

Junior Round\_1

Page 1

- 1 A wooden post supports 10kN with a factor of safety of 2. If the engineer requires a factor of safety of 4, how much the load must be reduced by? Give your answer in kilonewtons (kN) rounded off to a whole number.
- 2 A certain car engine only converts 30% of the energy in the fuel in gasoline into useful work. The other 70% is wasted as heat. If 100 litres of fuel was used on a trip, how much of the fuel was wasted generating heat? Give your answer in litres, rounded off to a whole number.
- 3 A boat displaces 5,000 litres of water. If it also weighs 5,000 kg, what is the density of water in kilograms per litre?
- 4 The unloaded length of the spring is 400 mm. If the spring rate (k) is 10 N/mm, what will the length of the compressed spring (in mm) when it is loaded by a 600 N load?
- 5 Two 100 watt lamps, one 1100 watt microwave oven, and an 1800 watt blow drier are operating simultaneously. What is the total power consumed by these appliances in kilowatts? Round off your answer to one decimal place?
- 6 Your battery charger charges AA cells at a 460 mA rate. Your AA cells are rated at 2,300 mAh. What is the minimum number of hours must you charge a completely discharged cell so that it reaches its full capacity. Give your answer rounded to the nearest whole number.
- 7 At a rate of 96 km/h, how far can I drive in 20 minutes? Give your answer in kilometres, rounded of to the nearest whole number.
- 8 How much wood is needed for 25 desks? Give your answer in square metres, rounded off to one decimal place.
- 9 If a community's water pump drips 2 drops every second and each drop is 1 ml, how many litres of water will be wasted in one year? (Assume a 365 day year.)
- 10 How many times must the smaller wheel turn before the larger wheel completes a whole revolution?
  - A 1-1/2
  - B 2/3
  - C 2
  - D 2.7

25/09/2011 9:32:10 PM

- 11 On a factory line there are several machines. One machine takes 52 minutes to make the product; another machine takes 4 minutes to place the product in a package; a third takes 2 minutes to seal it; and a fourth takes 2 minutes to place the package into a box. How long (in hours) does the whole process take from start to finish?
- 12 On a particular map, 1 cm represents 50 km. If two cities are shown 6 cm apart on a map, what is the real distance between them in kilometres?
- 13 You design a vehicle that uses a 65 horsepower (hp) transverse mounted engine. On testing the complete car, you measure only 45 hp at the front wheels. What is the mechanical efficiency of this vehicle? Express your answer to the nearest whole percentage.
- 14 Our 1200 kg sports car accelerated from 18 kilometres per hour to a speed of 100 kilometres per hour in 3 seconds. We have found that our engine produced an average power of 150 kW over this time. What is the average horse-power our engine had to produce to cause this acceleration? Give your answer rounded to the nearest whole number.
- 15 An embedded heating cable is installed in a driveway to melt ice and snow. The driveway is 4 metres wide and 40.2 metres long. The heating cable uses 804 W of power. What is the average power consumed per square metre of driveway? Round off your answer to the nearest whole number.
- 16 Electric energy is measured in kilowatt-hours. What is the cost in cents of using a 60W light bulb for 20 hours if the cost of electricity is 15c/kilowatt-hour?
- 17 The blower motor in a car heater has a resistance of 12 ohms. What is the current supplied by a 12 volt car battery? Express your answer to the nearest tenth of an ampere.
- 18 By installing a \$90 programmable thermostat a family is able to reduce its monthly heating gas bill by \$2 per month during peak winter months of December, January and February. For the rest of the year, the savings are about \$1 per month. How many years will it take for this family to recover the cost of the programmable thermostat?
- 19 The cylindrical container has a diameter of 15 cm, while the rectangular-shaped box has a rectangular top that measures 14 cm by 10 cm. Which of the following statements is correct?
  - A The rectangular box holds more raisins
  - B The cylindrical box holds more raisins
  - C They both hold the same amount
  - D Impossible to tell without knowing the height

25/09/2011 9:32:10 PM

- 20 If the motor has an efficiency of 97% and the pump is 68% efficient, how much hydraulic power is produced by the pump (in watts) if 1,000 W of electrical power were supplied to the motor?

25/09/2011 9:32:10 PM

## Answer Key : Junior Round\_1

Question:	Answer
1	5 (+/- 0.5%)
2	70 (+/- 0.5%)
3	1 (+/- 0.1%)
4	340 (+/- 1%)
5	3.1 (+/- 0.1%)
6	5 (+/- 0.1%)
7	32 (+/- 0.2%)
8	7.2 (+/- 0.2%)
9	63072 (+/- 10%)
10	A
11	1.0 (+/- 0%)
12	300 (+/- 0%)
13	69 (+/- 1%)
14	201 (+/- 2.0%)
15	5 (+/- 0.2%)
16	18 (+/- 1%)
17	1 (+/- 0.1%)
18	6 (+/- 0.1%)
19	B
20	660 (+/- 5%)

25/09/2011 9:32:10 PM