Escape Velocity

① $v = \sqrt{\frac{2GM}{r}}$

$= \sqrt{\frac{2(6.67 \times 10^{-11})(7.34 \times 10^{22})}{(1.74 \times 10^{6})}}$

$v = \boxed{2372 \text{ m/s}}$

② Mercury

$v = \sqrt{\frac{2(6.67 \times 10^{-11})(3.28 \times 10^{23})}{(2.57 \times 10^{6})}}$

$v = \boxed{4126 \text{ m/s}}$

Venus

$v = \sqrt{\frac{2(6.67 \times 10^{-11})(4.83 \times 10^{24})}{(6.31 \times 10^{6})}}$

$v = \boxed{10\,105 \text{ m/s}}$

Earth

$v = \sqrt{\frac{2(6.67 \times 10^{-11})(5.98 \times 10^{24})}{(6.38 \times 10^{6})}}$

$v = \boxed{11\,182 \text{ m/s}}$

③ Mars

$$v = \sqrt{\frac{2(6.67\times10^{-11})(6.37\times10^{23})}{(3.43\times10^{6})}}$$

$$v = \boxed{4977 \text{ m/s}}$$

Jupiter

$$v = \sqrt{\frac{2(6.67\times10^{-11})(1.90\times10^{27})}{(7.18\times10^{7})}}$$

$$v = \boxed{59\,415 \text{ m/s}}$$

Saturn

$$v = \sqrt{\frac{2(6.67\times10^{-11})(5.69\times10^{26})}{(6.03\times10^{7})}}$$

$$v = \boxed{35\,417 \text{ m/s}}$$

Uranus

$$v = \sqrt{\frac{2(6.67\times10^{-11})(8.80\times10^{25})}{(2.67\times10^{7})}}$$

$$v = \boxed{20\,968 \text{ m/s}}$$

② Neptune

$$v = \sqrt{\frac{2(6.67\times10^{-11})(1.03\times10^{26})}{(2.48\times10^{7})}}$$

$$v = \boxed{23\,538 \text{ m/s}}$$

③ $M = 0.82 M_e = 0.82(5.98\times10^{24}) = 4.90\times10^{24}$ kg

$r = 0.95 R_e = 0.95(6.38\times10^{6}) = 6.061\times10^{6}$ m

$$v = \sqrt{\frac{2(6.67\times10^{-11})(4.90\times10^{24})}{(6.061\times10^{6})}}$$

$$v = \boxed{10\,389 \text{ m/s}}$$

④ Mercury

$$E = \frac{GMm}{r}$$

$$= \frac{(6.67\times10^{-11})(3.28\times10^{23})(500)}{(2.57\times10^{6})}$$

$$E = \boxed{4.26\times10^{9} \text{ J}}$$

④ Venus

$$E = \frac{(6.67\times10^{-11})(4.83\times10^{24})(500)}{(6.31\times10^{6})}$$

$$E = \boxed{2.55\times10^{10}\ J}$$

Earth

$$E = \frac{(6.67\times10^{-11})(5.98\times10^{24})(500)}{(6.38\times10^{6})}$$

$$E = \boxed{3.13\times10^{10}\ J}$$

Mars

$$E = \frac{(6.67\times10^{-11})(6.37\times10^{23})(500)}{(3.43\times10^{6})}$$

$$E = \boxed{6.19\times10^{9}\ J}$$

Jupiter

$$E = \frac{(6.67\times10^{-11})(1.90\times10^{27})(500)}{(7.16\times10^{7})}$$

$$E = \boxed{8.83\times10^{11}\ J}$$

④ Saturn

$$F = \frac{(6.67 \times 10^{-11})(5.67 \times 10^{26})(500)}{(6.05 \times 10^{7})}$$

$$F = \boxed{3.14 \times 10^{11} \text{ J}}$$

Uranus

$$F = \frac{(6.67 \times 10^{-11})(8.80 \times 10^{25})(500)}{(2.67 \times 10^{7})}$$

$$F = \boxed{1.10 \times 10^{11} \text{ J}}$$

Neptune

$$F = \frac{(6.67 \times 10^{-11})(1.03 \times 10^{26})(500)}{(2.48 \times 10^{7})}$$

$$F = \boxed{1.39 \times 10^{11} \text{ J}}$$

⑤ $$v = \sqrt{\frac{2GM}{r}}$$

$$= \sqrt{\frac{2(6.67 \times 10^{-11})(1.98 \times 10^{30})}{(6.95 \times 10^{8})}}$$

$$v = \boxed{616\,479 \text{ m/s}}$$