

1. What are the units for the coefficient of friction? \_\_\_\_\_

2. 332 m/s is equivalent to

- a) 1195 km/h      b) 700 km/h  
c) 92 km/h      d) 3332 km/h

3. For every action force there is a reaction force. This is:

- a) Newton's 3<sup>rd</sup> law      b) Newton's 2<sup>nd</sup> law  
d) Newton's 1<sup>st</sup> law      d) An Older Brother

4. If a car accelerates at  $2.0 \text{ m/s}^2$  and weighs 10kg. What is the force net?

- a) 2N      b) 5 N  
b) 20N      d) 400 N

5. If a skydiver's force net is  $-166\text{N}$  and she weighs 72kg. What is her acceleration?

- a)  $0.434 \text{ m/s}^2$  [down]      b)  $0 \text{ m/s}^2$   
c)  $2.3 \text{ m/s}$  [down]      d)  $-9.8 \text{ m/s}^2$

6. State the two types of friction. \_\_\_\_\_

7. What does GUT stand for. Explain fully. (3)

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8. Given the mass and diameter (twice the radius) of these planets, calculate the acceleration due to gravity. (10)

|         | MASS(kg)             | DIAMETER (km) |
|---------|----------------------|---------------|
| Saturn  | $5.7 \times 10^{26}$ | 120 536       |
| Jupiter | $1.9 \times 10^{27}$ | 142 984       |
| Uranus  | $8.7 \times 10^{25}$ | 51 108        |
| Earth   | $6.0 \times 10^{24}$ | 12 756.34     |

**Calculate the density of Saturn. Would it float in a bucket of water?**

9. An astronaut on the surface of Mars finds that a rock accelerates at  $3.8 \text{ m/s}^2$  when it is dropped. She also finds that a Newton Scale on Mars reads 180 N when she steps on it. (6)

- a) What is her mass calculated on the surface of Mars?  
b) What would the Newton scale read if she stepped on it on earth?  
c) What would her mass be on earth?

10. How much force does it take to pull a 50 kg packing crate along a floor at a constant speed given each of the following coefficients of friction: (4)

- a) 0.10      b) 0.40

**OR**

10. A 400 kg crate is pulled along a steel floor against a friction force of 800 N. What is the coefficient of friction between the crate and the steel floor? (4)

11. If the force on a satellite is 20 000N, what is the force on the satellite if it moves **twice** the distance away? (3)

12. The earth exerts a force of 3500 N on a satellite that is orbiting 7500 km above the surface of the earth. What force does the satellite exert on the earth?(2)

**OR**

12. Draw the FBD for an airplane in flight.(2)

13. An astronaut is suspended 12 m from her space station orbiting Planet Portuguese. Explain what she could do to return to space station. Assume that the jet pack used to propel her is out of fuel, but that it can be removed without endangering her.(2)

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14. A 1000 kg car starting from rest ( $v_1=0$ ) experiences an air resistance of 5200 N and road friction of 2200 N. If the wheels push with a force of 8000 N ( $F_{\text{applied}}$ ), what is the car's net force? What is the car's acceleration? How far would the car travel in 15 seconds? (6)

15. A swimmer releases a 30kg rock from rest under water. If the resistance and buoyancy provided by the water is 160 N, how long will it take the rock to fall 1.4 m? (4)

**OR**

15. A fully loaded rocket has a mass of  $2.71 \times 10^6$  kg. Its engines have a thrust of  $3.54 \times 10^7$  N.

a) Draw a FBD of the forces on the rocket?

b) What is the acceleration of the rocket at takeoff?

c) Does the acceleration of the rocket increase or decrease as the engines continue to fire?

16. A boy and a girl swim at 3.0 m/s. They jump into the river 1.0 km across, with a current of 2.0 m/s [E]. (4)

a) The boy faces North at all times. What is his velocity relative to the ground?

b) The girl swims so that she ends up directly across from her starting point. What is her velocity relative to the ground?

c) How long does it take each to cross (in minutes)? OPTIONAL

d) How far apart are the boy and girl when they reach the opposite bank? OPTIONAL

**Bonus:**

11. A girl pulls two sleds of mass 15 kg and 35 kg with a force of 65N. What is the acceleration of the two masses and what is the tension between the two if the 15 kg mass is first. Draw a diagram. (5)