TABLE

Australian Institute of Physics (Tasmanian Branch)

AIP SCHOOLS PHYSICS QUIZ – 2005
ROUND 1 – EINSTEIN'S LIFE

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

1.1 Which institution did Einstein retire from:

(a) Harvard University	(b) Institute for Advanced Studies	(c) Yale University	(d) Los Alamos National Laboratory

1.2 Which two countries did Einstein hold citizenship of:

(a) Germany and Israel	(b) USA and Germany	(c) Switzerland and Israel	(d) USA and Switzerland

1.3 What did Einstein mean when he said 'God does not play dice'?

(a) Cosmic expansion can be described by an equation	(b) Gambling was against his religious philosophy	(c) There was no random factor varying the speed of light from frame to frame	(d) Probabilistic character of quantum mechanics did not offer complete description of nature

1.4 What was the surname of the physicist who is credited with Einstein in predicting a state of matter in which a single quantum state is attained?

1.5 In which year did Einstein die?

(a) 1953	(b) 1955	(c) 1957	(d) 1959

1.6 The atomic number of the element Einsteinium is:

(a) 89	(b) 99	(c) 109	(d) 119

1.7 After World War II, Einstein was a leading figure in which political group:

(a) The United Nations	(b) The Peace Corps	(c) World Government Movement	(d) The Government of Israel

1.8 Primarily with which field is Einstein's first wife, Mileva Maric, claimed to have helped him:

(a) Chemistry	(b) Mathematics	(c) Engineering	(d) Physics

1.9 Einstein was not present at the ceremony to award his Nobel Prize in 1922 because:

(a) He was traveling to Japan	(b) He was busy publishing the General Theory of Relativity	(c) He was ill	(d) He was marrying for the second time

1.10 Einstein devoted his doctoral thesis to:

(a) his father Hermann Einstein	(b) his friend Marcel Grossmann	(c) his teacher Hermann Minkowski	(d) his wife Mileva Maric

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ROUND 2

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

2.1 What theory did the discovery of the 3K microwave background radiation support?

2.2 How many microphones are there in a megaphone?

2.3 Which of the following are vector quantities:

(a) Speed (b) Velocity (c) Acceleration (d) Magnetic flux (e) Angular Momentum (e) Force

2.4 What distinguishes different isotopes of an element?

2.5 What colour is seen on the outside of the arch of a primary rainbow?

2.6 A block of ice is floating in a glass of water. In the absence of evaporation, what happens to the level of the water in the glass when the ice melts?

2.7 What are the three ways in which heat can be transferred?

2.8 Assume that the gravitational acceleration on the moon is 1/6 that on Earth. As measured on the Moon, what would be the weight of a person having a mass of 60kg?

2.9 The effect which is now called the photoelectric effect was observed as early as in 1839? Who reported it?

(a) H Hertz (b) J J Thomson (c) J C Maxwell (d) A E Bequerel

2.10 “The net force on an object equals the rate of change of momentum of the object” is a statement of which physical principle?

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ROUND 3

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

3.1 If a fixed mass of gas has its volume doubled and its temperature halved, then its pressure:

(a) stays the same	(b) decreases by a factor of 2	(c) increases by a factor of 4	(d) decreases by a factor of 4	(e) increases by a factor of 2	(f) none of these

3.2 The energy of a photon depends on:

(a) its speed	(b) its wavelength	(c) its mass	(d) its polarisation	(e) both (a) and (b)	(f) both (b) and (c)

3.3 A car of mass 900kg has an engine which exerts a force of 450N on the road via its wheels. Assuming 100% efficiency, what is the acceleration of the car if this force is constantly applied?

3.4 The frequency of the second hand on an analogue clock is:

(a) 1 Hz	(b) 60 Hz	(c) 1/60Hz	(d) 1.666mHz

3.5 Kepler's third law states: The ratio of the squares of the revolutionary periods for two planets is equal to the ratio of the cubes of their semimajor axes. Two planets have circular orbits around a star. One planet orbits 4 times as far from the star compared with the other planet. The orbital period of the inner planet with respect to the outer planet is:

(a) half	(b) one eighth	(c) the same	(d) one quarter	(e) none of these

3.6 Name the two rovers currently still operating on the surface of Mars.

3.7 As the distance from a radio transmitter is increased, the electric field strength of the radio transmission changes proportionally to:

(a) the inverse of the square of the distance	(b) the inverse of the cube of the distance	(c) the square of the distance	(d) stays the same

3.8Glass has a refractive index of 1.5. When a light beam emerges from glass into air, the average light speed

(a) increases by 50 %	(b) decreases by 50 %	(c) stays the same	(d) none of these

3.9 An excited atom reaches its ground state by emitting a green photon. If instead, it attained an intermediate state by emitting a photon, then this photon could be:

(a) red	(b) blue	(c) blue or ultra-violet	(d) ultra-violet	(e) none of these

3.10 A laser produces a pulse of light once every 20ms. Each pulse has an average energy of 600mJ. What is the average power of the light produced by the laser in Watts?

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AIP SCHOOLS PHYSICS QUIZ – 2005
ROUND 4 – EINSTEIN'S LEGACY

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

4.1 Einstein's General Theory of Relativity is primarily concerned with
(a) gravitation (b) speed of light (c) quantum mechanics (d) nuclear energy

4.2 Einstein's paper on diffusion and Brownian motion determined the following fundamental constant:
(a) Planck's constant (b) Boltzmann's constant (c) the speed of light (d) Avogadro's number

4.3 Einstein's paper on the photoelectric effect fixed the value of:
(a) Planck's constant (b) Boltzmann's constant (c) the speed of light (d) Avogadro's number

4.4 One hundred years ago this week, the editors of Annalen der Physik recieved a manuscript titled "DOES THE INERTIA OF A BODY DEPEND UPON ITS ENERGY-CONTENT" from Albert Einstein. What formula appeared there for the first time?

4.5 What Einstein's prediction affects the PLANET collaboration (in which the University of Tasmania participates) for detecting extrasolar planets?

4.6 What principle was first demonstrated by pulsar timing observations in a double-star system?
(a) gravitational red shift (b) gravitational radiation (c) constancy of the speed of light (d) gravitational bending of light

4.7 Einstein's General Theory of Relativity leads to the prediction of:
(a) quasars (b) magnetars (c) pulsars (d) black holes

4.8 What name is given to the constant, included in the General Theory of Relativity, that Einstein called his greatest blunder?

4.9 Which of these sensing technologies does NOT exploit the photoelectric effect:
(a) piezo transducer (b) charge couple device (c) photomultiplier (d) plastic scintillator

4.10 In 1917 Einstein published a paper on stimulated emission. What acronym is given to the device which provided the first practical demonstration of this effect in 1954?

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AIP SCHOOLS PHYSICS QUIZ – 2005
ROUND 5

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

5.1 You are on an airless planet where the acceleration due to gravity is $10 m/s^2$. A ball at rest is dropped from a height of 405 meters. How long will it take the ball to reach the ground?

5.2 Name two of the planets that are circled by a system of rings.

5.3 A plane is flying due north at 1000km/h. A wind suddenly develops that blows eastward at 100km/h. If the wind persists, and pilot does not compensate for the wind, after 1 hour where will the aircraft be relative to its intended position?

5.4 Order the following electromagnetic spectral regions with respect to increasing frequency;
(a) Gamma ray (b) Infra-red (c) X-ray (d) Radio waves (e) Ultra-violet

5.5 Consider a region of space containing a magnetic field with field lines that are directed towards you. Describe the motion of an electron that is injected into the magnetic field with a component of motion in (but not traveling parallel to) the same direction as the field lines.

5.6 A planet is 100 million km from its star, and is 1 million times less massive than the star. How far from the planet do the gravitational forces of the star and planet balance?
(a) about 100 thousand km (b) about 50 million km (c) about 1 million km (d) none of these

5.7 Two resistors with resistances R_1 and R_2 are connected in parallel within a circuit, where $R_1 = 4R_2$. The current flowing in resistor R_1 is;
(a) the same as for R_2 (b) one quarter that of R_2 (c) four times that of R_2 (d) none of these

5.8 Order the following solar system bodies in terms of increasing mean density:
(a) Earth (b) Sun (c) Saturn (d) Moon

5.9 Which of the following elementary particles are charged:
(a) Neutrino (b) Photon (c) Neutron (d) Electron (e) Proton

5.10 A transformer with 200 turns in the primary winding and 100 turns in the secondary winding gives what output voltage when connected to the 240V mains AC supply?

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ROUND 6

FIND THE MOST APPLICABLE ANSWER IF THE QUESTION IS MULTIPLE CHOICE

6.1 A cup of pure water at is heated by a microwave oven inside a hyperbarometric chamber set to sea level pressure, and the time taken for the water to boil is measured. The experiment is repeated with the air pressure reduced to that typical of a high mountain. At the lower pressure the water will

(a) take longer to boil (b) take the same time to boil (c) take shorter to boil (d) not boil but instead evaporate

6.2 A star is observed to be due north of an observer at midnight. At what time, to the nearest minute, will the star next be due north?

(a) 23hours 56minutes later (b) 23hours 50minutes later (c) 24 hours later (d) None of these

6.3 In which direction do high pressure systems circulate in the southern hemisphere?

6.4 Compare the kinetic energy of a bullet of mass 10 g traveling at 1000 m/s with Michael Johnson, mass 80 kg, during an Olympic training run, clocking 10 seconds for the 100 meters sprint.

6.5 You are listening to a concert outdoors. A wind is blowing in the direction from you to the stage. What effect does the wind have on the frequency of the sound that you hear?

6.6 Name three scientists associated with temperature scales.

6.7 Name the antiparticle counterpart of the positron.

6.8 In what year was the Antarctic ozone hole discovered?

(a) 1979 (b) 1985 (c) 1987 (d) 1983

6.9 What is the name of the comet that was struck by the Deep Impact probe in July this year?

6.10 If a piece of wire is stretched to four times its length without change in volume, what is the change in its resistance?