

Practice Questions - Topic 9: Exploring The Moon



By Ben Fletcher

Name:			
Form:			
Mark:	/33	Percentage:	%

Feel free to contact me by my school email if you have any queries or want an explanation of a question. – Ben F :)

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 system	Moons
Mercury	planet	0.38	0.24	170	4.9	0.055	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	1.5×10^{-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 moon: Triton >12 others
Pluto	dwarf planet	39.5	248	-230	2.4	2.2×10^{-3}	no	1 major moon: Charon >4 other moons
Haumea	dwarf planet	43.1	283	-241	1.4	6.7×10^{-4}	no	2
Eris	dwarf planet	67.8	557	-230	2.3	2.8×10^{-3}	no	at least 1

1. a)

Explain what “tidally-locked” means for **observations** of the moon and why the moon is tidally locked to the Earth.

.....
.....

(2 marks)

b)

Suggest two possible methods to observe the moon’s far-side surface.

1.

2. (2 marks)

c)

Here is a diagram of the near and far side of the moon:

Side A

Side B



Identify which side is the near side and which side is the far side.

Side A –

Side B – (1 mark)

d)

State two observational differences between the near and far side of the moon and explain how they each arose.

Difference 1:

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.....

Difference 2:

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(4 marks)

(9 marks)

2.

Name three theories as to the Moon's formation.

1.

2.

3.

(3 marks)

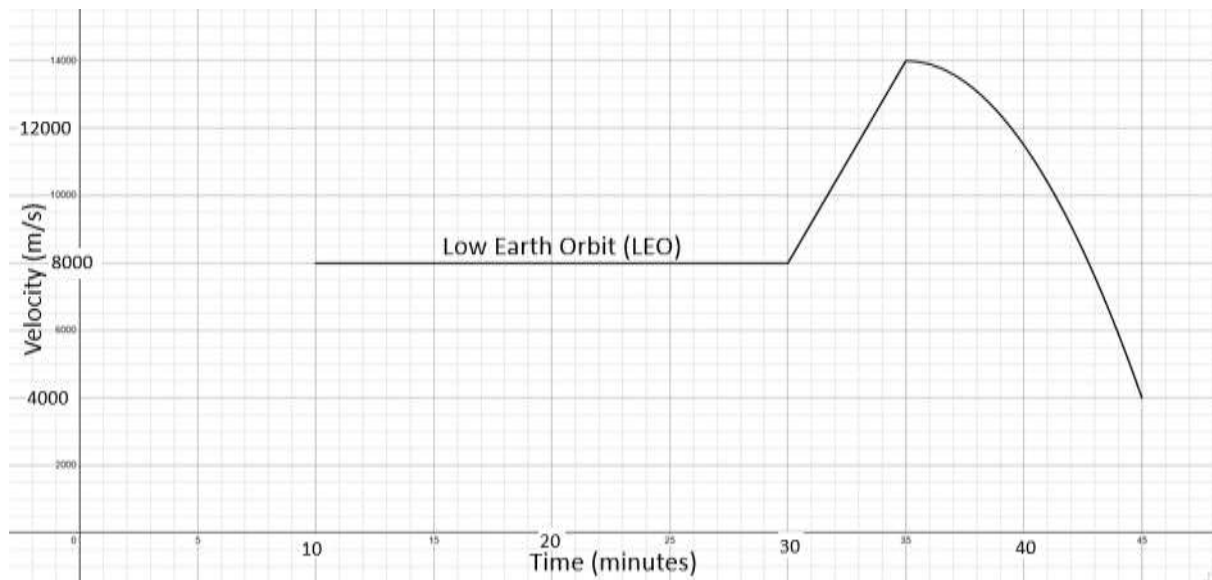
_____ km (4 marks)

km (4 marks)

4.

Graph 1 shows the journey of a probe on its way to the moon.

Graph 1



a)

During launch (minutes 0 to 10) the probe has to get past the atmosphere to enter orbit of the Earth. The Earth's atmosphere is thicker with a lower altitude. The probe's rockets provide a constant thrust. Finish the graph to show the probe's velocity during the first 10 minutes.

(2 marks)

From Low Earth Orbit (LEO) the probe accelerates at a constant rate to a velocity that will allow it to reach the moon. Calculate the acceleration during this time. Give your answer in ms^{-2} .

c)

The probe's kinetic energy at 32.5 minutes is 605GJ.
Calculate the probe's mass. Use the equation:

$$E_k = \frac{1}{2}mv^2$$

Tonnes (4 marks)

Tonnes (4 marks)

d)

Calculate the thrust of the probe's engines from LEO to a moon intercept. Use the equation:

$$F = ma$$

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.....

.....

..... kN (3 marks)

e)

Each rocket booster on the probe supplies 25kN of thrust. Calculate the number of rocket boosters on the probe.

.....

..... rocket boosters (1 mark)

f)

Each rocket booster costs £10,000,000. The cost of the rocket booster's is shown to be 5% the cost of the whole probe. What is the total cost of the probe? Give your answer in standard form.

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..... (3 marks)

..... (17 marks)

Thanks for doing my questions ! :D

Mark scheme can be found at <https://physics.bourne-grammar.lincs.sch.uk/astronomy/paper2>