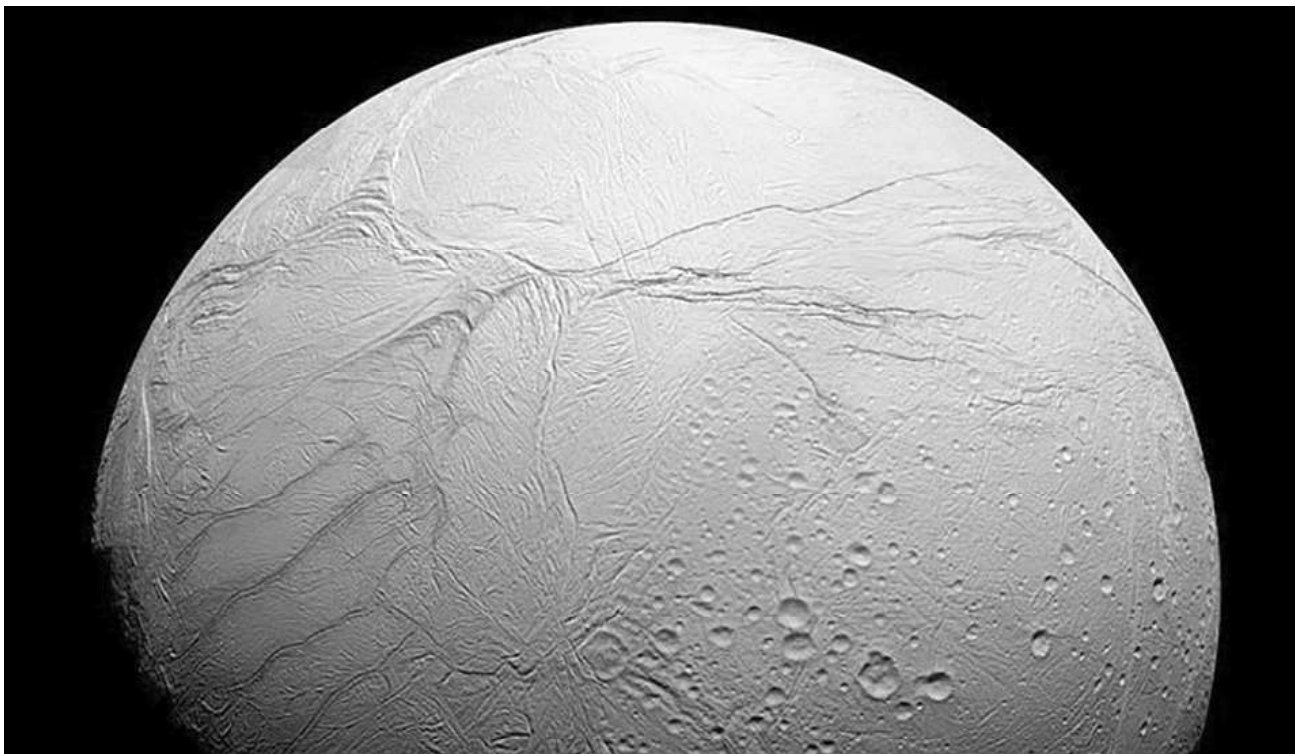


**FIGURE 7 - EUROPA**



**(Source: NASA)**

**FIGURE 8 - ENCELADUS**



**(Source: NASA)**

FIGURE 9

	ENCELADUS	EUROPA	NUCLEUS OF THE COMET 67P
Recorded Surface Temperature (°C)	−200	−220	−70
Diameter (km)	500	6200	4
Distance from parent planet (km)	238 000	671 000	Does not orbit a parent planet
Type of parent planet	Gas giant	Gas giant	None
Presence of liquid water below the surface	Yes	Yes	No

FIGURE 10



(Source: NASA)

FIGURE 11

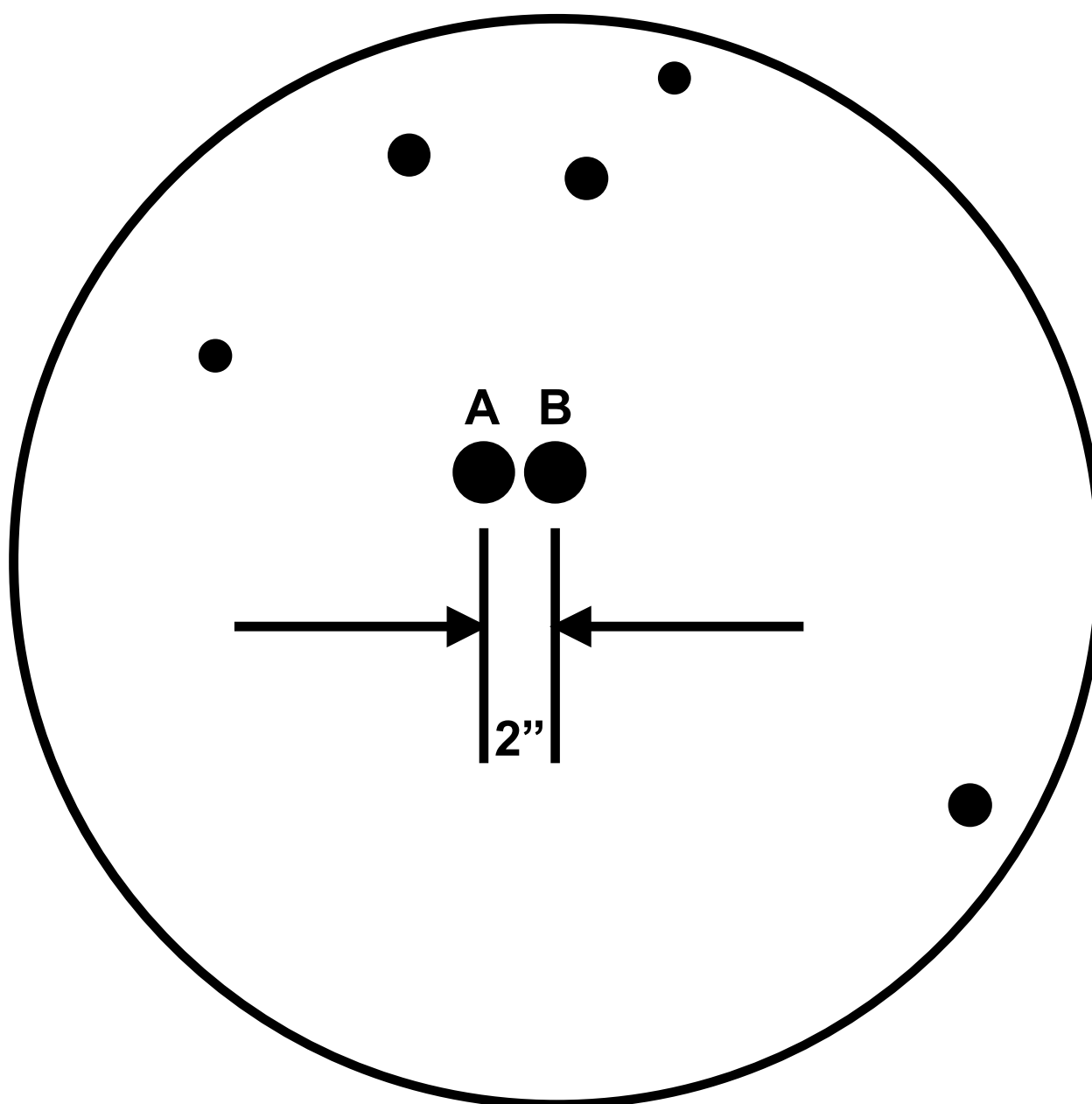




FIGURE 13



	PHOTOGRAPH A Inside the plane of the Milky Way	PHOTOGRAPH B Outside the plane of the Milky Way
Photograph		
Date	18 December	08 August
Time	01:20 GMT	21:30 GMT
Lunar phase	New	Full
Exposure time	30 seconds	10 seconds
Number of visible stars		15

FIGURE 14

Apparent magnitude

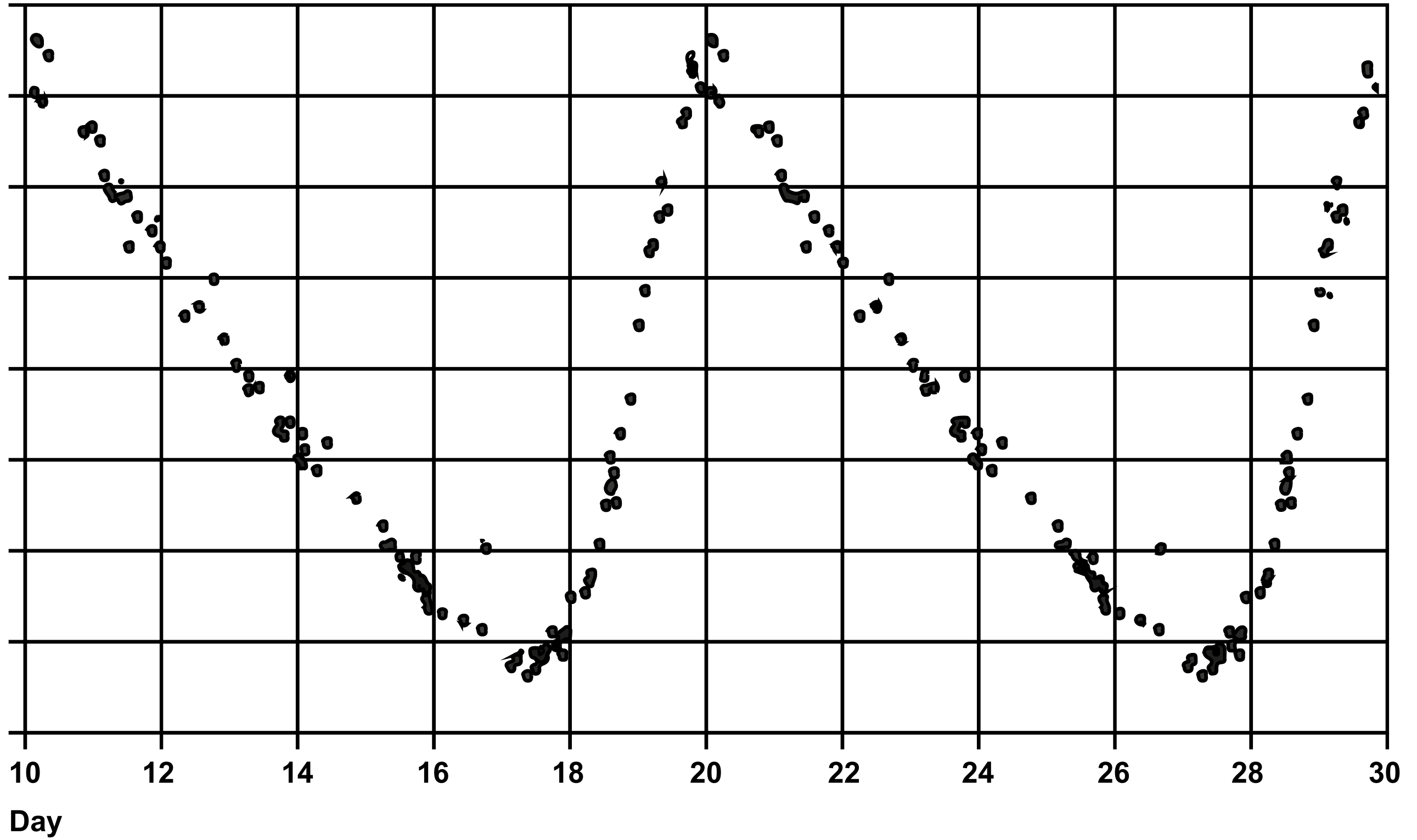
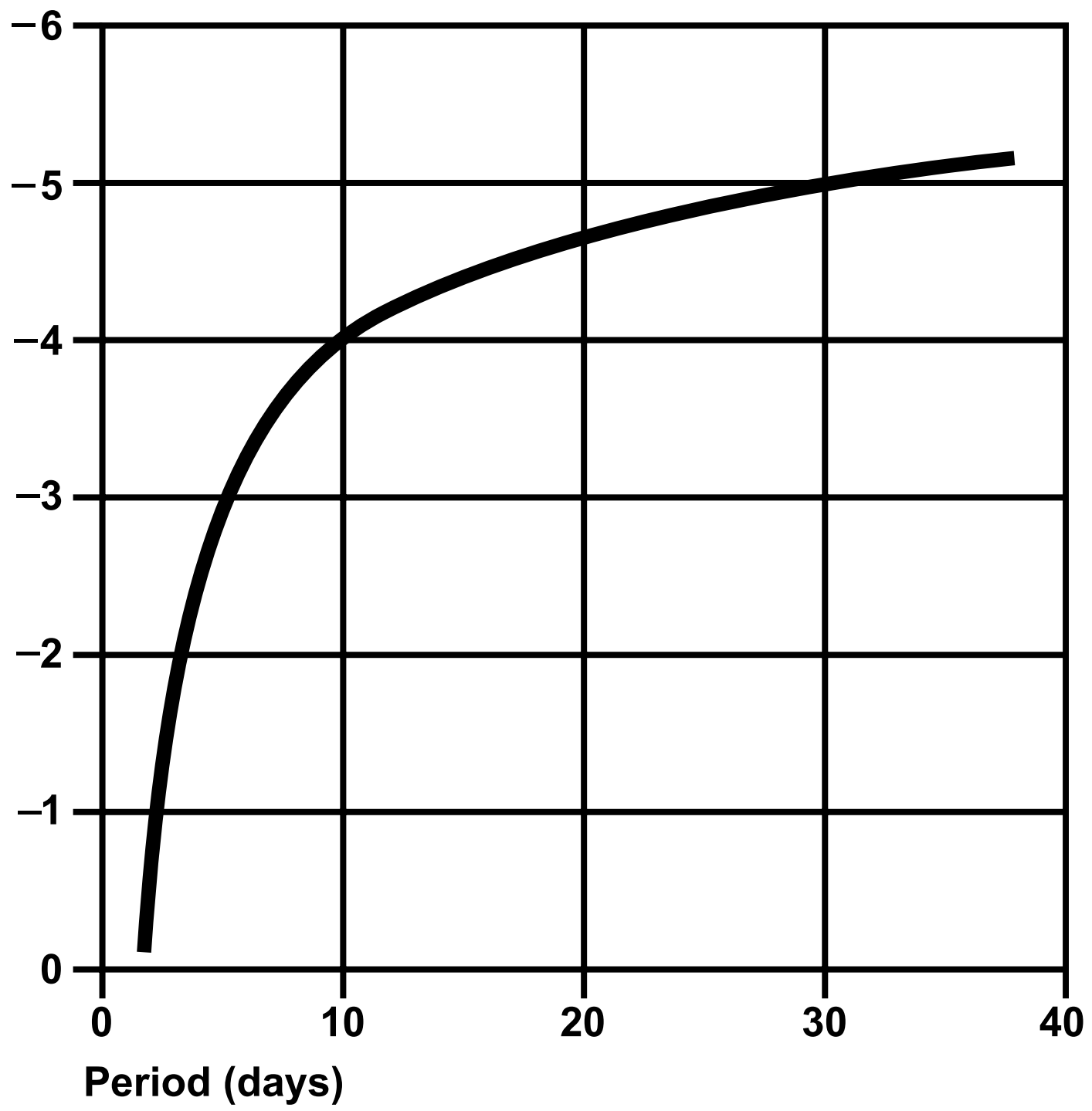


FIGURE 15

Absolute  
magnitude



FORMULAE AND DATA SHEET

FORMULAE

Equation of Time = Apparent Solar Time (AST) – Mean Solar Time (MST)

Kepler’s 3rd law:	$\frac{T^2}{r^3} = \text{a constant}$
Magnification of telescope:	magnification = $\frac{f_o}{f_e}$
Distance modulus formula:	$M = m + 5 - 5\log d$
Redshift formula:	$\frac{\lambda - \lambda_0}{\lambda_0} = \frac{v}{c}$
Hubble’s law:	$v = H_0 d$

Data

Mass of Earth	$6.0 \times 10^{24} \text{ kg}$
Mean diameter of Earth	13 000 km
Mean diameter of Moon	3500 km
Mean diameter of Sun	$1.4 \times 10^6 \text{ km}$
One Astronomical Unit (AU)	$1.5 \times 10^8 \text{ km}$
Mean Earth to Moon distance	380 000 km
One light year (l.y.)	$9.5 \times 10^{12} \text{ km}$
One parsec (pc)	$3.1 \times 10^{13} \text{ km} = 3.26 \text{ l.y.}$
Sidereal day of Earth	23 h 56 min
Synodic day of Earth	24 h 00 min
Temperature of solar photosphere	5800 K
Hubble Constant	68 km/s/Mpc
Speed of light in vacuum	$3.0 \times 10^8 \text{ m/s}$

Name	Type of body	Mean distance from Sun/AU	Sidereal period/Earth year	Mean temperature /°C	Diameter /1000 km	Mass/ Earth mass	Ring systems	Moons
Mercury	planet	0.38	0.24	170	4.9	0.55	no	none
Venus	planet	0.72	0.62	470	12.1	0.82	no	none
Earth	planet	1.0	1.0	15	12.8	1.00	no	1: the Moon
Mars	planet	1.5	1.9	−50	6.9	0.11	no	2 small moons: Deimos and Phobos
Ceres	dwarf planet	2.8	4.6	−105	0.95	$1.5 \times 10^{-4}$	no	none
Jupiter	planet	5.2	11.9	−150	143	318	yes	4 major moons: Ganymede, Callisto, Europa, Io >60 others
Saturn	planet	9.5	29.5	−180	121	95	yes	5 major moons: including Titan, Iapetus >55 others
Uranus	planet	19.1	84.0	−210	51	15	yes	5 major moons: including Titania, Oberon >20 others
Neptune	planet	30.0	165	−220	50	17	yes	1 major: Triton >12 others
Pluto	dwarf planet	39.5	248	−230	2.4	$2.2 \times 10^{-3}$	no	1 major: Charon >4 other moons
Haumea	dwarf planet	43.1	283	−241	1.4	$6.7 \times 10^{-4}$	no	2
Eris	dwarf planet	67.8	557	−230	2.3	$2.8 \times 10^{-3}$	no	at least 1