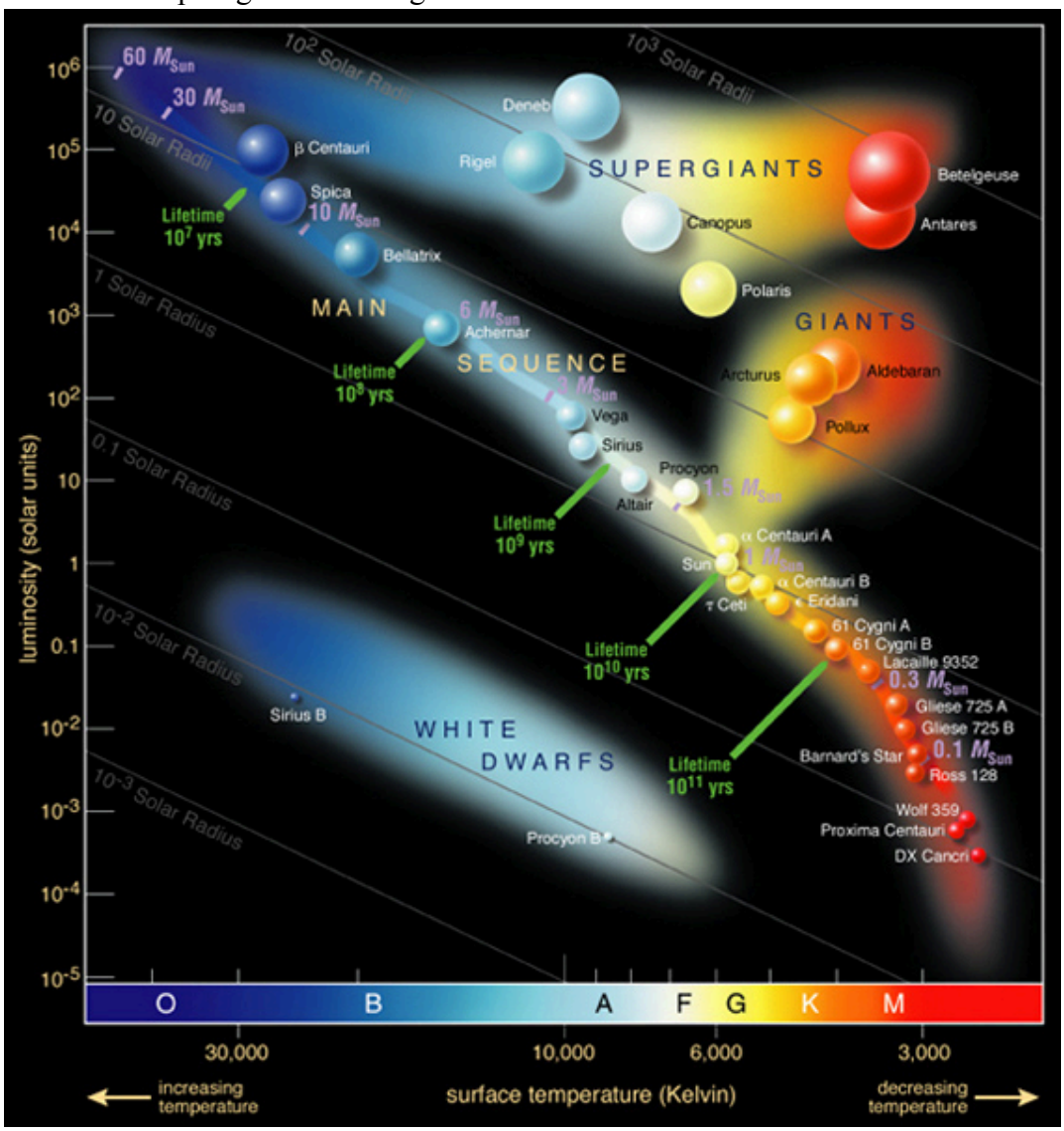
Science 10 Formula Sheet

$v = \Delta d / \Delta t$ $E_P = mgh$ $E_K = \frac{1}{2}mv^2$ $E_M = E_P + E_K$

$E_H = mc\Delta T$ $g = 9.8 m/s^2$ Carbon-14 Half-life: 5730 years

Hertzsprung-Russell Diagram



1. In regard to the structure of DNA, what role do the adenine, guanine, cytosine and and thymine play?
    a. They are the sugar and a phosphate backbone
    b. They form the sets of two nitrogen bases that are paired together
    c. They form the entire double helix
    d. They are responsible for making proteins

2. Identify the correct order of organization of genetic material, from largest to smallest.
    a. Gene, chromosome, nucleotide, genome
    b. Genome, chromosome, gene, nucleotide
    c. Chromosome, gene, genome, nucleotide
    d. Chromosome, genome, nucleotide, gene

3. A strand of DNA is found to contain 28% Cytosine. What percentage of the strand would be Thymine?
    a. 28% b.72% c. 44% d. 22%

4. Which of the following statements about gene mutation is false?
    a. A gene mutation always results in the death of the organism
    b. If a gene sequence of nitrogen bases is CGATA, then an example of a mutated form of the gene sequence might be AGATA
    c. A faulty gene could potentially mutate into a healthy gene
    d. Radiation, such as X-rays or UV rays, is an example of a potential mutagen

5. A small strand of DNA that codes for a particular protein or trait is called a:
    a. Gene b. Chromosome c. Mutation d.Nucleotide

6. Which of the following allele pairings would you expect to find in an organism expressing the recessive version of a trait?
    a. Tt b.TT c. tt d. tT

7. In pea plants green pods (G) are dominant over yellow pods (g). A homozygous recessive plant is crossed with a heterozygous plant. What percentage of the offspring will have green pods?
    a. 100% b. 75% c. 50% d. 25%

8. Which of the following identify genotype?

I	TT
II	short-haired cat
III	the genes for a particular trait
IV	the physical appearance of an organism

    a. I and III only
    b. I and IV only
    c. II and III only
    d. II and IV only

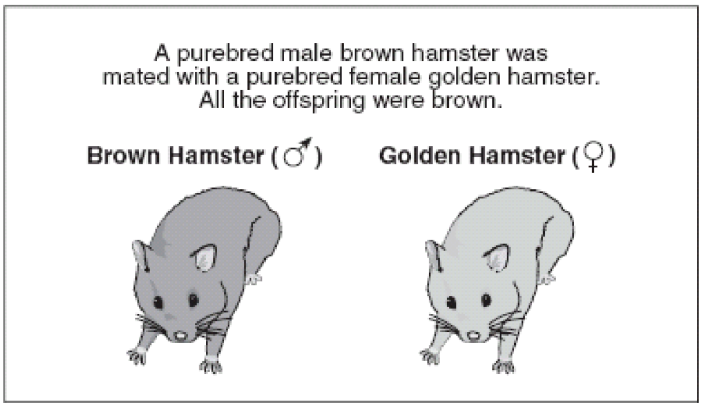
Use the following representation of a Punnett Square to answer question 9

	P	Q
R	S	T
U	V	W

9. Which of the following represent the position of the alleles of potential offspring?
   a. P, Q, S, T b. P, Q, R, U c. R, S, U, V d. S, T, V, W

10. Having purple flowers is dominant and having pink flowers is recessive. If there is a 100% chance that a particular plant will have purple flowers, which of the following represent the alleles of the parent generation?
   a. pp x pp b. Pp x Pp c. PP x pp d. Pp x pp

Use the following information to answer question 11



11. Which of the following describes the genotype of the offspring?
   a. heterozygous
   b. homozygous recessive
   c. homozygous dominant
   d. heterozygous dominant and homozygous recessive

12. What will produce a white flower with a red trim when a white flower is crossed with a red flower?
   a. Mutation b. Dominance c. codominance d. incomplete dominance

13. Hemophilia is a sex-linked blood clotting disorder that can occur in both men and women but is more common in men. This is because the allele causing hemophilia occurs in the following location
   a. on an X chromosome
   b. on a Y chromosome
   c. on both an X and a Y chromosome
   d. on a non-X and a non-Y chromosome

Use the following information to answer question 14

A male black mouse was mated with a female white mouse.

Black Mouse (♂) **White Mouse (♀)**

Codons Found in Messenger RNA

First Base	Second Base: U	Second Base: C	Second Base: A	Second Base: G	Third Base
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

14. When the black mouse and the white mouse were crossed, 9 out of 12 offspring were white. Which of the following describes the most likely genotype of the female parent given the fur colour of the offspring produced?
    a. heterozygous only
    b. homozygous dominant only
    c. homozygous recessive only
    d. homozygous dominant or heterozygous

15. What chain of amino acids would be produced from the DNA sequence TAC CCG ATG GTA ?

    a. Met - Gly - Tyr - His
    b. Stop - Pro - Met - Val
    c. Met - Arg - Tyr - Phe
    d. Ile - Val - Met - Glu

16. Which of the following statements regarding gene expression are correct?

I	Both transcription and translation occur in the nucleus
II	Transcription makes a single strand of complementary RNA from the DNA code
III	Codons are three letter sequences that correspond to a specific amino acid
IV	Transcription builds connects amino acids to form a protein
V	Translation occurs at a ribosome

    a. I, II, III
    b. II, III, V
    c. I, II, IV
    d. All are correct

17. A woman with blood type AB and a man with type A have a child with blood type B. What must the genotype of the father be?
    a. A
    b. AA
    c. AO
    d. It is impossible to tell from the information given.

18. Mutations are important in evolution because
    a. they are the only source of new variation in populations
    b. they remove less fit individuals from populations
    c. they occur to create new species when selective pressures are strong
    d. they create differences in fitness in populations

19. Which of the following is true of variation?
    a. It is necessary for natural selection.
    b. It exists in almost all populations.
    c. It is caused by mutations and sexual reproduction.
    d. All of the choices are correct.

20. According to Darwin's theory of natural selection, the individuals that tend to survive are those that have…
    a. variations best suited to the environment.
    b. the ability to change their bodies to fit the environment.
    c. the best luck.
    d. the biggest body.

20a. The breeding of plants and animals for particular traits by humans is called _____.
    e. natural selection
    f. gene flow
    g. founder effect
    h. artificial selection

21. Which of the following best describes the properties of an electron?

	Relative Mass	Location
A.	large	In the nucleus
B.	large	Orbiting the nucleus
C.	small	In the nucleus
D.	small	Orbiting the nucleus

22. The non-metallic element in the third period other than sulphur and chlorine is_____.
A. oxygen B. fluorine C. nitrogen D. phosphorus

23. Which of the following represents the Bohr model electron arrangement of an argon atom?
A. 2, 16 B. 2, 18 C. 2, 8, 6 D. 2, 8, 8

24. What isotope has 25 protons and 29 neutrons?
A. Copper-25 B. Copper-54 C. Manganese-29 D. Manganese-54

25. What is the chemical formula for aluminum oxide?
a. A. Al_2O_3 B. Am_2O_3 C. NH_4O D. $(NH4)_2O$

26. In which of the following compounds does iron have the same ion charge (combining capacity)?

I. FeS
II. $Fe(OH)_2$
III. $FeCrO_4$
IV. $Fe_2 (CO_3)_3$

A. I and II only B. I, II and III only C. II, III and IV only D. I, II, III and IV

27. What is the name of the compound $Sn(SO_4)_2$?
A. Tin sulfate B. Tin (I) sulfate C. Tin (II) sulfate D. Tin (IV) sulfate

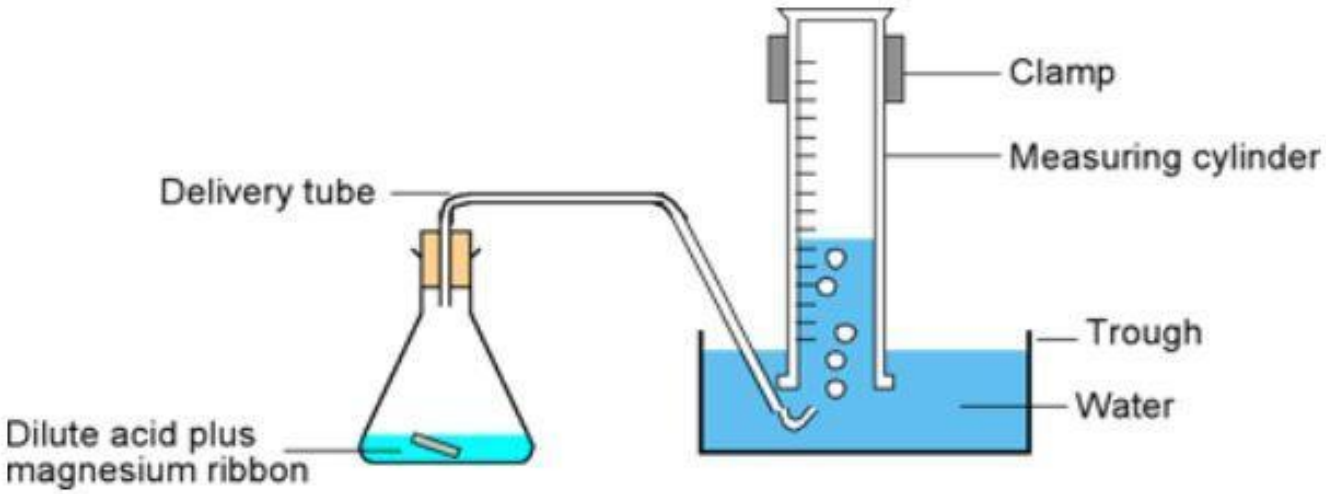
28. What is the formula for the compound dinitrogen pentoxide?
A. NO_4 B. NO_5 C. N_2O_4 D. N_2O_5

29. In a chemical reaction, mass is conserved. This means that:
    A. The mass of the reactants stays the same during a chemical reaction
    B. The mass of the products stays the same during a chemical reaction
    C. The type and number of atoms in the reactants equals the type and number of atoms in the products
    D. The mass of the products is always twice the mass of the reactants.

30. The reaction: $Zn_{(s)} + 2\ HCl_{(aq)} \rightarrow H_{2(g)} + ZnCl_{2(aq)}$ is an example of:
    A. Synthesis B. Decomposition C. Single replacement D. Double replacement

31. The reaction: $2\ KClO_{3(s)} \rightarrow 2\ KCl_{(s)} + 3\ O_{2(g)}$ is an example of:
    A. Synthesis B. Decomposition C. Single replacement D. Double replacement

Use the illustration for the questions #12 and # 13.



32. What are the reactants in the demonstration above?
    A. Mg and O_2 B. Mg and H_2 C. Mg and H_2O D. Mg and HCl

33. What gas is collected in the test tube?
    A. O_2 B. H_2 C. Cl_2 D. MgH_2

34. Which set of ordered coefficients correctly balances the following equation?

    ___ K_3PO_4 + ___ $ZnSO_4$ → ___ K_2SO_4 + ___ $Zn_3(PO_4)_2$

    A. 1, 2, 3, 2 B. 2, 1, 3, 2 C. 2, 2, 1, 3 D. 2, 3, 3, 1

35. Which of the following products would complete and balance the equation?

    $CH_4 + 2\ O_2 \rightarrow$ ____ + 2 H_2O

    A. CO B. CO_2 C. 2 CO D. 2 CO_2

36. Which of the following correctly classifies each formula as an acid, base or salt?

	Acid	**Base**	**Salt**
A.	$Ca(OH)_2$	H_2CO_3	$MgCl_2$
B.	H_2CO_3	$Ca(OH)_2$	$MgCl_2$
C.	$MgCl_2$	H_2CO_3	$Ca(OH)_2$
D.	$Ca(OH)_2$	$MgCl_2$	H_2CO_3

37. Which of the following is most likely to cause blue litmus paper to turn red?
A. soap B. baking soda C. lemon juice D. oven cleaner

38. Coffee has a pH of 5. Which of the following shows the correct colour of each pH indicator when a small amount of black coffee is tested?

	Indigo Carmine	Methyl Orange	Bromthymol Blue
A.	blue	yellow	yellow
B.	blue	yellow	blue
C.	yellow	red	blue
D.	yellow	red	yellow

39. If two substances react and the temperature of the mixture increases, the reaction is
A. Endothermic B. Exothermic
C. One that needs a catalyst D. Not one that produces anything new

40. Which of the following reactions is written correctly for an exothermic reaction?

A. $2\ C_2H_{6(g)} + 7\ O_{2(g)} + \text{heat} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)}$

B. $2\ C_2H_{6(g)} + 7\ O_{2(g)} - \text{heat} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)}$

C. $2\ C_2H_{6(g)} + 7\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)} - \text{heat}$

D. $2\ C_2H_{6(g)} + 7\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O_{(g)} + \text{heat}$

Physics Section #41-60 (20 marks)

41. Calculate the potential energy of Justin Bieber (mass = 68 kg) if he is singing from a stage 8m above the ground.

A. 2990 J
B. 5331 J
C. 7298 J
D. 10 487 J

42. The F-18 Hornet is flying in the exosphere at top speed. What types of energy does it have?

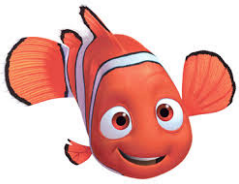
I	Kinetic Energy
II	Potential Energy
III	Mechanical Energy

A. I only
B. I and II only
C. II and III only
D. I, II, and III

43. An 18kg water barrel is lowered from the roof (30 metres above the ground) to the 4th floor (13 metres above the ground). How has the barrel's potential energy changed?

A. Increased by 300
B. Decreased by 300 J
C. Increased by 3000 J
D. Decreased by 3000J

44. A 2kg fish is swims with 25 J of kinetic energy. How fast is it moving?

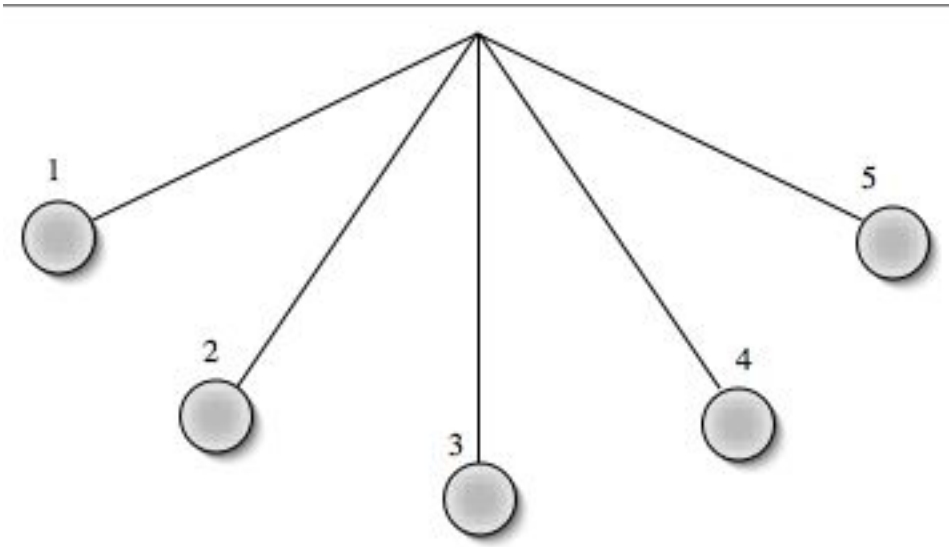


A. 1.39 m/s B. 5.00 m/s C. 6.94 m/s D. 25 m/s

45. A 0.9kg baseball is thrown straight up with an initial velocity of 20m/s. Assuming there is no air resistance, how high will the ball go?

A. 1 m B. 20 m C. 41 m D. 200 m

Use the following drawing of a pendulum to answer questions 46 & 47. Assume the pendulum is <u>dropped from rest at point 1</u> and that there is no air resistance.



46. When the pendulum is at point 5, the pendulum has:

    C. Potential Energy and Kinetic Energy

    B. Kinetic Energy only
    C. Potential Energy only
    D. No Energy

47. When does the pendulum have the most mechanical energy (E_M)?

    A. Point 1 & 5 B. Points 2 & 4 C. Point 3 D. Same at all points

48. A metal ball is dropped from 10 metres above the ground and bounces back up into the area. A second ball, identical in every way except with exactly double the mass, is dropped from the same height. If we ignore friction, which of the following statements is true?

    A. The second ball will bounce higher than the first ball.
    B. The second ball will bounce lower than the first ball.
    C. The second ball will bounce the same height as the first ball.
    D. We cannot determine the difference between the ball's heights.

49. A swinging pendulum will eventually come to rest at the bottom with no kinetic energy. Where has the energy gone?

    A. It has been converted into gravitational energy
    B. It has been converted into heat and sound energy
    C. It has been converted into potential energy
    D. It has been converted into gravity

50. A basketball (m = 1.15 kg) is dropped from 1.8m and bounces back up to 1.2m. How much mechanical energy is converted into sound energy?

    A. 6.8 J
    B. 13.5 J
    C. 18.5 J
    D. 20.3 J

51. A Train (mass = 1500 kg) is traveling at 20 m/s and the driver applies the brakes slowing it down. It has radiated 200,000 J of heat energy. How fast is it now traveling?

A. 0 m/s
B. 8.44 m/s
C. 11.5 m/s
D. 133 m/s

52. In the equation "E = mcΔT", what does Δ mean?

A. specific heat capacity
B. temperature
C. multiplied by
D. change in

53. Assuming the specific heat capacity of magnesium is 1020 J/kg°C, how much energy is required to heat raise 12g of water by 20°C?

A. 4.25 J B. 245 J C. 612 J D. 244 800 J

54. A lithium battery overheats and converts 125,000 J of energy into heat. If the battery's temperature has raised by 25°C and lithium has a specific heat capacity of 3560 J / kg°C, what is the mass of the battery?

A. 1.4g B. 1.4kg C. 878g D. 878kg

55. According to the equation below, when Radium decays into Radon, what other particle is produced?

$$^{222}_{88}Ra \rightarrow {}^{218}_{86}Rn + ?$$

A. a proton B. a neutron C. a beta particle D. an alpha particle

56. Which of the following has the highest energy / penetrating power?

A. an alpha particle B. a beta particle C. a gamma particle D. an electron

57. A Carbon-14 sample of a woolly mammoth hair shows it contains only 3% of its original Carbon-14. Approximately how old is this hair?

A. 5 years B. 3 half-lives C. 29,000 half lives D. 29 000 years

58. Mendelium-257 has a half-life of approximately 6 hours before it decays into Einsteinium-253. If you have a sample that's one day old, what percentage of it will be Einsteinium-253?

A. 2% B. 6% C. 94% D. 98%

59. Which of the following occurs in a nuclear power plant?

A. Fusion of hydrogen atoms B. Fission of hydrogen atoms
C. Fusion of uranium atoms D. Fission of uranium atoms

60. When Uranium-235 is struck by a neutron, it can decay into Barium-141 and Krypton-92. How many neutrons are also emitted?

A. 1 B. 2 C. 3 D. 4

61. What is the current age of the Universe, as estimated by the Big Bang Theory?

A. about 14 000 years
B. about 14 000 000 years
C. about 14 000 000 000 years
D. about 14 000 000 000 000 years

62. What does it indicate if light from a galaxy is shifted to the red part of the spectrum?

A. The galaxy is not moving.
B. The galaxy is moving away from Earth.
C. The galaxy is moving closer to Earth.
D. The galaxy is moving the same speed as Earth.

63. What does the image below represent and how can it be used?

A. The spectrum of sunlight, and each colour shows a different element
B. The spectrum of sunlight, and the colours show the presence of hydrogen
C. The spectrum of hydrogen, and the colours are a fingerprint unique to that element
D. The spectrum of hydrogen, and the colours have all been blue shifted by the expansion of the universe.

64. What force holds the stars in a galaxy together in a group?

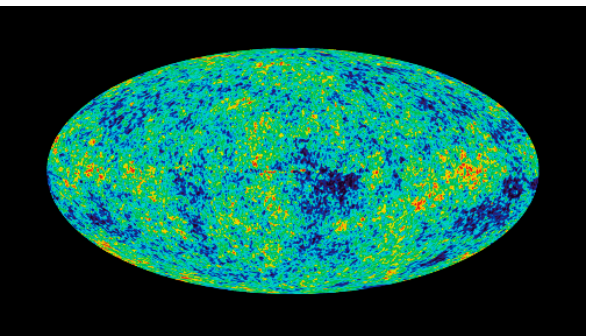
A. black holes B. centrifugal force C. dark matter D. gravity

65. The image on the right shows a vast cloud of hydrogen and dust surrounding as a tiny star. The star is 30 km across and spins many times per second. It is possible for light to escape from it. What kind of star is it?

A. a white dwarf
B. a neutron star
C. a proton star
D. a black hole

66. Which electromagnetic waves are observed using an optical telescope?

A. radio
B. visible light
C. infrared
D. X rays



67. What is represented by the image on the left?

A. cosmic redshift left over from the Big Bang
B. cosmic microwaves left over from the Big Bang
C. cosmic redshift showing an expanding Universe.
D. cosmic microwaves showing the cosmic redshift

68. What it the origin of the cosmological redshift?

A. The collision of supermassive black holes.
B. The expansion of the universe.
C. Galaxies speeding towards us.
D. The cosmic microwave background.

69. How do most nebulas form?

A. from the cores of a dead stars
B. from the left over debris of supernova explosions
C. from the collisions of pairs black neutron stars
D. from the collisions of galaxies passing through each other

70. What is the main feature visible in the image shown at right?

A. a nebula
B. a red dwarf
C. a supernova
D. an irregular galaxy

71. What are the two most common elements in the Universe?

A. helium and neon
B. hydrogen and helium
C. hydrogen and neon
D. oxygen and iron

72. What is the main nuclear reaction in the Sun today?

A. H + H He
B. He + He Li
C. He + He O
D. Al + Al Fe

73. What is the final fate of a white dwarf star?

A. red giant, in about 5 billion years
B. red giant, in about 100 billion years
C. black dwarf, in about 5 billion years
D. black dwarf, in about 100 billion years

74. What is happening in the photograph shown at right?

A. Two nebulas are collapsing together
B. Two galaxies are colliding
C. A star is exploding in a supernova
D. Two stars are in close orbit around each other.

75. What is the next stage in the life cycle of our Sun?

A. red giant
B. red supergiant
C. supernova
D. black dwarf

76. Approximately how long does it take light to move from the surface of the Sun to the next nearest star, Alpha Centauri?

A. 3 seconds
B. 8 minutes
C. 4 years
D. 20 000 years

77. What is the original source of most of the hydrogen in the universe?

A. In nebulas.
B. During supernova explosions.
C. In the cores of small stars that will not become supernovas.
D. In the first minute of the Big Bang event, after protons and neutrons came into existance.

78. Which of the following supports the hypothesis that supermassive black holes exist in the centres of galaxies?

A. Rotating spiral galaxies do not fly apart.
B. Nebulas collapse into new stars.
C. Stars at the centre of the Milky Way seem to be orbiting nothing at all.
D. Supernovas may explode and collapse into black holes.

79. In about 50 billion years, our Sun will no longer be a yellow star. What will it be?

A. a white dwarf
B. a red dwarf
C. a red giant
D. a black hole

80. If a supergiant star explodes, what will the core of the star turn in to?

A. a white dwarf or a nebula
B. a red dwarf or a white dwarf
C. a neutron star or a black hole
D. a black dwarf or a white dwarf

Refer to the Hertzsprung Russell Diagram below for the following questions:

81. What is the approximate luminosity and surface temperature of the star Belatrix?

A. 4000 brighter than the Sun and 6 000 degrees
B. 4000 brighter than the Sun and 20 000 degrees
C. 10 000 times brighter than the Sun and 6 000 degrees
D. 10 000 times brighter than the Sun and 20 000 degrees

82. What kind of a star is Antares?

A. main sequence
B. red dwarf
C. red supergiant
D. white dwarf

83. Suppose that Polaris and Sirius looked equally bright as viewed from Earth. Which star would be closest to us?

A. Polaris, because it is a yellow star.
B. Sirius, because it is a white star.
C. Polaris, because it is brighter than Sirius.
D. Sirius, because it is dimmer than Polaris.