- 1. A ball is thrown straight up. At the top of its path, the net force acting on it is
 - A) greater than its weight.
 - B) equal to its weight.
 - C) less than its weight, but not zero.
 - D) instantaneously equal to zero.
 - E) dependent on the force it was thrown with.
- 2. Anna is falling through the air when she opens her parachute and soon reaches a terminal velocity. Starting at the time when her parachute opens,which of the graphs below most closely resembles the velocity-time graph of her motion?



3. Data from an experiment was plotted to give the graph below. Which expression best represents the data?



A) d = 20 t	B) d = 15 t	C) d = 25
D) d = 25 + 15 t	E) d = 25 + 20 t	

4. A ping-pong ball dropped from rest reaches a terminal velocity of 1.0 m/s. If the same ball were projected <u>upwards</u> at 1.0 m/s, its instantaneous acceleration would be: (magnitude only)

A) 0	B) 1.0 m/s^2	C) 2.0 m/s ²
D) 9.8 m/s ²	E) 19.6 m/s ²	

- 5. The Space Shuttle travels at a speed of 7.61 x 10^3 m/s in its circular orbit around the Earth. If the period of its orbit is 1.50 h, what is the radius of its orbit? A) 5.07 x 10^3 m B) 1.14×10^4 m C) 6.85×10^5 m D) 6.54×10^6 m E) 4.11×10^7 m
- 6. A car travelling on a straight track accelerates uniformly from rest for 5.0 s and then travels at a constant speed for the next 5.0 s, covering a total distance of 75 m in that time. Determine the constant speed that the car achieved.
 A)7.5 m/s
 B) 10 m/s
 C) 15 m/s
 D)20 m/s
 E) 30 m/s
- 7. Two cyclists are travelling at constant speeds around a 400 m track in opposite directions. The speed of Jeff is 1.5 times the speed of Rob. The cyclists find they meet every 20 s. What is the speed of Jeff?
 A)9.0 m/s
 B) 12 m/s
 C) 13 m/s
 D)20 m/s
 E) 30 m/s
- Which word fits best? Pitch is to sound as _____ is to light.
 - A) colour
 - B) brightness
 - C) speed
 - D) amplitude
 - E) intensity
- 9. A guitar string sounded at the same time as a 512 Hz tuning fork produces 20 beats in 4.0 seconds. The string is tightened and 2.0 beats/s are now heard. What was the original frequency of the guitar string?

 A)492 Hz
 B) 507 Hz
 C) 510 Hz
 D)517 Hz
 E) 532 Hz
- 10. A car has a loose bolt in the dashboard with a natural frequency of 5.0 Hz. It vibrates in resonance whenever the car reaches a certain speed, because one of the car's tires is unbalanced and "bumps" the car once each rotation. If the radius of the tire is 36 cm, what is the car's speed, when the bolt vibrates? A > 7.2 cm/s

A)7.2 cm/s	B) 45 cm/s	C) 5.7 m/s
D)11 m/s	E) 72 km/h	

- 11. Which of the following statements correctly describes the changes that occur in a sound wave, as it passes from cool air into warmer air?
 - A) Speed, wavelength and frequency all increase.
 - B) Speed, wavelength increase; frequency decreases.
 - C) Speed, wavelength increase; frequency unchanged.
 - D) Speed, frequency decrease; wavelength increases.
 - E) Speed, frequency decrease; wavelength unchanged.

12. A single converging lens forms an image of a candle on a screen as shown below.



If the bottom half of the lens is now covered, the image on the screen will:

- A) only show the top half of the candle.
- B) only show the bottom half of the candle.
- C) show all of the candle.
- D) not show an image of the candle at all.
- E) become out of focus.
- 13. A light ray travels through three different media in the path shown below.



If v represents the speed of light then which of the following relationships is correct?

A) \mathbf{v}_1	>	\mathbf{V}_2	>	\mathbf{V}_3
B) v ₁	>	\mathbf{V}_3	>	\mathbf{V}_2
C) v ₃	>	\mathbf{V}_2	>	\mathbf{V}_1
$D)v_3$	>	\mathbf{v}_1	>	\mathbf{V}_2
E) v ₂	>	\mathbf{v}_1	>	\mathbf{V}_3

- 14. Zircon has a critical angle of 31°. Total internal reflection occurs when light is incident
 A)from air to zircon at an incident angle of 31°
 B) from air to zircon at an incident angle of > 31°
 C) from air to zircon at an incident angle of < 31°
 - D)from zircon to air at an incident angle of $> 31^{\circ}$
 - E) from zircon to air at an incident angle of $< 31^{\circ}$
- 15. Consider what you would see if a large rectangular block of glass were placed on this exam, between your eyes and the words. The block has parallel flat sides. Compared to originally, the test would now appear: A)exactly as it did before.
 - B) further away and the printing smaller.
 - C) further away and the printing larger.
 - D) closer to you and the printing smaller.
 - E) closer to you and the printing larger.
- 16. An electrical measurement in amperes at a point in a circuit is a measure of
 - A) the force that moves the charge.
 - B) the resistance to the movement of charge.
 - C) the energy used to move the charge.
 - D) the speed of the charge.
 - E) the amount of charge passing a point per second.

- 17. A student was completing a problem and ended with a final answer that had units: <u>Volt Ampere</u> metre/second
 Which quantity was he solving for?
 A)power
 B) energy
 C) force
 D)resistance
 E) charge
- **18**. Consider the following circuit diagram. The input is a constant voltage source.



When the switch is open, the ammeter reads 2.0 A.When the switch is closed, the ammeter would read:A) 0.74 AB) 0.93 AC) 2.0 AD) 2.3 AE) 9.3 A

19. Three identical conducting spheres, X, Y, and Z, are mounted on insulated stands. Initially, X has a charge of +4 C, Y is neutral and Z has a charge of -10 C. Sphere Y is touched to X, then to Z, and then to X again. What charges are on each sphere now?

	X	Y	Z
A)	0 C	0 C	0 C
B)	+4 C	0 C	-10 C
C)	-2 C	-2 C	-2 C
D)	-1 C	-1 C	-4 C
E)	-2 C	-2 C	-6 C

- 20. Which of the following materials would make the best magnetic shielding around a computer monitor?
 A)tin
 B) lead
 C) plastic
 D)nickel
 E) copper
- 21. A straight conductor rests in the space between two arms of a ferromagnetic core (presently unmagnetized). After the switch has been closed for a while, in what direction is the magnetic force acting on the conductor?



A) upB) downC) rightD) leftE) there is no force exerted

- 22. Which of the following devices does <u>not</u> make use of an electromagnet in its normal operation?
 - A) liquid crystal display monitor
 - B) loudspeaker
 - C) electric motor
 - D) galvanometer
 - E) floppy disk drive
- 23. An ideal transformer has 500 turns in the primary and 100 turns in the secondary. It is used to power a 60 W soldering iron. If the primary voltage is the household 120 VAC, what current would flow in the secondary circuit?
 A)0.20 A
 B) 0.40 A
 C) 0.50 A
 D)2.0 A
 E) 2.5 A
- 24. The 1998 Nobel Prize in Physics went to Laughlin, Stormer, and Tsui for their discovery of a new form of quantum fluid with fractionally charged excitations. The experimental data for this work was obtained at
 - A) Stanford Linear Accelerator Centre
 - B) Oak Ridge National Laboratory
 - C) Chalk River Nuclear Laboratories
 - D) Lawrence Livermore National Laboratory
 - E) Bell Laboratories
- 25. The Lunar Prospector probe reached the moon and detected signs that the moon has a solid iron core 500 to 800 km in diameter. It also detected, near the poles, signs of
 - A) a strong magnetic field.
 - B) tons of oxygen stored as oxides.
 - C) sporadic gamma ray bursts.
 - D) ancient volcanic activity.
 - E) water in the form of ice.
- 26. Since the Cold War ended, the United States has been investigating means of reducing its stores of weaponsgrade plutonium. Which of the following has been contemplated as a long term solution?
 - A) incinerating the plutonium in blast furnaces.
 - B) chemically forming safe plutonium compounds.
 - C) using it in Canadian CANDU reactors.
 - D) freezing it down to liquid Helium temperatures.
 - E) exploding it in small amounts at a time.
- 27. Cathode rays are to beta radiation as X-rays are to:
 - A) alpha radiation
 - B) beta radiation
 - C) gamma radiation
 - D) phonon radiation
 - E) neutrino radiation

- 28. Polonium-218 (atomic number 84) decays by emitting an alpha particle, followed by a beta particle. The resulting product is an isotope of bismuth. How many neutrons would this isotope of bismuth have?
 A) 131
 B) 132
 C) 133
 D) 134
 E) 135
- 29. It has been claimed that 1999 is unusual in that it contains two blue moons, in January and March. The media have been reporting this as a second full moon within a calendar month, although this appears to be a fairly recent interpretation. The question is this: At what time of day does the full moon rise?
 - A) The full moon rise can occur at any time.
 - B) The full moon rise occurs at midnight.
 - C) The full moon rise occurs at sunset.
 - D) The full moon rise occurs any time between sunset and midnight.
 - E) The full moon rise occurs in daylight hours.
- 30. The Y2K problem will arrive this year. It was caused by the high price of computer memory which made programmers code the year in only two digits, thereby using only two bytes of memory, and ignoring the century. Suppose that 2000 were expressed in binary code instead, as a string of 1's and 0's. How many 1's are in the binary representation of 2000?

A) 5	B) 6	C) 7
D) 8	E) 11	