Grade 12 Physics Diagnostic Test

Time: 1.5 hour

Name: _____

Date: _____

Please show all your work for full marks. ***Square/box your final answers*** *and pay attention to units and* ***significant digits.***

1. A stone is dropped with zero initial velocity from a bridge that is 75.0 m above the water. Nancy waits 2.45 s after releasing the first stone and throws a second stone so that the two stones hit the water at the same time.

   a) [2 marks] Calculate how long the first stone take to hit the water?

   b) [2 marks] Calculate the **initial velocity** the second stone must be released with?

   c) [3 marks] Under another scenario, a stone is thrown up at the velocity of 30.0 m/s, after 2.00 seconds, the second stone is also thrown upwards at a slightly faster velocity 40.0 m/s. At what time do they meet in the air?

2. A candle has 7525 J of energy stored in its chemical bonds. the energy is used to heat 150 g of water, which has a starting temperature of 21.0 ℃.

   a) [T, 2 marks] Calculate the **final temperature** of the water if all the energy is transferred to the water.

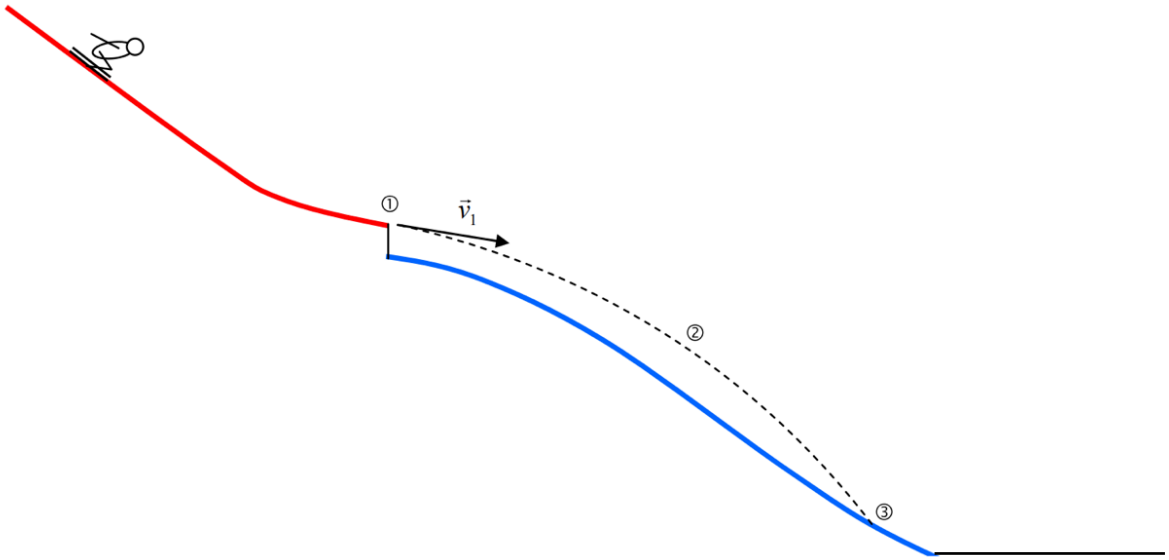
   b) [T, 3 marks] Is the energy stored in the candle sufficient to melt a 10.0 g cube of ice from $-2℃$ to $3℃$?

Table 1 Specific Latent Heats for Various Substances

Substance	Specific latent heat of fusion (L_f) (J/kg)	Melting point (°C)	Specific latent heat of vaporization (L_v) (J/kg)	Boiling point (°C)
aluminum	6.6×10^5	2519	4.0×10^5	10 900
ethyl alcohol	1.1×10^5	−114	8.6×10^5	78.3
carbon dioxide	1.8×10^5	−78	5.7×10^5	−57
gold	1.1×10^6	1064	6.4×10^4	2 856
lead	2.5×10^4	327.5	8.7×10^5	1 750
water	3.4×10^5	0	2.3×10^6	100

Substance	Specific Heat Capacity (J/kg·°C)	Substance	Specific Heat Capacity (J/kg·°C)
Water	4.18×10^3	Ethyl alcohol	2.46×10^3
Ice	2.1×10^3	Aluminum	9.2×10^2
Glass	8.4×10^2	Iron	4.5×10^2
Iron	4.5×10^2	Copper	3.8×10^2
Silver	2.4×10^2	Lead	1.3×10^2

3. The ski jump is an exciting and death-defying event that turns human beings into projectiles! A ski jumper will be launched with a velocity of 26.1m/s, 11.25° below the horizontal at ①. Later on, all frictions are neglected, the jumper makes her leap and we can note three events:
   - leaving the ramp at ①,
   - during ②, part way down after 1.80 s,
   - after she landing at ③, the plat form (both sloped portion and flat portion) that allows her come to stop eventually.

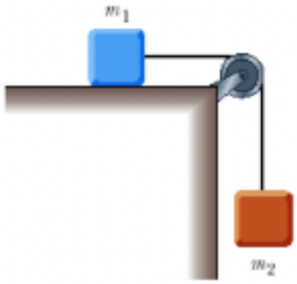


a) [2 marks] What **height** up the mountain is required to allow the ski jumper reach the velocity of 26.1m/s when she leaves the ramp? Use conservation of energy.

b) [3 marks] Calculate what is the ski jumper's **speed** when she landing (i.e., the instant after 1.8s since she leaving the ramp).

4. A crate with a mass of 32.5 kg sits on a frictionless surface and is connected to a second crate by a string that passes over a pulley. The second crate has a mass of 40.0kg. The pulley is frictionless and has no mass. The string also has no mass.

   a) [2 marks] Draw a free body diagram for both masses
   b) [2 marks] Determine the acceleration of the system of crates.
   c) [1 mark] Determine the tension in the string.



5. [A, 2 marks] When two tuning forks are vibrating at the same time one observes that the sound grows louder then softer at regular intervals. The change in volume occurs at a rate of exactly 48times in 16.0 s. if one tuning fork is known to have a frequency of 256.0 Hz, what are the two possible frequencies of the second tuning fork?

Multiple choice [20 marks]

1. Which of the following values is a scalar value?
   a) velocity
   b) time
   c) displacement
   d) force
   e) acceleration

2. an ambulance races toward you with the siren sounding. the property of sound that accounts for the siren sounding different as it approaches as compared to when it departs is:
   a) resonance
   b) a standing wave
   c) frequency beats
   d) the Doppler effect
   e) none of above

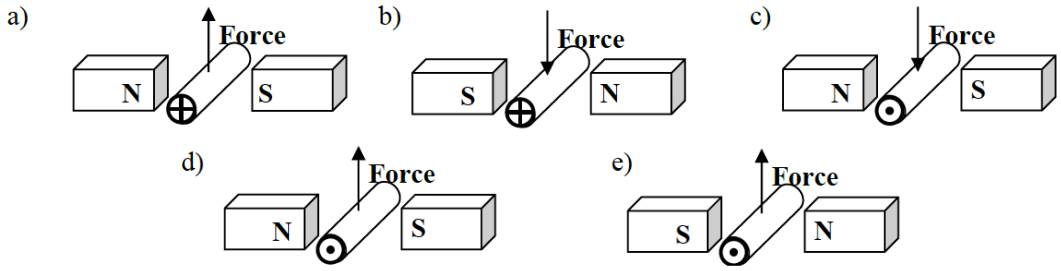
3. Which of the following forms of energy is a form of potential energy?
   a) sound
   b) thermal
   c) light
   d) magnetic
   e) mechanical

4. A student throws their physics text vertically upward. as the textbook rises, which of the following quantities increases?
   a) total energy
   b) speed
   c) acceleration
   d) kinetic energy
   e) gravitational potential energy

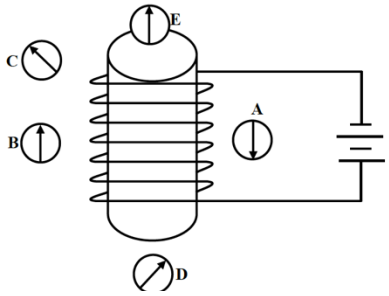
5. Which of the following is a negatively charged particle?
   a) nucleus
   b) proton
   c) electron
   d) neutron
   e) None of above

6. an ambulance races toward you with the siren sounding. the property of sound that accounts for the siren sounding different as it approaches as compared to when it departs is:
   f) resonance
   g) a standing wave
   h) frequency beats
   i) the Doppler effect
   j) none of above

7. Which of the following situations represents the correct relationship between the current, magnetic field and force acting on the conductor?



8. Which of the following compass needles is accurately representing the direction of the magnetic field associated with this coil?



a) A b) B c) C d) D e) E

9. Specific heat capacity of an object depends on:
   a) the material from which the object is made
   b) the shape of the object
   c) the temperature of the object
   d) the mass of the object
   e) the density of the object

10. The propulsion of a rocket in space by the expulsion of gases from the rocket is best explained by using which of Newton's laws of motion?
    a) Newton's 1st Law
    b) Newton's 2nd Law
    c) Newton's 3rd Law
    d) Newton's Law do not apply in space
    e) Newton's 4th Law

11. If the unbalanced force acting on an object is doubled, the acceleration of the object is:
    a) the same
    b) doubled
    c) quadrupled
    d) it cannot be determined
    e) halved

12. A 120 V, 8.0 A circuit has a resistance of:
    a) 10 Ω
    b) 12 Ω
    c) 15 Ω
    d) 18 Ω
    e) 16 Ω