

Mark schemes

- 1.** (a) Milky Way 1
- (b) distance = $300\,000 \times 500$ 1
- $d = 150\,000\,000$ (km) 1
- an answer of 150 000 000 scores 2 marks*
- (c) 3 1
- (d) accept any number greater than 1.0 and less than 12.0 1
- (e) $\frac{9}{0.6}$ 1
- 15 1
- an answer of 15 scores 2 marks*
- [7]**
- 2.** (a) (force of) gravity causes the satellite to accelerate (towards the Earth)
allow satellite is (constantly) accelerating 1
- the acceleration causes a change in direction
acceleration causes a change in speed negates this mark point 1
- velocity changes because direction changes 1

(b) length of orbit taken from graph = 42 100 (km)

1

$$42\,100 = 7.73 \times \text{time}$$

or

$$\text{time} = \frac{42\,100}{7.73}$$

allow

$$\text{their distance} = 7.73 \times \text{time}$$

1

$$\text{time (1 orbit)} = 5446(\text{s})$$

allow a value consistent with their distance

1

$$\text{number of orbits} = \left(\frac{24 \times 3600}{5446} \right)$$

$$= 15.86$$

$$\text{allow } \left(\frac{24}{1.51} \right) = 15.86$$

allow a value consistent with their distance

1

$$\text{number of orbits} = 15$$

allow a value consistent with their distance

an answer of 16 scores 4 marks

1

or

$$\text{length of orbit taken from graph} = 42\,100 \text{ (km) (1)}$$

$$7.73 = \frac{\text{distance}}{24 \times 3600} \text{ (1)}$$

$$\text{distance} = 667\,872 \text{ (km) (1)}$$

$$\text{number of orbits} = \left(\frac{667872}{42100} \right)$$

$$= 15.86 \text{ (1)}$$

allow a value consistent with their two distances

$$\text{number of orbits} = 15 \text{ (1)}$$

allow a value consistent with their two distances

up to full marks can be awarded for a method calculating velocity in km/h and time in hours

an answer of 15 scores 5 marks

(c) the predicted data is very close to the actual data

1

- (d) supported the prediction (made by Bode)
allow predicted and actual values are very close 1

so provides evidence that the equation is true / correct / works / accurate
allow proves for provides evidence

1
[11]

3. (a) dwarf planet 1

(b) nebula
correct order only 1

gravity 1

(c) (becomes a) red giant 1

(d) the greater the distance (from the Sun) the greater the time taken to orbit the Sun 1

(e) any value between 3 and 7 inclusive 1

(f) because some planets do not fit the pattern 1

named planet that does not fit pattern
eg Venus 1

reason why named planet does not fit pattern
its temperature is higher than expected
or
Uranus: its temperature is lower than expected
or
Neptune: its temperature is higher than expected
or
Mercury: its temperature is lower than expected 1

[9]

- 4.** (a) any **one** from:
- Earth is at the centre (not the Sun)
 - there are fewer planets
 - accept there is no asteroid belt shown*
 - accept there are only 5 planets (and not 8)*
 - accept other planets have no moons shown*
- 1
- (b) Shows the moon in orbit around the Earth
 - accept the planets have circular orbits*
 1
- (c) circular
 - accept elliptical*
 1
- (d) gravity 1
- (e) Mira is much more massive 1
- [5]**

- 5.** (a) gas
 - correct order only*
 1
- gravity 1
- protostar
 - accept correct word circled in box provided no answer given in answer space*
 1
- (b) the explosion of a massive star 1
- (c) The telescopes and measuring instruments were not sensitive enough. 1
- [5]**

6. (a) (i) (enough) dust and gas (from space) is pulled together
accept nebula for dust and gas
accept hydrogen for gas
accept gas on its own
dust on its own is insufficient
mention of air negates this mark 1
- by:
gravitational attraction
or
gravitational forces
or
gravitaty
ignore any (correct) stages beyond this 1
- (ii) joining of two (atomic) nuclei (to form a larger one)
do not accept atoms for nuclei 1
- (iii) more sensitive astronomical instruments / telescopes
or
infrared telescopes developed
accept better technology
more knowledge is insufficient 1
- (b) (i) (other) planets / solar systems
do not accept galaxy
moons is insufficient 1
- (ii) provided evidence to support theory
accept proves the theory 1
- (c) elements heavier than iron are formed only when a (massive) star explodes
accept materials for elements
accept supernova for star explodes
accept stars can only fuse elements up to (and including) iron 1

[7]

7.

(a) hydrogen

1

(b) supernova

1

(c) red super giant

1

(d) any **four** from:

- fusion takes place within stars
- hydrogen formed into helium
- fusion continued and formed larger elements
- elements heavier than iron were formed in supernova
- (heavy) elements were scattered by the supernova explosion.

accept light elements formed

4

[7]